Agendum
Oakland University
Board of Trustees Formal Session
June 26, 2023

<u>MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE</u>
A Recommendation

1.   <u>Division and Department:</u> Academic Affairs, School of Engineering and Computer Science, Department of Computer Science and Engineering.

2.   <u>Introduction:</u> Oakland University proposes a new degree graduate program in Artificial Intelligence, specifically the Master of Science in Artificial Intelligence within the Department of Computer Science and Engineering (CSE), in the School of Engineering and Computer Science (SECS).

A CSE committee composed by faculty experts in Artificial Intelligence (AI) was formed to examine existing AI programs throughout the State of Michigan and the nation, understand labor market data, obtain information regarding the accreditation process (ABET), survey student interest, receive feedback from our community partners including the CSE advisory board, and compose a formal proposal for the Master of Science in AI program (Attachment A).

According to a recent update of the Worldwide Semiannual Cognitive Artificial Intelligence Systems Spending Guide from International Data Corporation (IDC), the AI software platforms market grew rapidly during 2019 and it will continue to speed up significantly in the next 10 years. Thus, IDC forecasts that the overall market will reach $13.4 billion in revenue in 2024 with a CAGR (Compound Annual Growth Rate) of 31.1% over the entire period.

Given the increasing demands and the high industrial investments in this area, it is necessary that the university gets involved and trains skilled leaders in the creation of Artificial Intelligence systems that will function seamlessly alongside humans. In this context, this program is aimed at achieving this goal, as well as addressing the emerging needs of this market.

The program will include a strong foundation in AI core concepts. A total of 12 credits in the core AI curriculum will cover different areas including the Ethics of AI, machine learning, Natural Language Processing, deep learning and beyond. In addition, 12-20 credits will be applied to deepening understanding through the following concentrations will be required: (1) Edge AI and IoT, (2) Embedded AI, (3) Human- Centered AI, Augmented/Virtual Reality and Robotics, (4) Machine Learning, (5) Smart Manufacturing and Industry 4.0, (6) Artificial Intelligence for IT Operations (AIOps), (7)

AI for Cyber Security and Trustworthy AI, (8) Augmented/Virtual Reality and (9) Ethics of AI.

Need for the Master of Science in Artificial Intelligence degree at Oakland University

The proposed program will serve engineers and professionals in Computer Science located mostly in the southeastern region of Michigan. This is consistent with the missions of the Department and of Oakland University, one of which is to provide the knowledge and skills essential for career and personal success in computer science. The department's long-range plans call for an increase in the number of flexible high-quality degree programs that align with emerging fields and new career opportunities, especially in STEM education.

Unlike other existing programs in the state of Michigan, the interdisciplinary nature of the proposed program aims to serve automotive industry, manufacturing, IT, financial, healthcare, law enforcement and defense organizations through its specialized concentrations Edge AI and IoT; Embedded AI; Human-Centered AI and Robotics; Machine Learning; Smart Manufacturing and Industry 4.0; AI for Cyber Security & Trustworthy AI; and Augmented/Virtual Reality.

3.   **Previous Board Action:** None.

4.   **Budget Implications:** The primary source of funding new resources will be graduate tuition once the program is accepting students. Therefore, by year two, the program will generate net revenues. The School of Engineering and Computer Science is currently working with University Advancement to identify community donors for additional program funding. Tuition revenue for 70 AI students will reach a steady state in year 4. Salary expenses include full-time faculty, Clerical Technical and graduate assistants. Operating expenses include supplies and services, travel, library, and marketing. The proforma budget is included as Attachment B.

5.   **Educational Implications:** The proposed program will develop a complete set of curricula in AI that significantly improves the AI teaching and research capabilities at Oakland University. The newly developed courses will be available and beneficial to students majoring in Computer Science (CS) and Information Technology (IT) thus

enhancing the existing BS programs offered by the School of Engineering and Computer Science.

6.   **Personnel Implications:** The program would require one (1) new Assistant Professor, one (1) Clerical Technical and two (2) new Teaching Assistants (TAs) per year over the period of the first 5 years, however these resources will be needed gradually, and they are proportional with the growth of the program. One Assistant Professor will be hired in the 2nd year of the program.

7.   **University Reviews/Approvals:** This proposal for Master of Science in Artificial Intelligence degree program was reviewed and approved by the School of Engineering and Computer Science Assembly, the OU Graduate School Grad Council, the OU Senate, and the Executive Vice President for Academic Affairs and Provost.

8.   **Recommendation:**
WHEREAS, the Master of Science in Artificial Intelligence degree program is consistent with the objectives contained in Oakland University's Institutional Priorities; and

WHEREAS, the Master of Science in Artificial Intelligence degree program will build on the academic and research strengths in the Department of Computer Science and Engineering and provide new educational and community engagement opportunities in the field of AI; now, therefore, be it

RESOLVED, that the Board of Trustees authorizes the School of Engineering and Computer Science to offer a Master of Science in Artificial Intelligence degree program; and, be it further

RESOLVED, that the Executive Vice President for Academic Affairs and Provost will complete annual reviews of the Master of Science in Artificial Intelligence degree program to evaluate academic quality and fiscal viability to determine whether the program should continue.

9.   **Attachments:**
A. Proposal for the Master of Science in Artificial Intelligence degree program
B. Proforma budget for the Master of Science in Artificial Intelligence Science degree program

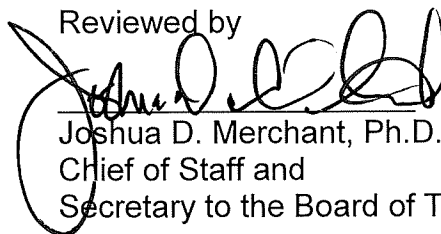Submitted to the President
on _ *O6/22* _____, 2023 by

Britt Rios-Ellis, M.S., Ph.D.
Executive Vice President for
Academic Affairs and Provost

Recommended on ___ *6/22* ___, 2023
to the Board for approval by

Ora Hirsch Pescovitz, M.D.
President

Reviewed by

Joshua D. Merchant, Ph.D.
Chief of Staff and
Secretary to the Board of Trustees

Oakland University

GRADUATE COUNCIL

Policy ^{updated 2016-17}

NEW DEGREE PROGRAM –GUIDELINES AND PROCEDURES

The Senior Vice President for Academic Affairs and Provost encourages proposals for new degree programs since continuing program development is vital to the university. This process may take up to two years – timing of the proposal submission is crucial. The timeline presented in this document is a **general guide** for new program development.

However, to meet this timeline it is crucial to have a well-reasoned and documented proposal. It is the purpose of these guidelines to help academic units develop good proposals and to elucidate the approval process.

The new degree proposal is a detailed description of the new program as outlined below. While writing the proposal, it is important to remember that it is the principal document used in the approval process for the program. Therefore, it must be written so that it is suitable and sufficient for two different audiences: 1) various faculty and administrative bodies within the university, and 2) a consultant, usually an expert in the field.

Any questions regarding the preparation of the proposal should be referred to the Graduate School.

THE PROPOSAL

Cover Memo

All proposals must be accompanied with a **signed cover memo** from the Dean stating that the proposal has received the appropriate school/college and department/school approvals, and that implementation of the proposal is recommended. **All proposals should be submitted in a word document to gradcouncil@oakland.edu**

Title Page

Abstract
One-page summary of the proposal

Table of Contents

The Table of Contents should show all headings and subheadings in these Guidelines and Procedures, along with page numbers in the Proposal where the information is found. If some information is better located in another location, e.g., an additional appendix or supplemental binder, be sure to record according to this outline where the information is located.

Body of Proposal
Cover Memo

REQUESTED Effective Term/Year
Fall 2023
Proposed Title of the Graduate Degree program
Master of Science in Artificial Intelligence
Department
Department of Computer Science and Engineering
School/College
School of Engineering and Computer Science
The delivery method for the Graduate Degree program is X **face to face (100%)** ☐ **fully online (100%)** ☐ **primarily online (75%)**

I, Dean (enter last name) certify that the (insert title of proposed degree program) has been reviewed by the appropriate school/college and department committees and that implementation of the proposed degree program is recommended.

11/27/2022   Dean Louay Chamra

_____   _____   _____
Dean of College/School (signature)   Date   Dean of College/School (print)

_____   _____
DECISION OF GRADUATE COUNCIL   Date

Degree Program Title: Master of Science in Artificial Intelligence

Degree: Master of Science in Artificial Intelligence

Name of Degree Program Coordinator: Dr. Hua Ming

Requested Implementation Term: Fall 2023

School or College Governance

Department of Computer Science and Engineering

08/19/2022   09/02/2022

Graduate Committee on Instruction

09/05/2022   09/21/2022

School of Engineering and Computer Science

09/30/2022   10/14/2022

University Governance

Graduate Council

10/16/2022   Date Approved

Senate

Date Submitted Date Approved

Board of Trustees

Date Submitted Date Approved

Presidents Council

Date Submitted Date Approved

The School of Engineering and Computer Science (SECS) proposes a new Master of Science program in Artificial Intelligence (AI). This proposal is aligned with the vision of SECS to offer our students a high-quality education in AI. Thus, the SECS interdisciplinary committee for AI and Data Science initiatives and programs led the effort to propose this new program, which will be offered by the Department of Computer Science and Engineering (CSE) at Oakland University. The proposed program is designed to give students a comprehensive framework for artificial intelligence with specialization in one of nine concentration areas: (1) Edge AI and IoT, (2) Embedded AI, (3) Human-Centered AI, Augmented/Virtual Reality and Robotics, (4) Machine Learning, (5) Smart Manufacturing and Industry 4.0, (6) Artificial Intelligence for IT Operations (AIOps), (7) AI for Cyber Security and Trustworthy AI, (8) Augmented/Virtual Reality and (9) Ethics of AI.

Students will engage in an extensive core intended to develop depth in all the core concepts that build a foundation for artificial intelligence theory and practice. Also, they will be given the opportunity to build on the core knowledge of AI by taking a variety of elective courses selected from colleges throughout campus to explore key contextual areas or more complex technical AI applications. Program graduates will be well positioned to attain research and development positions in this rapidly growing field or to progress into Ph.D. degrees in related fields.

The Master of Science in Artificial Intelligence is composed of eight (8) courses: three (3) core courses, three (3) concentration courses to be chosen from one of four specialization areas, and one or two other electives depending on the selected option (project or thesis). The existing research centers in AI, including the NSF IUCRC Center on Pervasive AI (PPI), will provide the necessary support to propose projects in collaboration with academic and industry partners. PPI currently has over 40 industry partners committed to the AI education and research missions of the center. The MSc in AI program formed an advisory board of executives of leading national companies, as well as state and federal government agencies. All these industry partners have expressed strong support for this proposed new master's degree in AI.

Ensuring a steady future inflow of talent in AI engineering at the graduate level is critical to address persistent domestic AI workforce shortages. A unique aspect of the proposed program is the intended demographic it aspires to serve and the unique concentrations that are offered to meet the current industry demands, especially in the State of Michigan. Specifically, the program will be accessible to both full-time and part-time students, aiming to train students who aspire to have AI research and development (R&D) and leadership careers in industry. To accommodate the needs of working professionals who might be interested in this degree program, the course offerings for the MS in AI will be in the late afternoon and evening hours to allow students to earn the degree through part-time study.

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I. Rationale

a. How the program will help promote the role and mission of the university

The proposed program will serve engineers and professionals located mostly in the southeastern region of Michigan. This is consistent with the missions of Oakland University, one of which is to provide the knowledge and skills essential for career and personal success. The university's long-range plans call for an increase in the number of flexible high-quality degree programs that align with emerging fields and new career opportunities.

Market research has demonstrated that there are few fields with as much projected growth over the next 10 years as artificial intelligence. Creating a high-quality master's degree program that caters to the more technical aspects of the discipline is imperative for the university. With increased globalization of artificial intelligence and worldwide collaboration efforts for technology development, it is expected that students graduating with this degree will have a good opportunity for finding high-level research engineering positions in different industries in Michigan, across the United States, as well as anywhere else in the world.

The master's degree in artificial intelligence represents an opportunity for the Oakland University to build on its already strong portfolio of dynamic master's programs. This program will support the university's effort to build a robust academic pathway to both research and professional careers in AI. Moreover, the program will also allow students to build their technical skills and to further understand the complex human systems in which they will be implemented.

The program will provide opportunities for our faculty to understand the challenging problems in the artificial intelligence and technology industry, to make connections with research engineers in industry, and conduct interdisciplinary translational research and collaborative research with industry partners. Such close interaction and connection will enrich the undergraduate and graduate curricula through the development of new courses, required or elective, and the establishment of teaching labs with modern engineering equipment and software systems.

The establishment of the proposed program can lead to more research funding from industry and from federal and state agencies, through strong connections with industry and collaborative translational research activities among faculty of multidisciplinary areas.

b. Need for the program –unique or distinctive aspects

Market Needs:

Over the past years, there were 5,500 job postings at the MS level looking for professionals with skills in artificial intelligence and 29,000 for skills in machine learning, according to Burning Glass' Labor Insight database. In addition, according to a recent update of the Worldwide Semiannual Cognitive Artificial Intelligence Systems Spending Guide from International Data Corporation (IDC), the AI software platforms market grew rapidly during 2019 and it will continue to speed up significantly in the years 2022–2024 [6]. Thus, IDC forecasts that the overall market will reach $13.4 billion in revenue in 2024 with a CAGR (Com- pound Annual Growth Rate) of 31.1% over the entire period.

To better understand the demand for jobs in artificial intelligence in the US, we looked into a report provided by Indeed [7], launched in 2021. Artificial intelligence-related jobs postings on Indeed increased by 29.1% over the last year. This category of job postings on Indeed increased by 57.9% from May 2017 to May 2018 and by 136.3% between May 2016 and May 2017.

Career and job site LinkedIn [1] released its annual "Emerging Jobs" list for 2019, which identifies the roles that have seen the largest rate of hiring growth from 2015 through this year. AI specialist is number one on the list – typically an engineer, researcher or other specialist that focuses on machine learning and artificial intelligence, figuring out where it makes sense to implement AI or building AI systems. Hiring for this role has been tremendous, growing 74% annually in the past 4 years alone. "AI has infiltrated every industry, and right now the demand for people skilled in AI is outpacing the supply for it," as confirmed by Guy Berger, the principal economist at LinkedIn. This is the third year in a row that a role related to machine learning or artificial intelligence has topped the LinkedIn list, and we can only expect demand to increase.

Indeed [7] also identified the top 10 positions with the highest percentage of job descriptions that include the keywords "artificial intelligence" and "machine learning" between 2018 and 2019. Figure 1 shows the ranking for jobs. Many of the jobs requiring AI skills among 2019's top positions are not listed on 2018's list, such as deep learning engineer. It is interesting to note that autonomous driving, facial recognition, and robotics are the three most rapidly growing fields for 2019. This figure also brings attention to the need for graduates with high AI skills in industry nationwide but also for the state of Michigan, where the automotive industry is the main sector.

Indeed also shows that machine learning engineer not only is the top AI job in terms of the number of job postings, but also offers one of the highest salaries. Figure 2 shows the ranking for salaries. Gartner CIO Survey of IT Senior Leaders shows that only 4% of surveyed organizations have already invested in and deployed AI initiatives, but that 46% of them have short- to long-term plans. Besides, this survey shows that there are two main challenges faced by senior IT leaders in exploring and adopting artificial intelligence: the availability of skilled and experienced staff and the lack of IT and business understanding in AI's potential.

Paysa [4] found that in 2017, 35% of the jobs required a Ph.D. Even when a Ph.D. was not mandatory, 26% required just a master's degree. Based on the forecast for this market, the expectation is that now and in the near future, this number will be much higher. A report published in 2017 by Element AI [2], a Montreal company that consults on machine learning systems, describes that fewer than 10,000 people have the skills necessary to tackle serious artificial intelligence research.

Ensuring a steady inflow of future talent in AI Engineering at the graduate level is among the national priorities to address persistent domestic AI workforce shortages and to remain the global leader in AI [5]. However, only around 33% of current graduate students in AI related fields are US citizens or permanent residents, based on recent NSF/CRA 2018 surveys [5, 3]. More than half of the AI workforce in both academia and the private sector was born abroad, and U.S. companies are increasingly setting up AI labs abroad because they cannot find enough talent at home [5]. Based on the forecast for this market [2], the expectation is that, now and in the near future, this number will be much higher. Every major type of business today is run mostly on AI, including the systems we use in government and transport, our bank accounts, and increasingly the devices that surround our daily lives.

Given the increasing demands and the high industrial investments in this research area, it is necessary that the university gets involved and trains skilled leaders in the creation of artificial intelligence systems that will function seamlessly alongside humans. In this context, this program is

aimed at achieving this goal, as well as addressing the emerging needs of this market. The proposed MS in AI will help students in the creation of systems that can reason and respond to this complex set of realities.

Rank	Job title	% of postings containing AI or machine learning	Rank	Job title	% of postings containing AI or machine learning
1.	Machine learning engineer	75.0 %	6.	Algorithm developer	46.9 %
2.	Deep learning engineer	60.9 %	7.	Junior data scientist	45.7 %
3.	Senior data scientist	58.1 %	8.	Developer consultant	44.5 %
4.	Computer vision engineer	55.2 %	9.	Coordinator of data science	41.5 %
5.	Data scientist	52.1 %	10.	Lead data scientist	32.7 %

Source: Indeed

Figure 1: Top 10 Jobs involving AI skills

Rank	Job Title	Average Salary
1.	Machine learning engineer	$ 142,858.57
2.	Data scientist	$ 126,927.41
3.	Computer vision engineer	$ 126,399.81
4.	Data warehouse architect	$ 126,008.25
5.	Algorithm engineer	$ 109,313.51

Source: Indeed

Figure 2: Top 5 AI job titles with the highest salaries

In addition to this, Indeed points out that by first identifying AI-related jobs using titles and keywords in descriptions, the share of jobs requiring AI skills has grown 4.5X since 2013 (see Figure 3).
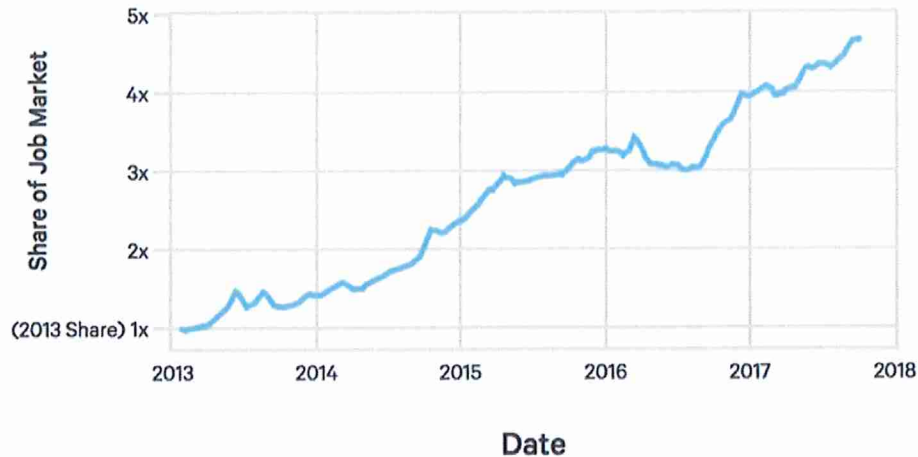
Source: Indeed
Figure 3: Share of US jobs requiring AI skills

Relationship of AI with Data Science, Machine Learning, and Robotics

Artificial intelligence, data science, machine learning, and robotics are terms commonly used in the popular press/media, but are difficult to attach precise meanings to. Nevertheless, from a technical perspective, there is a shared understanding of what these terms stand for. While it is very unlikely that experts in these domains will all agree on ironclad definitions of the terms, we discuss in this section at a high level the relationship between these four areas.

The term artificial intelligence was first coined by John McCarthy in 1956. In that decade, researchers came together to clarify the concepts around the "thinking machine," which up to that point had been quite divergent. McCarthy is said to have picked the name artificial intelligence for its neutrality. Nowadays, AI is defined as the development of intelligent algorithms and systems that allow such systems to act or be perceived to act intelligently. AI has traditionally been pursued as a subarea of computer science; research in the area brings in innovative ideas from other fields, including mathematics, philosophy, psychology, social science, and linguistics.

Machine learning (ML) can be defined as a field of computer science that gives computer systems the ability to "learn" with data without being explicitly programmed. However, in the last decade, the field has transformed into a major research area of computer science.

Data science is an interdisciplinary field of scientific methods, processes, algorithms, and systems to extract knowledge or insights from data in various forms, either structured or unstructured (Wikipedia).

Robotics is an interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others. Robotics is at the intersections of electronics, computer science, AI, mechatronics, nanotechnology, and bioengineering. Robotics addresses design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing.

AI intersects with data science (DS) and robotics (ROB), with techniques from machine learning (ML) playing a major role in all three areas. AI includes subareas such as knowledge representation, cognitive modeling, perception, human-computer interaction, and natural language processing that are not well represented in Data science and robotics. Based on feedback from the industry executives board of this new program and the market assessment, there are major differences between AI Engineers and Data Engineers/Scientists. AI engineers focus on the design, implementation, and testing/evolution/maintenance of the models unlike data engineers/scientists who focus more on the preparation of the data to be used by those ML models including data cleaning, sampling, sanitization, etc. This proposal focuses on training and preparing new AI engineers.

Research and Teaching Needs

There has been rapid growth in the hiring of professors who work in AI as well as in co-related areas that either exploit AI techniques or provide some of the basic science used to develop those techniques. This is evidenced by the fact that professors from all SECS departments are involved in this current proposed list of courses.

Another important motivation for this new degree is from a research perspective. Given the number of active researchers in AI, there will be opportunities for professors and students to perform research together on the many AI research projects being pursued in Southeast Michigan, as well as the possibility for MS students to continue onto a Ph.D. program in computer science or related domains. The Master's in AI will develop advanced research in core AI and its applications by integrating AI research and educational activities, increasing collaboration within Oakland University and establishing an exciting AI learning environment for students in collaboration with the strong support of industry partners.

Survey with Current Students, Alumni and Industry

During the Winter and Summer terms of 2022, the SECS interdisciplinary committee on AI and DS conducted surveys with 157 participants including our current students, alumni and industry/government. As described in Figure 5, almost half of the participants are from our current OU students in SECS and the other half represent industry participants.
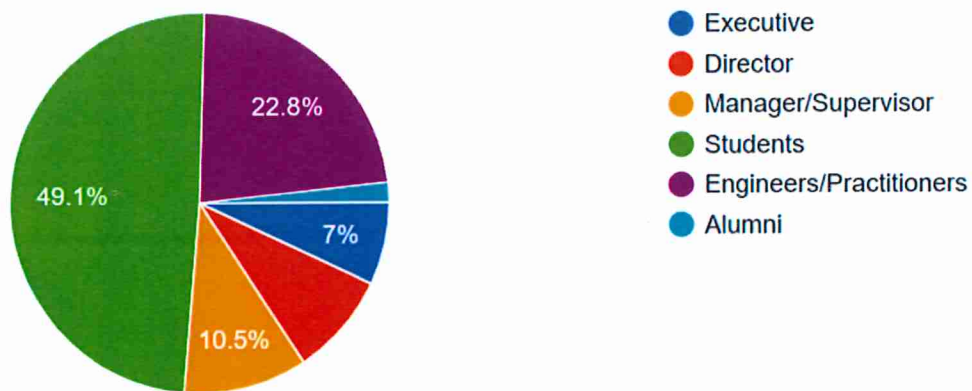
Figure 5: Distribution of the participants

Depending on the position of the participants, we prepared two surveys where the first survey was for industry/government executives to gather interest in a new MSc degree in AI and the needed skills, while the second survey was for students to evaluate their interest to join the program, why they would be interested and the preferred teaching modalities.

Q3. Is there a need in your organization for personnel with the knowledge, training, and skills acquired by those who complete a graduate degree (Master or Certificates) in AI?
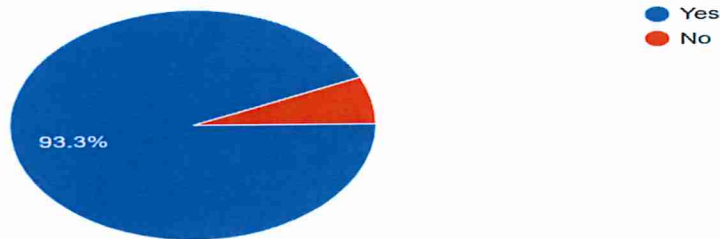
If Yes – Is this need expected to increase over the next 5-10 years?
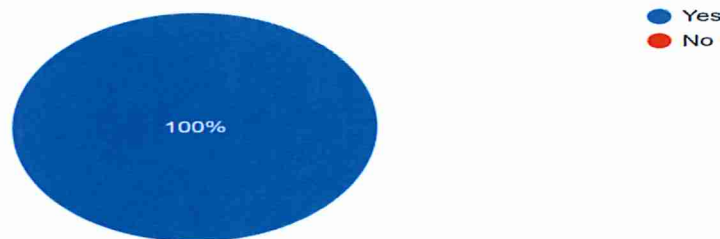
Figure 6: Executives opinion on their needs for AI graduates

Figure 6 shows a very strong interest from executives in leading national companies to train their employees for an MSc in AI for now and at least the next 10 years. They highlighted, as shown in Figure 7, the most needed skills especially in Machine Learning, Human-Centered AI/AI Ethics, Edge AI, etc. Those needs have guided our choices in terms of the concentrations for the new master in AI.

Q4. From the following topics, please indicate any topics or subject matter that you think should be considered for inclusion

15 responses
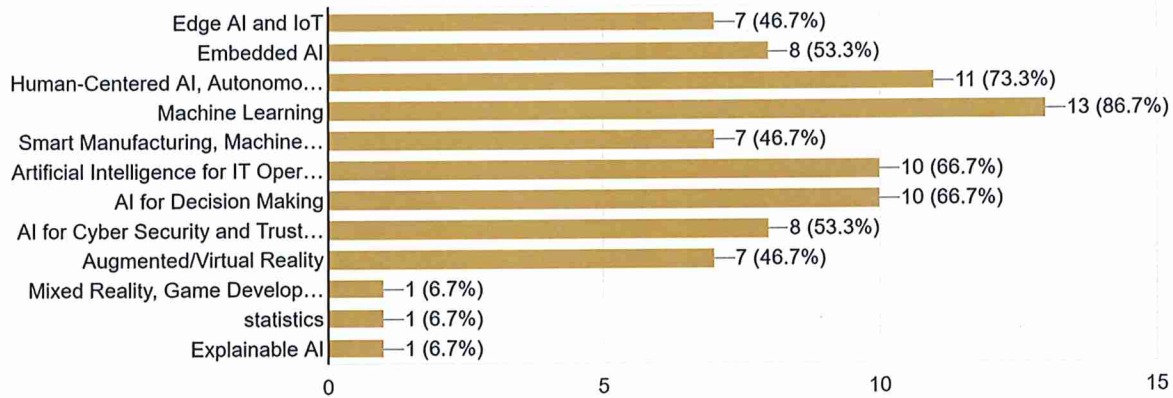
Figure 7: Industry executives opinion on the needed AI skills

Figure 8 describes a very strong interest from our students and alumni to join the MSc in AI with over 90% of them very likely to apply when the program is offered. The flexibility/modularity of the program and the teaching modality/flexibility are among the most important factors that the student would consider joining the program, as described in Figure 9.

Q1. Please rate your level of interest in stackable certificates or a master of science degree in AI? (very high, somewhat high, neither high nor low, somewhat low, very low)

Figure 8: Potential students interest in the Master in AI

Q2. Rate the likelihood of submitting an application for admission to the proposed program if it were launched within the next 1-2 years? (almost c...somewhat likely, somewhat unlikely, very unlikely)

Legend:
- almost certain
- very likely
- somewhat likely
- somewhat unlikely
- very unlikely

Pie chart values:
- 43.2%
- 9.1%
- 22.7%
- 20.5%

Q5. Is your interest in the program influenced by the following (check all that apply)

Category	Value
Mode of delivery: on-site face-t...	27 (61.4%)
The program structure (modula...	33 (75%)
Flexibility in enrolment status (i....	33 (75%)
Estimated program cost	26 (59.1%)
Influenced by my current emplo...	1 (2.3%)
Job placment or internship	1 (2.3%)
Will prefer only online or hybrid...	1 (2.3%)
Online Mode	1 (2.3%)
The availability of projects/han...	1 (2.3%)

Q6. What is your preferred mode of delivery?

Legend:
- On-site face-to-face
- On-line
- Blended (short period(s) of on-site face-to-face followed by on-line)

Pie chart values:
- 29.5%
- 36.4%
- 34.1%
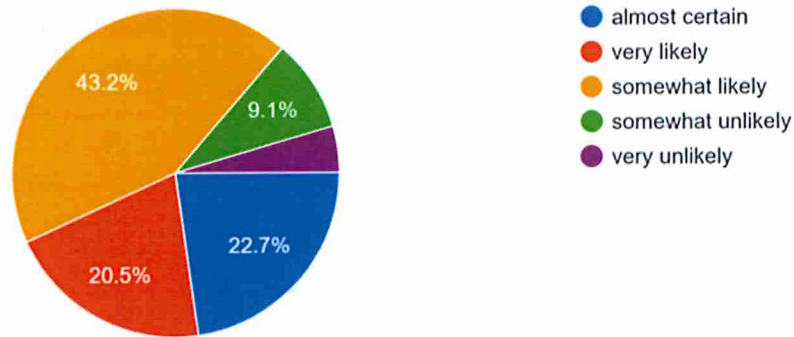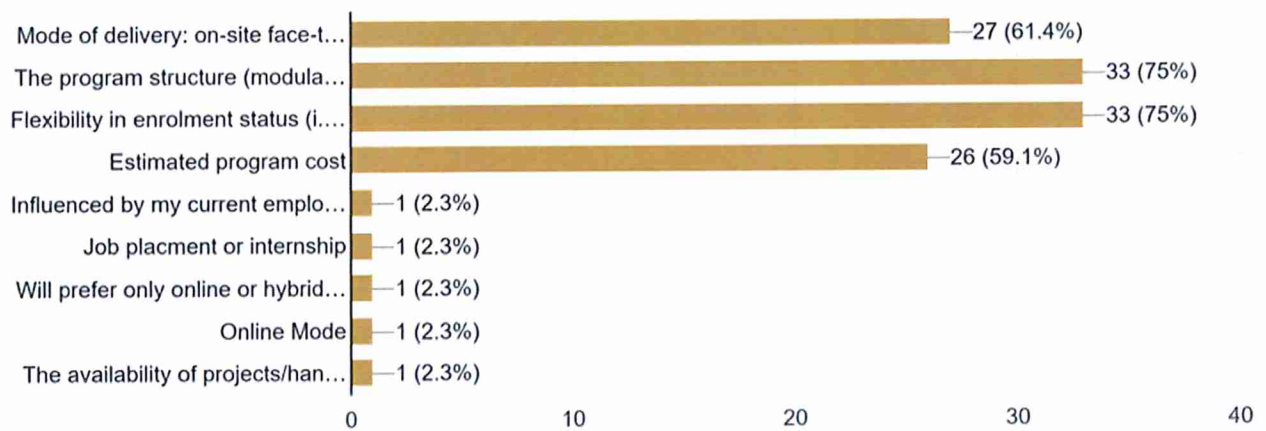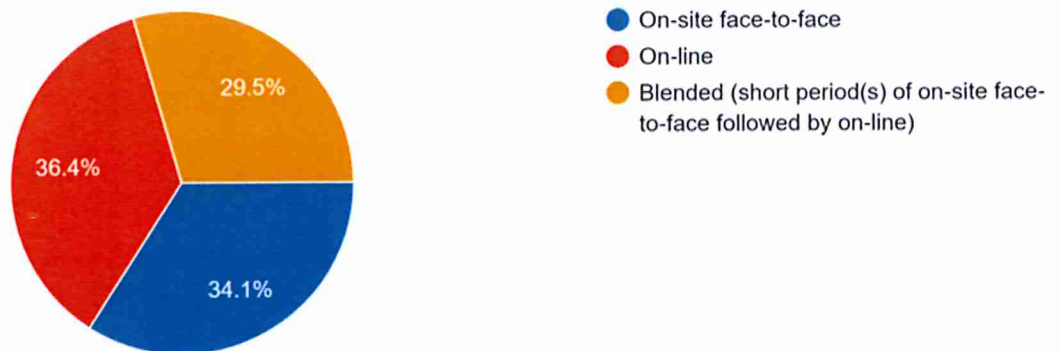
Figure 9: Outcomes of the survey with potential students

To conclude, the survey with different stakeholders show a large interest in this new proposal for the MSc in AI.

c.   List the goals and objectives of the program

The objective of the MSc in AI is to graduate AI Engineers by achieving the following goals:
- **Goal 1:** Understand representations, algorithms and techniques used across works in artificial intelligence and be able to apply and evaluate them in applications as well as develop their own.
- **Goal 2:** Understand and apply machine-learning techniques, in particular to draw inferences from data and help automate the development of AI systems and components.
- **Goal 3:** Understand the various ways and reasons humans are integrated into mixed human-AI environments, whether it is to improve overall integrated system performance, improve AI performance or influence human performance and learning.
- **Goal 4:** Understand the ethical concerns in developing responsible AI technologies.
- **Goal 5:** Implement AI systems, model human behavior, and evaluate their performance.

d.   Comparison to other similar programs –State/Regional/National

In past years, artificial intelligence was considered a subset of computer science with regard to measuring MS graduates. Thus, computer science-related programs continued to grow over 100% between 2012 and 2016. In a US-centered analysis, interest in artificial intelligence research is growing fast and there is no sign of it slowing down anytime soon, as can be seen by the recent NSF call for proposals and the AI executive order. Table 1 shows an overview of the immediate competitors in the artificial intelligence master's program space.

Table 1: Master Science in Artificial Intelligence's competitors

University	Degree	Host College/School	Credits/Units	Concentrations	Options
University of Michigan-Dearborn	MS in Artificial Intelligence	College of Engineering and Computer Science	30 total credits: 12 foundation, 9 concentration, 9 elective	Four concentrations: Vision, Machine Learning, Knowledge Management and Reasoning, and Intelligent Interaction	Project Thesis
Carnegie Mellon University	MS in Artificial Intelligence and Innovation	Language Technologies Institute	192 units: 84 core (include 36-unit capstone), 72 knowledge, 36 elective	No specific concentrations; however, there are 4 main phases of Innovation they identify: Opportunity Identification, Opportunity Development, Business Planning, and Incubation of a Business with a Viable Product	Summer internship, summer practicum (in addition to the courses)
Illinois Tech	MAS (Professional Masters)	Computer Science Department, College of Computing	30 total credits: 6 core, 3 data analytics, 3 data processing, 6 AI applications, 2-3 interdisciplinary elective, 9-10 elective	No specific concentrations; however, courses may be chosen from Data Analytics, Data Processing, and AI Applications	For electives, students may choose a course from the core or interdisciplinary electives list (provided it is not already being applied elsewhere)
Johns Hopkins University	MS in Artificial Intelligence	Whiting School of Engineering	4 core classes and 6 elective classes. Exact credit totals are not listed. Courses must be completed within 5 years, and 9 credits must be taken at the 700-level.	No concentrations	May also obtain an AI Graduate Certificate (4 foundational courses)
Boston University	MS in Artificial Intelligence	Department of Computer Science	32 total credits: 16 core and 16 elective	No concentrations	None
Florida Atlantic University	MS in Artificial Intelligence	Department of Computer and Electrical Engineering and Computer Science	30 total credits for both thesis (including 6 credits for the thesis) and non-thesis options. 3 core courses, 7 elective (non-thesis) or 5 elective (thesis)	No specific concentrations; however, elective groups include Vision, Data Analytics/Algorithms, Knowledge Management/Reasoning, Machine Learning, and Applications	Both non-thesis and thesis options allow up to 3 elective courses to be substituted with any course in the College of Engineering and Computer Science, with prior approval from the advisor
Drexel University	MS in Artificial Intelligence and Machine Learning	College of Computing and Informatics	45 total credits: 5 core courses, 10 elective courses, and 1 capstone	No specific concentrations; however, elective groups include Data Science/Analytics, Foundations of Computation/Algorithms, and Applications of AI and Machine Learning	May also obtain a post-baccalaureate certificate in AI and machine learning
University of Georgia	MS in Artificial Intelligence	Institute for Artificial Intelligence	30 total credits, including 3 hours of thesis and 2 hours of research	No concentrations	None

Carnegie Mellon University: The Language Technologies Institute at Carnegie Mellon offers a 192-unit Master of Science in Artificial Intelligence and Innovation program. There are four main phases of innovation that students have the opportunity to take courses in: Opportunity Identification, Opportunity Development, Business Planning, and Incubation of a Business with a Viable Product. Each student must complete 84 core units (including a 36-unit capstone), 72 knowledge units, and 36 electives. Students must also complete a summer internship and a summer practicum.

Illinois Tech: The College of Computing at Illinois Tech offers a 30-credit Professional Master of Artificial Intelligence program. Students may choose courses from three different categories: Data Analytics, Data Processing, and AI Applications. Each student must complete 6 core credits, 3 data analytics credits, 3 data processing credits, 6 AI applications credits, 2–3 interdisciplinary elective credits, and 9–10 elective credits. For electives, students may choose a course from the core/interdisciplinary electives list (provided it is not already being applied elsewhere).

Johns Hopkins University: The Whiting School of Engineering at Johns Hopkins offers a Master of Science in Artificial Intelligence program (no credit total listed). Students must take 4 core classes and 6 elective classes. Courses must be completed within 5 years, and 9 credits must be taken at the 700-level. Prospective students may also obtain an AI graduate certificate, which requires completion of 4 foundational courses.

Boston University: The Department of Computer Science at Boston University offers a 32-credit Master of Science in Artificial Intelligence program. Students must take 16 core credits and 16 elective credits. In this degree program, students will learn to apply creative thinking, algorithmic design, and coding skills to build modern AI systems.

Florida Atlantic University: The Department of Computer and Electrical Engineering and Computer Science at Florida Atlantic University offers a 30-credit Master of Science in Artificial Intelligence program. Students may choose courses in many different elective groups: Vision, Data Analytics/Algorithms, Knowledge Management/Reasoning, Machine Learning, and Applications. Each student can choose either a thesis (which includes 6 credits) or non-thesis track. Three core courses and 7 elective courses are re- quired for the non-thesis track. Three core courses and 5 elective courses are required for the thesis track. Both the non-thesis and the thesis options allow up to 3 elective courses to be replaced with any course in the College of Engineering and Computer Science, with prior approval from an advisor.

Drexel University: The College of Computing and Informatics at Drexel University offers a 45-credit Master of Science in Artificial Intelligence and Machine Learning program. Students may choose courses from several different elective categories, such as Data Science/Analytics, Foundations of Computation/Algorithms, Applications of AI, and Machine Learning. Students must take 5 core courses, 10 elective courses, and 1 capstone. Alternatively, students may choose to obtain a post-baccalaureate certificate in AI and Machine Learning.

University of Georgia: The Institute for Artificial Intelligence at the University of Georgia offers a 30-credit Master of Science in Artificial Intelligence program. The 30 credit hours must include 3 hours of thesis and 2 hours of research. The program is intended to prepare students for careers as developers of AI applications or for further graduate work in AI/related fields.

There are also a number of graduate certificate programs in artificial intelligence emerging at top US institutions, such as Stanford, MIT, Columbia, and Georgetown.

II.   Academic Unit

a.   How the goals of the unit are served by the program

The proposed program will serve engineers and professionals in Computer Science located mostly in the southeastern region of Michigan. This is consistent with the missions of the Department and of Oakland University, one of which is to provide the knowledge and skills essential for career and personal success in computer science. The department's long-range plans call for an increase in the number of flexible high-quality degree programs that align with emerging fields and new career opportunities, especially in STEM education.

Given the increasing demands and the high industrial investments in this research area, it is necessary that the university gets involved and trains skilled leaders in the creation of artificial intelligence systems that will function seamlessly alongside humans. In this context, this program is aimed at achieving this goal, as well as addressing the emerging needs of this market. The proposed MSc in AI will help students in the creation of systems that can reason and respond to this complex set of realities.

One of the main goals of the department is to expand graduate education where, currently the population of master students is relatively small compared to competitors and has been declining in recent years (currently, around 90 students). The AI program will help increase both the quality and quantity of graduate students in the department so the department can offer a more diverse set of graduate courses and continue expanding research efforts.

b.   How existing staff will support the proposed program

The proposed MS in AI program will be hosted by the CSE department. One program coordinator will be responsible for administering the program and they will be supported by a CSE administrative assistant.

The responsibilities of the graduate program coordinator will include marketing the program locally by keeping a close relationship with the local industry, synchronizing efforts with SECS to promote the program, coordinating the scheduling of courses and instructors, finding qualified lecturers and guest speakers from local industry to complement the full-time faculty of the program, arranging for initial individual counseling meetings with students admitted to the program, applying graduate program policy appropriately to accommodate the individual graduation plans of students, and promoting a research focus in the areas of core and applied AI. The coordinator will also be responsible for the overall quality of the program, including monitoring the academic qualifications of the students admitted to the program, updating the curricula, approving MS thesis dissertation committees, and periodically assessing of the program.

The CSE Graduate Program Committee will advise and assist the program coordinator in matters related to review of applications, admission to the program, dismissal from the program, and program updates. The graduate program coordinator will be appointed by the CSE department chair. The graduate program coordinator and the members of the graduate program committee will serve as program advisors for all the students, assisting them in course selection, monitoring their progress toward completion of the degree, and providing career counseling.

The MS in AI program will reside in CSE department. A full-time secretary in the CSE department will provide support for this program and assist students in the admission application process, registration, and so on.

c.   Faculty qualifications - current scholarly activity of the faculty in the proposed program
Appendix A

This program will require experienced faculty with expertise in AI. These faculty members require experience in teaching, evaluation of student learning, experience directing student research and grading. Current faculty with AI backgrounds will direct and facilitate development. The full list of faculty and their expertise, affiliated with various departments in SECS, can be found in Appendix A.

d.   Current Resources and how will the new program impact existing resources

Classroom, laboratory and/or studio space

Enrollment in the core and foundation classes will be combined into the current Computer Science graduate courses. The MSc in artificial intelligence students will register in classes that currently exist. Thus, we will use the existing classroom, laboratory and/or studio space.

Equipment

No additional space or special equipment will be required for the program. All implementation will use available space and resources of the existing labs of the AI faculty.

Current Resources and Impact of Increased Enrollment

Currently the Department of Computer Science has over 26 faculty to support the MSc in AI program. Furthermore, several faculty from the ECE, ISE and ME departments will contribute to the program by teaching several courses relevant to AI that are offered by their departments.

Enrollment in the Department of Computer Science and Engineering graduate programs has been decreasing recently, as shown in Figure 10. Thus, the proposed program will contribute to improve the quality and quantity of the graduate students in the department based on our survey and market assessment outcomes.
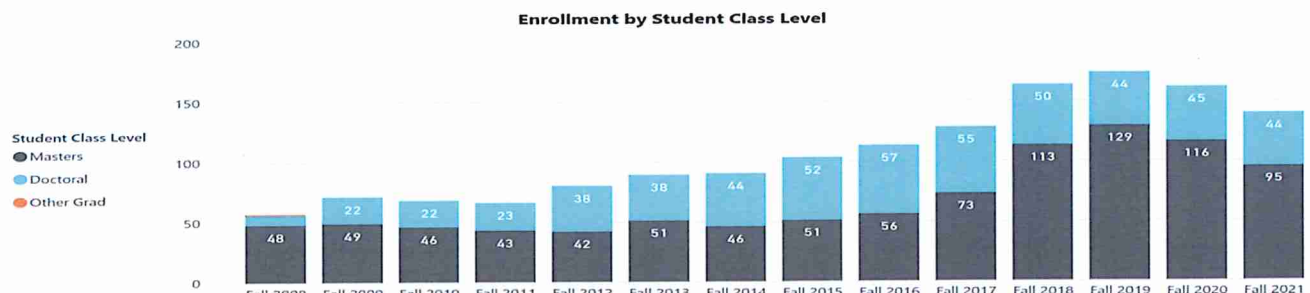
Figure 10: CSE graduate enrollment decline in the last few years

III.   Program Plan

a.   Admission Requirements

All students are required to submit an application to be considered for the admission into the program. Before an applicant's file can be reviewed for full program admission, all application documents must be received in Oakland University Graduate School. Incomplete applications will not be sent to departments for admission review.

DEGREE AND GPA REQUIREMENT: Regular admission to the program requires a bachelor's degree in a science, technology, engineering, or mathematics (STEM) field earned with an average of B (or better) from an accredited program. An entering student should have completed one course in probability and statistics, one course in programming, and one course in calculus II (see the table shown below). A course in calculus III and a course in linear algebra are recommended but not required.

Deficiencies in the required prerequisite courses must be made up completed with a grade of "B" or better before entrance into the graduate program. Industry experience in programming/algorithms and computing can be considered as part of the admission evaluation process and an interview can be conducted with the applicant to check their credentials. The evidence for the credentials includes non-credits or credits certificate or industry experience in programming/algorithms which should be verified and assessed during an interview.

Algorithms/Programming	Mathematics	Statistics (one of these or equivalent required)
CSI 2290 or equivalent (required)	MTH 1555 and MTH 2775 (or Equivalent required)	STA 2220
CSI 3610 or CSI 3640 or equivalent (required)	APM 2663 or APM 1663 or equivalent (recommended)	STA 2226
	APM 4777 or equivalent (recommended)	STA 4227

OFFICIAL TRANSCRIPTS: Transcripts are required from all post-secondary educational institutions from which the applicant earned a degree (beginning with first baccalaureate) and all enrollment in graduate level course work beyond the bachelor's degree.

TOEFL/IETLS: Foreign applicants whose native language is not English or do not have a degree from an English-speaking institution must provide the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IETLS) scores following the admission requirements of Oakland University.

LETTERS OF RECOMMENDATION: Two letters of recommendation, with at least one from a person familiar with the candidate's academic performance.

b.   Degree requirements.

To satisfy the requirements for the MSc degree in Artificial Intelligence, all students admitted to the program are expected to complete a minimum of 32 credit hours of graduate coursework, with a cumulative grade point average of B or better. The program of study consists of core courses, concentration courses, and electives. The program will require 16 credit hours of core courses, 12 credit hours of depth course work and 8 credit hours of elective courses for a total of 32 credit hours. The concentration courses are categorized into 9 areas. Each of the depth areas includes one core course. More details can be found in **Appendix B.**

Option 1: Professional Track. This option requires students take only courses, which may include an independent study, based on the preferences of the student. The minimum requirements are as follows:

Core courses – 12 credit hours

Concentration courses – 12 credit hours

Elective courses – 8 credit hours

Option 2: Research Track. This option requires a research thesis or project prepared under the supervision of the advisor. The thesis or project describes a research investigation and its results. The scope of the research topic for the thesis should be defined in such a way that a full-time student could complete the requirements for a master's degree in 24 months or 6 semesters following the completion of course work by regularly scheduling graduate research credits. The minimum requirements are as follows:

Core courses – 12 credit hours

Concentration courses – 12 credit hours

Master's Thesis/Project and/or Research/seminar Courses — 8 credit hours

c.   Curriculum Overview

A typical Plan of Study for students enrolled full-time in the program is outlined in **Appendix C.** The course descriptions for all new courses in the program are listed in **Appendix D.**

Research track (32 credits)

The research track requires 32 credits including 4 to 8 credits of thesis/project to graduate. The structure of credits is as follows:

a) **Core requirements (12 credits)**

All students must complete first the following three course:

- CSI 5130 - Artificial Intelligence (4 credits)

- CSI 5170 - Machine Learning (4 credits)

- CSI 5390 - Software Engineering OR CSI 5220 - Object Oriented Analysis Design (4 credits)

b) **Concentration requirement (12 credits)**

The student must declare/select only one concentration area, take one core course from the concentration area, and select 2 courses from the declared concentration area:

Edge AI and IoT Concentration

- CSI 5XXX - Foundations of Edge AI (4 credits): Core course in this concentration area
- CSI 5240 - Cloud Computing (4 credits)
- CSI 5490 - Wireless and Industrial Networks (4 credits)
- CSI 6470 - Advanced Computer Networks (4 credits)
- CSI 6480 - Information Security (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)
- CSI 5230 - Mobile and Smart Phone Application Development (4 credits)
- ECE 6212 - Wireless Communications (4 credits)

Embedded AI Concentration

- ECE 4900 - ST: Embedded Artificial Intelligence (4 credits): Core course in this concentration area
- ECE 5520 - Automotive Mechatronics I (4 credits)
- ECE 5720 - Microprocessor-Based Systems Design (4 credits)
- ECE 5731 - Embedded Computing in Mechatronics (4 credits)
- ECE 5770 - GPU Accelerated Computing (4 credits)
- ECE 6410 - Intelligent Control Systems (4 credits)
- ECE 6520 - Automotive Mechatronics II (4 credits)
- ECE 6712 - Parallel Embedded Computer Architecture (4 credits)
- ECE 6742 - DSP in Embedded Systems (4 credits)
- ECE 6745 - Real-Time Computing Systems (4 credits)
- CSI 5360 - Concurrent and Multi-Core Programming (4 credits)
- CSI 5420 - Software Architecture and Components (4 credits)

Human-Centered AI, Autonomous systems and Robotics Concentration

- CSI 5900 - AI-Human Interaction (4 credits) (4 credits) : Core course in this concentration area
- CSI 5550 - Visual Computing (4 credits)
- SYS 5900 - ST: Automotive User Experience (4 credits)
- CSI 5550 - Visual Computing (4 credits)
- CSI 6550 - Advanced Visual Computing (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)

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- ECE 5500 - Robotic Systems and Control (4 credits)

- ECE 5532 - Autonomous Vehicle Systems I (4 credits)

- ECE 6410 - Intelligent Control Systems (4 credits)

- ECE 6440 - Adaptive Control Systems (4 credits)

- ECE 6460 - Autonomous Vehicle Systems II (4 credits)

- ECE 6467 - Dynamics and Control of Robot Manipulators (4 credits)

- ISE 5422 - Robotic Systems (4 credits)

- ECE 5551 - Human-Robot Interaction (4 credits)

- CSI 5180 - Natural Language Processing (4 credits)

Machine Learning Concentration

- CSI 5140 - Deep Learning and Applications (4 credits) Core course in this concentration area

- CSI 5810 - Information Retrieval and Knowledge Discovery (4 credits)

- ME 5310 - Machine Learning Engineering Design (4 credits)

- ISE 5002 - Engineering Operations Research (4 credits)

- ISE 5430 - Engineering Operations Research - Deterministic Models (4 credits)

- ISE 5431 - Engineering Operations Research - Stochastic Models (4 credits)

- ISE 5517 - Statistical Methods in Engineering (4 credits)

- ME 5434 - Metamodeling and Optimization Methods in Design (4 credits)

- CSI 5180 - Natural Language Processing (4 credits)

Smart Manufacturing, Machine Vision and Industry 4.0 Concentration

- ISE 5512 - Artificial Intelligence in Manufacturing (4 credits): Core course in this concentration area

- SYS 5900 - ST: Virtual and Augmented Reality (4 credits)

- CSI 5240 - Cloud Computing (4 credits)

- CSI 6480 - Information Security (4 credits)

- ISE 5422 - Robotic Systems (4 credits)

- ISE 5456 - Engineering Risk Analysis (4 credits)

- ISE 5464 - Design for Manufacturing and Assembly Analysis (4 credits)

- ISE 5410 - Supply Chain Modeling and Analysis (4 credits)

- ISE 5002 - Engineering Operations Research (4 credits)

- ISE 5517 - Statistical Methods in Engineering (4 credits)

- CSI 5550 - Visual Computing (4 credits)

Artificial Intelligence for IT Operations (AIOps) Concentration

- CSI 5XXX - AI for IT Operations (4 credits): Core course in this concentration area
- CSI 5220 - Object Oriented Analysis and Design (4 credits)
- CSI 5200 - Fundamentals of Software Modeling (4 credits)
- CSI 5300 - Software Prototyping and Validation (4 credits)
- CSI 5380 - Software Verification and Testing (4 credits)
- CSI 5390 - Software Engineering (4 credits)
- CSI 5410 - Software Project Planning, Management and Maintenance (4 credits)
- CSI 5720 - Software Security (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)

AI for Cyber Security and Trustworthy AI Concentration

- CSI 5XXX AI in cybersecurity and Privacy (4 credits): Core course in this concentration area
- CSI 5460 - Information Security
- CSI 5480 - Information Security Practices
- CSI 5720 - Software Security
- CSI 5140 - Deep Learning and Applications (4 credits)

Augmented/Virtual Reality Concentration

- SYS 5900 - ST: Virtual and Augmented Reality (4 credits): Core course in this concentration area
- SYS 5900 - ST: Automotive User Experience (4 credits)
- CSI 4900/5900 - AI-Human Interaction (4 credits) (4 credits)
- CSI 5550 - Visual Computing (4 credits)
- ECE5551 - Human-Robot Interaction (4 credits)

Ethics of AI Concentration

- CSI 5XXX - Ethics and Bias in AI (4 credits): Core course in this concentration area
- CSI 5900 - AI-Human Interaction (4 credits) (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)
- CSE 5810 - Information Retrieval and Knowledge Discovery (4 credits)

c) **Electives (8 credits)**

Students on a research track must complete 8 credits from the following Elective Group courses

- CSI 6998 - Master's Thesis Research or CSI 6999 - Project/Independent Study (4 to 8 credits)

- CSI 7995 - Research Initiation (2 credits)
- CSI 7940 - Research Seminar (2 credits)

2. **Professional track (32 credits)**

The professional track requires 32 credits of graduate coursework. The structure of credits is as follows.

a) **Core requirements (12 credits)**

All students must complete first the following three course:

- CSI 5130 - Artificial Intelligence (4 credits)
- CSI 5170 - Machine Learning (4 credits)
- CSI 5390 - Software Engineering OR CSI 5220 - Object Oriented Analysis Design (4 credits)

b) **Depth requirement (12 credits)**

The student must declare/select only one concentration area, take one core course from the concentration area, and select 2 courses from the declared concentration area:

Edge AI and IoT Concentration

- CSI 5XXX - Foundations of Edge AI (4 credits): Core course in this concentration area
- CSI 5240 - Cloud Computing (4 credits)
- CSI 5490 - Wireless and Industrial Networks (4 credits)
- CSI 6470 - Advanced Computer Networks (4 credits)
- CSI 6480 - Information Security (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)
- CSI 5230 - Mobile and Smart Phone Application Development (4 credits)
- ECE 6212 - Wireless Communications (4 credits)

Embedded AI Concentration

- ECE 4900 - ST: Embedded Artificial Intelligence (4 credits): Core course in this concentration area
- ECE 5520 - Automotive Mechatronics I (4 credits)
- ECE 5720 - Microprocessor-Based Systems Design (4 credits)
- ECE 5731 - Embedded Computing in Mechatronics (4 credits)
- ECE 5770 - GPU Accelerated Computing (4 credits)
- ECE 6410 - Intelligent Control Systems (4 credits)
- ECE 6520 - Automotive Mechatronics II (4 credits)
- ECE 6712 - Parallel Embedded Computer Architecture (4 credits)

- ECE 6742 - DSP in Embedded Systems (4 credits)
- ECE 6745 - Real-Time Computing Systems (4 credits)
- CSI 5360 - Concurrent and Multi-Core Programming (4 credits)
- CSI 5420 - Software Architecture and Components (4 credits)

Human-Centered AI, Autonomous systems and Robotics Concentration

- CSI 5900 - AI-Human Interaction (4 credits) (4 credits) : Core course in this concentration area
- CSI 5550 - Visual Computing (4 credits)
- SYS 5900 - ST: Automotive User Experience (4 credits)
- CSI 5550 - Visual Computing (4 credits)
- CSI 6550 - Advanced Visual Computing (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)
- ECE 5500 - Robotic Systems and Control (4 credits)
- ECE 5532 - Autonomous Vehicle Systems I (4 credits)
- ECE 6410 - Intelligent Control Systems (4 credits)
- ECE 6440 - Adaptive Control Systems (4 credits)
- ECE 6460 - Autonomous Vehicle Systems II (4 credits)
- ECE 6467 - Dynamics and Control of Robot Manipulators (4 credits)
- ISE 5422 - Robotic Systems (4 credits)
- ECE 5551 - Human-Robot Interaction (4 credits)
- CSI 5180 - Natural Language Processing (4 credits)

Machine Learning Concentration

- CSI 5140 - Deep Learning and Applications (4 credits) Core course in this concentration area
- CSI 5810 - Information Retrieval and Knowledge Discovery (4 credits)
- ME 5310 - Machine Learning Engineering Design (4 credits)
- ISE 5002 - Engineering Operations Research (4 credits)
- ISE 5430 - Engineering Operations Research - Deterministic Models (4 credits)
- ISE 5431 - Engineering Operations Research - Stochastic Models (4 credits)
- ISE 5517 - Statistical Methods in Engineering (4 credits)
- ME 5434 - Metamodeling and Optimization Methods in Design (4 credits)
- CSI 5180 - Natural Language Processing (4 credits)

Smart Manufacturing, Machine Vision and Industry 4.0 Concentration

- ISE 5512 - Artificial Intelligence in Manufacturing (4 credits): Core course in this concentration

area

- SYS 5900 - ST: Virtual and Augmented Reality (4 credits)
- CSI 5240 - Cloud Computing (4 credits)
- CSI 6480 - Information Security (4 credits)
- ISE 5422 - Robotic Systems (4 credits)
- ISE 5456 - Engineering Risk Analysis (4 credits)
- ISE 5464 - Design for Manufacturing and Assembly Analysis (4 credits)
- ISE 5410 - Supply Chain Modeling and Analysis (4 credits)
- ISE 5002 - Engineering Operations Research (4 credits)
- ISE 5517 - Statistical Methods in Engineering (4 credits)
- CSI 5550 - Visual Computing (4 credits)

Artificial Intelligence for IT Operations (AIOps) Concentration

- CSI 5XXX - AI for IT Operations (4 credits): Core course in this concentration area
- CSI 5220 - Object Oriented Analysis and Design (4 credits)
- CSI 5200 - Fundamentals of Software Modeling (4 credits)
- CSI 5300 - Software Prototyping and Validation (4 credits)
- CSI 5380 - Software Verification and Testing (4 credits)
- CSI 5390 - Software Engineering (4 credits)
- CSI 5410 - Software Project Planning, Management and Maintenance (4 credits)
- CSI 5720 - Software Security (4 credits)
- CSI 5140 - Deep Learning and Applications (4 credits)

AI for Cyber Security and Trustworthy AI Concentration

- CSI 5XXX AI in cybersecurity and Privacy (4 credits): Core course in this concentration area
- CSI 5460 - Information Security
- CSI 5480 - Information Security Practices
- CSI 5720 - Software Security
- CSI 5140 - Deep Learning and Applications (4 credits)

Augmented/Virtual Reality Concentration

- SYS 5900 - ST: Virtual and Augmented Reality (4 credits): Core course in this concentration area
- SYS 5900 - ST: Automotive User Experience (4 credits)
- CSI 4900/5900 - AI-Human Interaction (4 credits) (4 credits)

- CSI 5550 - Visual Computing (4 credits)

- ECE5551 - Human-Robot Interaction (4 credits)

Ethics of AI Concentration

- CSI 5XXX - Ethics and Bias in AI (4 credits): Core course in this concentration area

- CSI 5900 - AI-Human Interaction (4 credits) (4 credits)

- CSI 5140 - Deep Learning and Applications (4 credits)

- CSE 5810 - Information Retrieval and Knowledge Discovery (4 credits)

c) **Electives (8 credits)**

Any SECS graduate courses or those from the approved list of courses for the MSc in AI program (appendix) can be considered as an elective.

d. Academic Progress – Probation – Dismissal

To stay in good academic standing, students must not allow their cumulative grade point averages (GPA) to drop below 3.0. The program follows the official Academic Policies and Procedures. (See university website for details.)

Inactive student status: At Oakland University, a matriculated graduate student is a student who has been previously admitted to and has enrolled in a graduate program. Graduate Study and Lifelong Learning classifies inactive, matriculated students into two categories: one category permits readmission to a graduate program, and the other category requires reapplication before an inactive student can re-enroll in a course. The periods of inactivity used to classify inactive students into the appropriate category are defined as follows:

Readmission: Students who have not enrolled for six or more consecutive semesters are permitted to submit a Request for Graduate Readmission form. Each request is evaluated in terms of the time limit established for completing degree requirements, performance in previous coursework, and progress made toward the degree. Students will not be readmitted to programs that have been suspended or discontinued. The catalog current at the time a student is readmitted will govern program requirements, policies and procedures.

Reapplication: Students who have not enrolled for seven consecutive years are considered inactive and their graduate student files are destroyed. These students are considered new applicants and must submit a new Application for Admission to Graduate Study and new supporting documents as specified in both the General Admission Requirements and the Program Admission Requirements.

e. Academic direction and oversight for the program

The proposed MS in AI program will be hosted by the CSE department. One program coordinator will be responsible for administering the program and they will be supported by the CSE administrative assistant and the department chair.

f. Interdisciplinary programs

Academic home: The Master of Science in AI program will be administered in the Department of Computer

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Science and Engineering. A program committee will be designated to oversee the degree program. The role of the program committee is to administer program policies, curricula changes and petition approvals. The Chair of the Department of Computer Science and Engineering will determine the members of the program committee and select a program coordinator.

Other participating academic units: Department of Electrical and Computer Engineering, Department of Industrial and Systems Engineering, Department of Mechanical Engineering and Department of Bio-Engineering from the School of Engineering and Computer Science.

g.   Accreditation

Not applicable.

h.   Prepare a brief description of the program

The Master of Science in Artificial Intelligence is composed of eight (8) courses: three (3) core courses, three (3) concentration courses to be chosen from one of four specialization areas, and one or two other electives depending on the selected option (project or thesis).

The proposed program is designed to give students a comprehensive framework for artificial intelligence with specialization in one of 9 concentration areas: (1) Edge AI and IoT, (2) Embedded AI, (3) Human-Centered AI, Augmented/Virtual Reality and Robotics, (4) Machine Learning, (5) Smart Manufacturing and Industry 4.0, (6) Artificial Intelligence for IT Operations (AIOps), (7) AI for Cyber Security and Trustworthy AI, (8) Augmented/Virtual Reality and (9) Ethics of AI.

Students will engage in an extensive core intended to develop depth in all the core concepts that build a foundation for artificial intelligence theory and practice. They will be given the opportunity to build on the core knowledge of AI by taking a variety of elective courses selected from colleges throughout campus to explore key contextual areas or more complex technical AI applications. Program graduates will be well positioned to attain research and development positions in this rapidly growing field, or to progress into Ph.D. degrees in related fields.

The graduates from the MSc in AI will be equipped with the following capabilities:

- Understand representations, algorithms and techniques used across works in artificial intelligence and be able to apply and evaluate them in applications as well as develop their own.
- Understand and apply machine-learning techniques, in particular to draw inferences from data and help automate the development of AI systems and components.
- Understand the various ways and reasons humans are integrated into mixed human-AI environments, whether it is to improve overall integrated system performance, improve AI performance or influence human performance and learning.
- Understand the ethical concerns in developing responsible AI technologies.
- Implement AI systems, model human behavior, and evaluate their performance.

A unique aspect of the proposed program is the intended demographic it aspires to serve and the unique concentrations that are offered to meet the current industry demands especially in the State of Michigan. Specifically, the program will be accessible to both full-time and part-time students, aiming to train students who aspire to have AI research and development (R&D) and leadership careers in industry.

i.   Source of Students

- Graduates of the CS and IT undergraduate programs of the CSE department;
- Graduates of other OU undergraduate programs (e.g., math and MIS) who have an interest in AI;
- Graduates of other higher education institutions in Michigan and around the country/world;

- Mid-career IT professionals in government agencies, businesses, hospitals, and non-profit organizations;
- General public who are interested in AI and satisfy the admission requirement of the program.

j.   Recruitment Plan

SECS will extensively promote the program via its newsletter and its network of industry executives and collaborators. The CSE department will prepare a brochure on the MS in AI program and mail it to the school's alumni, current students, local companies, and universities in the state of Michigan and to selected universities around the U.S. and internationally. The graduate program coordinator will also visit local companies to make them aware of the program and to meet with prospective students from these companies at their locations to explain the program and its benefit to their careers.

A special effort will be made to attract minorities and women to the program and prepare them to succeed within the MS in AI program and beyond. This will include involving the university chapters of national organizations, such as IEEE Women in Engineering and the Society of Women Engineers. Additionally, we will contact the National Society of Black Engineers, the Society of Hispanic Professional Engineers, and the American Indian Science and Engineering Society. Finally, a web page will also be prepared to disseminate information on the MS in AI program.

k.   Planned Program Enrollment

We project that about 20 students will enroll in the program during its first full year of implementation. By the third year, an enrollment of 60 students is expected. A steady-state enrollment of 80 students is expected by the fifth year. On average, a student will elect four to six courses per calendar year. We believe that the proposed program's projected first-year enrollment of 20 students and steady-state enrollment of 80 students are realistic estimates based on the SECS track record of enrollments in new degree programs, the popularity of AI, and the current industry support for the program.

l.   Advising students

Students will be assigned to a faculty mentor upon admission into the program. SECS Graduate advisor will monitor Plan of Study and scheduling.

m.   Retention Plan

We intend to create a strong sense of community among our students, faculty, and staff through several activities and programs in collaboration with the PPI center at OU. The students will be invited to the annual AI symposium, participate in the poster session, and get updates about the state of the art in AI from executives of national companies such as IBM, eBay, Google, etc. The center is also organizing joint workshops on AI with companies such as IBM to expose students to recent advances in AI tools. The students will also be invited to weekly AI seminars and brainstorming meetings of the center, along with the regular seminars of SECS and the CSE department.

Student retention is critical to ensure the self-sustainability and high quality of the program. The program will strive to retain a high-quality student enrollment by implementing the following retention plan:

- Set up mentoring for new students to ensure they have a clear understanding of the curriculum and

milestones/requirements for the successful completion of the program
- Early identification of students who are performing poorly in the program and make sure appropriate support is presented to these students
- Ensure sufficient academic advising to students by coordinating efforts of both the faculty and the academic advisors
- Hosting regular AI seminars: bring experts to campus to update students in the state of the art
- Encourage students to attend meetings of professional societies, such as IEEE and ACM, and participate in activities held by student-organized study groups
- Provide professional development opportunities and internships for students who are close to their graduation
- Help potential employers who may be interested in the graduates of the program to know our program and graduates better by holding AI job fairs and workshops
- Help graduates to market themselves in their job placement by hosting their resume and homepage on the department's website

n.   Provide list of businesses that would likely employ graduates of the program

- Educational Institutions: All universities, high schools, middle schools, and elementary schools
- Government Agencies: State of Michigan, NSA, DoE, DoT, and all other agencies at the county, state, and federal levels
- Military: DoD, Army, Navy, Air Force, and military contractors
- Financial Institutions/Banks and Insurance: Chase, Citi, Bank of America, all local banks in Michigan
- Hospitals and healthcare: William Beaumont Hospital, Crittenton Hospital, St. Joseph Mercy Hospital, Blue Cross Blue Shield of Michigan
- IT companies: Google, Apple, Microsoft, Amazon, eBay, Facebook, Symantec
- All sectors of the computing industry: GM, Stellantis, Ford, DTE, Comcast
- Etc. (AI is almost used in every business domain)

IV.   **Off Campus or Distance Delivered Programs**

Not applicable.

V.   **Needs and Costs of the Program**

A.   New Resources Needed for the Program
- Faculty positions: Two new full-time faculty
- Staff positions: 50% admin assistant needed
- Library Holdings: see library report
- Graduate assistants: one projected
- Space: none projected
- Equipment: none projected

B.   Source of New Resources
The cost of the program initially will be covered by increase in tuition revenue. See Appendix E.

C.   5-Year Budget and Revenue from Program **Appendix E**
D.   Library – Include library assessment report **Appendix F**
E.   Classroom, Laboratory, Space needs
       Not applied as we will use existing resources.

F.   Equipment Needs
      Not applied as we will use existing resources.

V.   Program Assessment Plan

The Department of Computer Science and Engineering already offers three MSc degree programs. The new program would utilize the same assessment procedures. More details are available in **Appendix G.**

The assessment plan for the new courses in the MSc in Artificial Intelligence (including the core courses) will be coordinated by the CSE department and will use both direct and indirect assessment to evaluate how well students are achieving the core outcomes of each individual course.

Regarding direct assessments, they will include an anonymized assessment of student coursework to be sampled at random from the core courses. Thus, the selected work will be cumulative and synthetic to each course, such as final projects, and then the program faculty will develop quality rubrics to assess the outcomes of each course and the level of achievement by current students. Coursework will be sampled annually.

Indirect assessments of the program and new core courses will include standard institutional metrics, including (but not limited to) application statistics, enrollment data, completion and persistence rates, and student surveys (current and graduate). The program will also conduct student interviews (group and individual) to understand student perceptions of program and course operation.

Annual assessments of the program will be conducted for the first four years in an effort to continually improve the admissions rubric and to identify curricular gaps and employment trends, as well as program strengths and weaknesses. Table 2 shows a provisional timeline for program assessment. A comprehensive program review will be conducted at the close of the program's fifth year.

Table 2: A provisional timeline for program assessment

Assessment Plan	Timeline	AY 23/24			AY 24/25			AY 25/26			AY 26/27			AY 27/28		
		F	Sp	Su	F	Sp	Su	F	Sp	Su	F	Sp	Su	F	Sp	Su
Current Student Survey	Every Summer			X			X			X			X			X
Graduate Surveys	Annually after graduation for first cohort		X			X			X			X			X	
Program Data	Every Summer			X			X			X			X			X
Student Coursework	Every Summer			X			X			X			X			X

Graduate students who complete the MS degree will be able to:

Goal 1: Understand representations, algorithms and techniques used across works in artificial intelligence and be able to apply and evaluate them in applications as well as develop their own.
Goal 2: Understand and apply machine-learning techniques, in particular to draw inferences from data and help automate the development of AI systems and components.
Goal 3: Understand the various ways and reasons humans are integrated into mixed human-AI environments, whether it is to improve overall integrated system performance, improve AI performance or influence human performance and learning.
Goal 4: Understand the ethical concerns in developing responsible AI technologies.
Goal 5: Implement AI systems, model human behavior, and evaluate their performance.

The mapping of these goals to the core courses is presented in the following table.

Table 7.2: Goals mapping.

Course	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
CIS 5130	***	***	**	**	**
CIS 5170	***	**	***	***	**
CIS 5390	**	**	**	*	***
CIS 5220	*	**	**	*	***

*** considered/developed extensively
** considered/developed substantially
* considered/developed marginally

Program assessment will be coordinated by CSE. Two of the program goals above will be chosen to assess two required courses (core and concentration) for two consecutive years. Assessment plans for succeeding years will be developed during the second year of the program and we will follow the university's program assessment and review procedure.

VII. Appendices

a. Abbreviated Faculty Vitae
b. Degree Requirements
c. Typical Student Plan of Study – Full-Time Schedule
d. Detailed New Course Descriptions or Syllabi
e. Proforma Budget
f. Library Budget Report
g. Graduate Assessment Plan
h. Support Letters
-Professional Societies
-Governmental Agencies
-Prospective Employers
-Professionals in the Field
i. Survey Data

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Marouane Kessentini	Office: EC 546	Office Phone 248-370-4591
Title: Professor		**Office Email** kessentini@oakland.edu
School: SECS		

Degrees – School – Year PhD, University of Montreal, 2012	Research Interest AI, Software Engineering

Grants Awarded

NSF grant #1: An Infrastructure for Software Quality and Security Issues Detection and Correction, 600,000$

NSF grant #2: PFI–TT: Intelligent Software Refactoring Bot for Continuous Integration, 250,000$

NSF grant #3: I-Corps: Intelligent Software Quality Monitoring and Improvement Technology 50,000$

NSF grant #4: IUCRC Center for Pervasive Personalized Intelligence Center 20,000$ (until May 2022) + 750,000$ (starting from October 2022)

NSF grant #5: Collaborative Research: Elements: Software: Software Health Monitoring and Improvement
Framework $378,451.00

NSF grant #6: NSF Intern on Intelligent Software Bots for Software Security, 50,000$

2 projects from the Ford Motor Company with a total of 400,000$ (The topic of both projects is around 1)designing, implementing, and validating intelligent schedulers for software in the car and 2) self-healing of software applications in the car.

IBM gift for Smart Manufacturing, 30,000$

Publications

Chaima Abid, **Marouane Kessentini**, Vahid Alizadeh, Mouna Dhaouadi, Rick Kazman: How Does Refactoring Impact Security When Improving Quality? A Security-Aware Refactoring Approach. IEEE Trans. Software Eng. 48(3): 864-878 (2022)

Chaima Abid, Dhia Rzig, **Marouane Kessentini**, Thiago Ferreira, and Tushar Sharma: X-SBR: On the Use of the History of Refactorings for Explainable Search-Based Refactoring and Intelligent Change Operators. IEEE Transactions on Software Engineering Digital Object Identifier: 10.1109/TSE.2021.3105037 (2022)

Soumaya Rebai, Vahid Alizadeh, **Marouane Kessentini**, Houcem Fehri, and Rick Kazman. "Enabling decision and objective space exploration for interactive multi-objective refactoring." IEEE Transactions on Software Engineering, TSE (2021), 21 pages, DOI: 10.1109/TSE.2020.3024814.

Makram Soui, Nesrine Mansouri, Raed Alhamad, **Marouane Kessentini** & Khaled Ghedira, NSGA-II as feature selection technique and AdaBoost classifier for COVID-19 prediction using patient's symptoms, Nonlinear Dynamics Journal, 20 pages, Springer (2021)

Makram Soui, Mabrouka Chouchane, Mohamed Wiem Mkaouer, **Marouane Kessentini**, Khaled Ghedira: Assessing the quality of mobile graphical user interfaces using multi-objective optimization. Soft Computing Journal 24(10): 7685-7714 (2021), Springer Elsevier Impact Factor: 3.05

Chaima Abid, **Marouane Kessentini**, Vahid Alizadeh, What Refactoring Topics Do Developers Discuss? A Large Scale Empirical Study Using Stack Overflow. IEEE Access Journal

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
AI, Software Engineering	AI, Software Engineering

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Anyi Liu Title: Assistant Professor School: SECS	Office: EC 526	Office Phone 248-370-2137 Office Email anyiliu@oakland.edu
Degrees – School – Year PhD, George Mason University, 2009		**Research Interest** Network and system security, intrusion detection and prevention, malware analysis and defense, steganography, digital forensics, privacy

Grants Awarded
NSF SFS: "*Collaborative Research: Building Cybersecurity Capability in Pervasive Computing,*" submitted Sept 30, 2016, Anyi Liu (P.I.), *awarded in 2016 and transferred to Oakland University in full*. Amount: $143,309

Balakrishnan Dharmalingam, Anyi Liu, Subra Ganesan, Sankardas Roy:
FineObfuscator: Defeating Reverse Engineering Attacks with Context-sensitive and Cost-efficient Obfuscation for Android Apps. EIT 2022: 368-374

David Werden, Matthew Muccioli, Anyi Liu:
TEEm: A Tangle-based Elastic Emulator for Storing Connected Vehicle Data in a Distributed Ledger Technology. ICISSP 2022: 230-241

Anyi Liu, Ali Alqazzaz, Ming Hua, Balakrishnan Dharmalingam:
Iotverif: Automatic Verification of SSL/TLS Certificate for IoT Applications. IEEE Access 9: 27038-27050 (2021)

Yangguang Tian, Yingjiu Li, Robert H. Deng, Nan Li, Pengfei Wu, Anyi Liu:
A new framework for privacy-preserving biometric-based remote user authentication. J. Comput. Secur. 28(4): 469-498 (2020)

Canlin Li, Jinhua Liu, Anyi Liu, Qinge Wu, Lihua Bi:
Global and Adaptive Contrast Enhancement for Low Illumination Gray Images. IEEE Access7: 163395-163411 (2019)

Anyi Liu, Selena Haidar, Yuan Cheng, Yingjiu Li:
Confidential State Verification for the Delegated Cloud Jobs with Confidential Audit Log.EAI Endorsed Trans. Security Safety 6(20): e3 (2019)

Graduate Courses Taught (relevant to new degree CSI 6600 - Network Security	Prospective Graduate Courses (relevant to new degree) AI in Cyber Security

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Medhi Bagherzadeh Title: Assistant Professor School: SECS	Office: EC 542	Office Phone 248-370-2208 Office Email mbagherzadeh@oakland.edu
Degrees – School – Year PhD, Iowa State University, 2014	**Research Interest** Making engineering of correct software easier for concurrent, secure, mobile and big data software	

Grants Awarded
"µNASA: Mutation Testing to Improve Correctness of Message Passing Software", Michigan Space Grant Consortioum (MSGC), PI: Mehdi Bagherzadeh
Submission date: December 2021, Duration: 2022 – 2023
Amount: $5,000 (+ $5000 matched by SECS)

"Collaborative Research: CCRI: New: A Software Refactoring Community Infrastructure"
National Science Foundation (NSF), Co-PI: Mehdi Bagherzadeh, PI: Marouane Kessentini,
Submission date: January 2022, Duration:
Amount: $ 756,364

Most Recent Publications (limit to 6)

Yiming Tang, Allan Spektor, Raffi Khatchadourian, Mehdi Bagherzadeh:
Automated evolution of feature logging statement levels using Git histories and degree of interest. Sci. Comput. Program. 214: 102724 (2022)

Yiming Tang, Allan Spektor, Raffi Khatchadourian, Mehdi Bagherzadeh:
A Tool for Rejuvenating Feature Logging Levels via Git Histories and Degree of Interest. ICSE-Companion 2022: 21-25

Tatiana Castro Vélez, Raffi Khatchadourian, Mehdi Bagherzadeh, Anita Raja:
Challenges in Migrating Imperative Deep Learning Programs to Graph Execution: An Empirical Study. MSR 2022: 469-481

Tatiana Castro Vélez, Raffi Khatchadourian, Mehdi Bagherzadeh, Anita Raja:
Challenges in Migrating Imperative Deep Learning Programs to Graph Execution: An Empirical Study. CoRR abs/2201.09953 (2022

Yiming Tang, Raffi Khatchadourian, Mehdi Bagherzadeh, Rhia Singh, Ajani Stewart, Anita Raja:
An Empirical Study of Refactorings and Technical Debt in Machine Learning Systems. ICSE2021: 238-250

Yiming Tang, Allan Spektor, Raffi Khatchadourian, Mehdi Bagherzadeh:
Automated Evolution of Feature Logging Statement Levels Using Git Histories and Degree of Interest. CoRR abs/2104.07736 (2021)

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
CSI 5720 - Software Security CSI 5200 Fundamentals of Software Modeling	Software Security, AIOps

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Debatosh Debnath Title: Associate Professor School: SECS	Office: EC 536	Office Phone 248-370-2701 Office Email debnath@oakland.edu
Degrees – School – Year PhD, Kyushu Institute of Technology (Japan), 1998	**Research Interest** Design and optimization of digital circuits, CAD for field-programmable devices, decision diagrams and their applications in VLSI CAD, innovative applications of FPGAs	

Grants Awarded

None.

Hassan Hijry, Richard Olawoyin, William Edwards, Gary McDonald, Debatosh Debnath, and Yehya Al-Hejri, "Predicting average wait-time of COVID-19 test re- 3 sults and efficacy using machine learning algorithms," International Journal of Industrial Engineering and Operations Management, Vol. 3, No. 2, pp. 75–88, December 2021. Peer reviewed journal. Hassan Hijry was a graduate student of SECS.

Faisal Alghayadh and Debatosh Debnath, "A hybrid intrusion detection system for 1 smart home security based on machine learning and user behavior," Advances in Internet of Things, Vol. 11, No. 1, pp. 10–25, January 2021. Peer reviewed journal. Faisal Alghayadh was a graduate student of SECS.

"Embedded Software Implementation of a Key Agreement Protocol Using160-bit Elliptic Curve," International Journal of Computers and Their Applications, 2010

"Synthesis of Easily Testable AND-EXOR Networks," International Journal of Computers and Their Applications, 2011

Graduate Courses Taught (relevant to new degree CSI 5640 - Computer Architecture	Prospective Graduate Courses (relevant to new degree) Edge AI

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Huirong Fu **Title: Professor** **School: SECS**	**Office:** EC 528	**Office Phone** 248-370-4625 **Office Email** fu@oakland.edu
Degrees – School – Year PhD, Nanyang Technological University (Singapore), 2002	**Research Interest** Information assurance and security, wireless and mobile networks, sensor networks, networks/protocols/applications, multimedia communication systems, resource management and quality of service (QoS)	

Grants Awarded
2022-2027 PI NSF $3,198,315.00
CyberCorps Scholarship for Service: Cyber Defense of Intelligent Systems

2021-2023 PI NSA and NSF $147,958.58
GenCyber Teacher Program

2020-2022 PI NSA and NSF $99,991.87
GenCyber Program – Students at Entry Level

2019-2022 PI NSF $20,000.00
Supplement for REU Site: Undergraduate Computer Research

(UnCoRe) in Secure and Trustworthy Cyberspace
2019-2022 PI NSF $360,000.00
REU Site: Undergraduate Computer Research (UnCoRe) in Secure and Trustworthy Cyberspace

2016-2022 PI NSF $156,694.00
Collaborative Research: Building Cybersecurity Capacity in Pervasive Computing

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Rui Zhu, Tao Shu, Huirong Fu:
Statistical inference attack against PHY-layer key extraction and countermeasures. Wirel. Networks 27(7): 4853-4873 (2021)

Abdulrahman Alzahrani, Ali Alshehri, Hani Alshahrani, Huirong Fu:
Ransomware in Windows and Android Platforms. CoRR abs/2005.05571 (2020)

Anyi Liu, Huirong Fu, Yuan Hong, Jigang Liu, Yingjiu Li:
LiveForen: Ensuring Live Forensic Integrity in the Cloud. IEEE Trans. Inf. Forensics Secur.14(10): 2749-2764 (2019)

Saikrishna Gumudavally, Ye Zhu, Huirong Fu, Yong Guan:
HECTor: Homomorphic Encryption Enabled Onion Routing. ICC 2019: 1-6

Ali Alshehri, Pawel Marcinek, Abdulrahman Alzahrani, Hani Alshahrani, Huirong Fu:
PUREDroid: Permission Usage and Risk Estimation for Android Applications. ICISDM 2019: 179-184

Abdulrahman Alzahrani, Hani Alshahrani, Ali Alshehri, Huirong Fu:
An Intelligent Behavior-Based Ransomware Detection System For Android Platform. TPS-ISA 2019: 28-35

Graduate Courses Taught (relevant to new degree)	Prospective Graduate Courses (relevant to new degree)
CSI 5460 - Information Security CSI 6470 - Advanced Computer Networks	AI in Cyber Security

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Jingshu Chen Title: Assistant Professor School: SECS	Office: EC 534	Office Phone 248-370-4087 Office Email jingshuchen@oakland.edu
Degrees – School – Year PhD, Michigan State University, 2015	Research Interest software reliability, program verification and automatic repair, formal methods, distributed systems	

Grants Awarded
A User-friendly Genetic Performance Estimation Platform for Bridging Systems Performance Prediction and Resource Management, Michigan Space Grant Consortium, Amount: $5000, 2022

Ensuring Average Recovery with Adversarial Scheduler.
    Jingshu Chen, Mohammad Roohitavaf and Sandeep S.Kulkarni,
    The International Conference on Principles of Distributed Systems (OPODIS) 2015.

Refinment of Probabilistic Stabilizing Programs Using Genetic Algorithms.
    Ling Zhu, Jingshu Chen and Sandeep S. Kulkarni,
    The Int'l Symposium on Stabilization, Safety and Security of Distributed System (SSS) 2015.

The Complexity of Adding Multitolerance.
    Jingshu Chen, Ali Ebnenasir and Sandeep S. Kulkarni,
    ACM Transactions on Autonomous and Adaptive Systems (TAAS), 2014.

Analyzing Conflict Freedom for Multithreaded Programs With Time Annotations.
    Jingshu Chen, Marie Duflot and Stephan Merz,
    The 14th Int'l workshop on Automated Verification of Critical Systems (AVOCS) 2014.

Towards Scalable Model Checking of Self-Stabilizing Programs.
    Jingshu Chen and Sandeep S. Kulkarni,
    J. Parallel Distrib. Comput. 73(4): 400-410, 2013.

SMT-Based Model Checking for Stabilizing Programs.
    Jingshu Chen and Sandeep S. Kulkarni,
    The Int'l Conference on Distributed Computing and Networking (ICDCN) 2013.

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
CSI 5610 - Advanced Data Structure & Algorithm	

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Dae-kyoo Kim Title: Associate Professor School: SECS	Office: EC 546	Office Phone 248-370-2863 Office Email kim2@oakland.edu
Degrees – School – Year PhD, Colorado State University, 2002	**Research Interest** Software design & specification, patten-based development, aspect-oriented design, component-based development, access control policies, access control modeling, smart grid data modeling, internet of things	

Grants Awarded
None.

Maggie Lei, Hao Li, Ji Li, Namrata Aundhkar, Dae-Kyoo Kim:
Deep learning application on code clone detection: A review of current knowledge. J. Syst. Softw. 184: 111141 (2022)

Mohammad A. Yahya, Dae-Kyoo Kim:
Cross-Language Source Code Clone Detection Using Deep Learning with InferCode. CoRRabs/2205.04913 (2022)

Peter Sun, Dae-Kyoo Kim:
Analyzing Impact of Dependency Injection on Software Maintainability. CoRRabs/2205.06381 (2022)

Dae-Kyoo Kim, Yeasun K. Chung:
R-BPMN for abstract modeling of business process patterns. Bus. Process. Manag. J. 27(5): 1445-1462 (2021)

Weifeng Pan, Ming Hua, Carl K. Chang, Zijiang Yang, Dae-Kyoo Kim:
ElementRank: Ranking Java Software Classes and Packages using a Multilayer Complex Network-Based Approach. IEEE Trans. Software Eng. 47(10): 2272-2295 (2021)

Yiran Wang, Dae-Kyoo Kim, Dongwon Jeong:
A Survey of the Application of Blockchain in Multiple Fields of Financial Services. J. Inf. Process. Syst. 16(4): 935-958 (2020)

Graduate Courses Taught (relevant to new degree CSI 7995 CSI 5390 CSI 5005	Prospective Graduate Courses (relevant to new degree) AIOps, Software Engineering

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Lanyu Xu Title: Assistant Professor School: SECS	Office: EC 524	Office Phone 248-370-4079 Office Email lxu@oakland.edu
Degrees – School – Year PhD, Wayne State University, 2021 BS, Tongji University, 2015	**Research Interest** Edge computing, internet of things, cognitive computing, reinforcement learning, connected health	

Grants Awarded
None.

- **Lanyu Xu**, Arun Iyengar and Weisong Shi, <u>ChatCache: A Hierarchical Semantic Redundancy Cache System for Conversational Services at Edge</u>, in Proceedings of the IEEE International Conference on Cloud Computing(Cloud), Sep. 5-10, 2021, Virtual.
- **Lanyu Xu**, Arun Iyengar and Weisong Shi, <u>CHA: A Caching Framework for Home-based Voice Assistant Systems</u>, in Proceedings of the Fifth ACM/IEEE Symposium on Edge Computing (SEC), November 11-13, 2020.
- **Lanyu Xu**, Arun Iyengar and Weisong Shi, <u>NULBroker: A Flexible and Responsive Broker for Cloud-based Natural Language Understanding Services</u>, in Proceedings of the 11th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), July 8, 2019, Renton, WA, USA.
- Xingzhou Zhang, Yifan Wang, Sidi Lu, Liangkai Liu, **Lanyu Xu**, Weisong Shi, <u>OpenEI: An Open Framework for Edge Intelligence</u>, in Proceedings of the 39th IEEE International Conference on Distributed Computing Systems (ICDCS), Vision/Blue Sky Track, July 7-10, 2019, Dallas, USA.
- Jie Cao, **Lanyu Xu**, Raef Abdallah and Weisong Shi, An OS for Internet of Everything: Early Experience form a Smart Home Prototype, ZTE Communications, November 2017.
- Jie Cao, **Lanyu Xu**, Raef Abdallah and Weisong Shi, <u>EdgeOS_H: A Home Operating System for Internet of Everything</u>, in Proceedings of the 37th IEEE International Conference on Distributed Computing Systems (ICDCS), Vision/Blue Sky Track, June 5-8, Atlanta, USA.

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
Game Design Game Programming	Edge AI

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Lunjin Liu Title: Professor School: SECS	Office: EC 346	Office Phone 248-370-2200 Office Email l2lu@oakland.edu
Degrees – School – Year PhD, Birmingham University (UK), 1995	**Research Interest** Software verification, static program analysis, programming languages, constraint and logic programming, abstract interpretation, web application security, software security	

Grants Awarded
> "CyberCorps Scholarship for Service: Cyber Defense of Intelligent Systems at Oakland University", $3198315, NSF, February 1, 2022 - January 1, 2027.
> PI: Huirong Fu
> co-PIs: Amartya Sen, Darrin M Hanna, Lunjin Lu

Publications

Assad Maalouf, Lunjin Lu:
Precise Command Injection Analysis in Android Applications. ICMSS 2021: 1-7

Assad Maalouf, Lunjin Lu:
Taint analysis of arrays in Android applications. SAC 2021: 893-899

Nabil Almashfi, Lunjin Lu:
Code Smell Detection Tool for Java Script Programs. ICCCS 2020: 172-176

Nabil Almashfi, Lunjin Lu:
Precise String Domain for Analyzing JavaScript Arrays and Objects. ICICT 2020: 17-23

Dae-Kyoo Kim, Ming Hua, Lunjin Lu:
Reflection on Building Hybrid Access Control by Configuring RBAC and MAC Features. SANER 2020: 522-526

Graduate Courses Taught (relevant to new degree CSI 7940 CSI 5350	Prospective Graduate Courses (relevant to new degree) AIOps, Software Engineering

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name Khalid Mahmood Malik Title: Associate Professor School: SECS	Office: EC 532	Office Phone 248-370-3542 Office Email mahmood@oakland.edu
Degrees – School – Year PhD, Tokyo Institute of Technology (Japan), 2010	**Research Interest** Trustworthy AI, hybrid knowledge and machine/deep learning in cybersecurity and healthcare	

Grants Awarded

Khalid Malik (Sole PI), "Deep Forgery Detector", Michigan Translational Research and Commercialization (MTRAC) Innovation Hub; $92,500(01/2022-12/2022).

Khalid Malik (Sole PI), "A Fully Automated AI-based Personalized Subarachnoid Hemorrhage Prediction Tool", *Brain Aneurysm Foundation*; $25,000 (09/2021-08/2022).

Syed Nassar (PI), Yang LianXiang (co-PI), Khalid Malik (Senior Personnel) "IUCRC Phase I: Oakland University: Center for Composite and Hybrid Materials Interfacing (CHMI)" National Science Foundation, $700,000 (08/2021-07/2026).

Khalid Malik (PI), Hafiz Malik (PI) "SaTC:CORE:Small:Collaborative:ForensicExaminer: Testbed for Benchmarking Digital Audio Forensic Algorithms", *National Science Foundation (NSF)*, $498, 489 (09/2018-09/2022)

"Using AI Techniques to predict emergence of infectious diseases and to detect outbreak of pandemics", Ministry of Education, KSA, PI (USA-team), Total: $1.67 Million; OU Share: *$546,204* (December 2020- November 2023).

Publications

Ali Javed, **Khalid Mahmood Malik**, Aun Irtaza, and Hafiz Malik, "Voice Spoofing Detector: A Unified Anti-Spoofing Framework" Expert System with applications" 2022

Momina Masood, Marriam Nawaz, **Khalid Mahmood Malik**, Ali Javed, Aun Irtaza, Hafiz Malik "Deepfakes Generation and Detection: State-of-the-art, open challenges, countermeasures, and way forward", Applied Intelligence, Springer, 2022

Fozia Mehboob, Abdul Rauf, Richard Jiang, Abdul Khader Jilani Saudagar, Khalid Mahmood Malik, Muhammad Badruddin Khan, "Towards Robust Diagnosis of COVID-19 using Vision Self-attention Transformer". Scientific Reports, 2022

Awais Khan, Ali Javed, Khalid Mahmood Malik, Muhammad Anas, James Ryan, and Hafiz Malik

Jamil Ahmed, Khalid Malik, Abdul Khader Jilani Saudagar, Muhammad Badruddin Khan, "Disease Progression Detection via Deep Sequence Learning of Successive Radiographic Scans". International Journal of Environmental Research and Public Health (IJERPH), 2022

Qamar Abbas, Khalid Mahmood Malik, Abdul Khader Jilani Saudagar, Muhammad Badruddin Khan, Mozaherul Hoque Abul Hasanat, Abdullah AlTameem,and Mohammed AlKhathami. "Convergence Track Based Adaptive Differential Evolution Algorithm (CTbADE)". CMC-Computers, Materials & Continua

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
CSI 5480 - Information Security Practice CSI 5510 - Advance Web Design & Application	AI in Cyber Security

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Hua Ming Title: Associate Professor School: SECS	Office: EC 544	Office Phone 248-370-3769 Office Email ming@oakland.edu
Degrees – School – Year PhD, Iowa State University, 2012		**Research Interest** Programming Infrastructure Support for Emerging Big Data-oriented Situation-aware Software Services, Theory and Application of Multi-layer Complex Network, Software Verification Techniques for Mission Critical Software Services, Big Data-oriented Software Intensive Systems, Functional Programming Paradigm, The State-of-the-art of Modern Compiler Construction, Domain-specific Programming Language Design and Implementation

Grants Awarded
Project title: "Mobility-driven 3-in-1 (Md3-1): A real-time situation-pervasive service model with prototype implementation providing intelligent measure, command and back-end support to assist flooring specialists in the field."
Role: PI
Type: Industrial gift grant
funder: World of Floors Inc.
Status: awarded ($10,000)

Publications
Liuhai Wang, Xin Du, Bo Jiang, Weifeng Pan, Ming Hua, Dongsheng Liu:
KEADA: Identifying Key Classes in Software Systems Using Dynamic Analysis and Entropy-Based Metrics. Entropy 24(5): 652 (2022)

Anyi Liu, Ali Alqazzaz, Ming Hua, Balakrishnan Dharmalingam:
Iotverif: Automatic Verification of SSL/TLS Certificate for IoT Applications. IEEE Access 9: 27038-27050 (2021)

Weifeng Pan, Ming Hua, Carl K. Chang, Zijiang Yang, Dae-Kyoo Kim:
ElementRank: Ranking Java Software Classes and Packages using a Multilayer Complex Network-Based Approach. IEEE Trans. Software Eng. 47(10): 2272-2295 (2021)

Carl K. Chang, Paolo Ceravolo, Rong N. Chang, Sumi Helal, Zhi Jin, Xuanzhe Liu, Ming Hua:
Software Services Engineering Manifesto - A Cross-Cutting Declaration. ICWS 2021: 703-709

Weifeng Pan, Xinxin Xu, Ming Hua, Ping Gong, Bo Jiang, Chunlai Chai, Bailin Yang:
Identifying Key People in Chinese Literary Works Using e-Core Decomposition. IEEE Access8: 169872-169886 (2020)

Chunlai Chai, Yukuan Lou, Shijin Zhang, Ming Hua:
Prior Knowledge about Attributes: Learning a More Effective Potential Space for Zero-Shot
Recognition. ICPR 2020: 4751-4757

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
CSI 5380 - Software Verification & Testing	AIOps, Software Engineering

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Md Atiqul Mollah Title: Assistant Professor School: SECS	Office: EC 324	Office Phone 248-370-4150 Office Email mollah@oakland.edu
Degrees – School – Year PhD, Florida State University, 2018	Research Interest Distributed computing	

Grants Awarded

None.

Publications

Md Nahid Newaz, Md Atiqul Mollah "Optimizing k-path selection for randomized interconnection networks", 2021 IEEE 28th International Conference on High Performance Computing, Data, and Analytics (HiPC), 222-231, December 17, 2021 (Peer Review).

Md Nahid Newaz, Md Atiqul Mollah, Peyman Faizian, Zhou Tong "Improving adaptive routing performance on large scale Megafly topology", 2021 IEEE/ACM 21st International Symposium on Cluster, Cloud and Internet Computing (CCGrid), 406-416, May 10, 2021 (Peer Review).

Md Nahid Newaz, Md Atiqul Mollah, "Optimizing k-path selection for randomized interconnection networks",2021 International Conference on High Performance Computing, Data, and Analytics(HiPC), IEEE, Online, December 2021. (Paper)

Md Nahid Newaz, Md Atiqul Mollah, Peyman` Faizian, Zhou Tong, "Improving Adaptive Routing Performance on Large Scale Megafly Topology",21st IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGrid 2021),, IEEE/ACM, Online, May 2021. (Paper)

Md Nahid Newaz, Md Atiqul Mollah, "Minimizing traffic congestion on flexible data center networks with adaptive path selection schemes",Sixth Annual Graduate Student Research Conference, Oakland University, Online, May 2021. (Oral Presentation)

Graduate Courses Taught (relevant to new degree CSI 5360	Prospective Graduate Courses (relevant to new degree) Edge AI

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Guangzhi Qu Title: Professor School: SECS	Office: EC 538	Office Phone 248-370-4625 Office Email gqu@oakland.edu
Degrees – School – Year PhD, University of Arizona, 2005		**Research Interest** Data mining, machine learning, healthcare computing, information and network security, discrete event simulation, graph databases

Grants Awarded

- **Survival Analysis Predictive Model**
Guangzhi Qu (PI), Consumers Energy, 2017-2019
- **From Parallelism Discovery to Parallelization Planning of Large Sequential Programs on Multicore Platforms**
Guangzhi Qu (PI), Osamah Rawashdeh (Co-PI), Ford Motor Company, 2016-2018.
- **Dynaknife: A Scalable Tool Suite for Dynamic Analysis and Debugging of Large Programs on Multicore Platforms**
Guangzhi Qu (PI), Osamah Rawashdeh (Co-PI), Ford Motor Company, 2015-2016.
- **Towards Effective Multicore Processing in Automotive Powertrain Control Systems**
Osamah Rawashdeh (PI), Guangzhi Qu (Co-PI), Lina Sawalha (Co-PI), Ford Motor Company, 2013-2015.

Publications

Zijun Han, Guangzhi Qu, Bo Liu, Feng Zhang:
Exploit the data level parallelism and schedule dependent tasks on the multi-core processors. Inf. Sci. 585: 382-394 (2022)

Feng Zhang, Erkang Xue, Ruixin Guo, Guangzhi Qu, Gansen Zhao, Albert Y. Zomaya:
DS-ADMM++: A Novel Distributed Quantized ADMM to Speed up Differentially Private Matrix Factorization. IEEE Trans. Parallel Distributed Syst. 33(6): 1289-1302 (2022)

Bo Liu, Haipeng Jing, Guangzhi Qu, Hans W. Guesgen:
Cascaded Segmented Matting Network for Human Matting. IEEE Access 9: 157182-157191(2021)

Bo Liu, Shuo Yan, Jianqiang Li, Yong Li, Jianlei Lang, Guangzhi Qu:
A Spatiotemporal Recurrent Neural Network for Prediction of Atmospheric PM2.5: A Case Study of Beijing. IEEE Trans. Comput. Soc. Syst. 8(3): 578-588 (2021)

Bo Liu, Xi He, Mingdong Song, Jianqiang Li, Guangzhi Qu, Jianlei Lang, Rentao Gu:
A Method for Mining Granger Causality Relationship on Atmospheric Visibility. ACM Trans. Knowl. Discov. Data 15(5): 92:1-92:16 (2021)

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)

CSI 5130 - Artificial Intelligence	Machine Learning, AI

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Julian Rrushi	Office: EC 344	Office Phone 248-370-4067
Title: Assistant Professor		
School: SECS		**Office Email** rrushi@oakland.edu

Degrees – School – Year	Research Interest
PhD, University of Milan (Italy), 2009	Cyber Security

Grants Awarded
DARPA Young Faculty Award, class of 2020

Publications

"Design and Emulation of Physics-Centric Cyberattacks on an Electrical Power Transformer", with Ph.D. student John Olijnyk and MS student Benjamin Bond, IEEE Access; peer reviewed; published.

"Physics-driven Page Fault Handling for Customized Deception against CPS Malware", sole author, ACM Transactions on Embedded Computing Systems; peer reviewed; published.

"Industrial Control Systems Security", with colleagues Irfan Ahmed, and Antonio Albanese, Springer, Winter/Summer 2022.

"Cyber Physical Embedded System Attack Surface Classification Model", with Ph.D. student John Olijnyk.

"A watchdog model for physics-based anomaly detection in digital substations", with Ph.D. student Hussam Al-Tarazi.

"One-class Generative Adversarial Network to Detect Cyber Physical Attacks Against Power Systems", with Ph.D. student Mohammad Yahya.

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
CSI 5007 - Design & Analysis of Algorithms CSI 5006 - Data Structures CSI 5480 - Information Security Practice	AI in Cyber Security, NLP

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Amartya Sen Title: Assistant Professor School: SECS	Office: EC 322	Office Phone 248-370-4260 Office Email sen@oakland.edu
Degrees – School – Year PhD, Missouri S&T, 2015	**Research Interest** Edge AI, Cloud AI	

Grants Awarded
"CyberCorps Scholarship for Service: Cyber Defense of Intelligent Systems at
Oakland University", $3198315, NSF, Submitted August 2021.
PI: Huirong Fu
co-PIs: Amartya Sen, Darrin M Hanna, Lunjin Lu

"NSA GenCyber Program – Students at Entry Level", $99991.87, NSA/NSF, August
1, 2020 - August 31, 2022.
PI: Huirong Fu
Senior Personnel: Supporting Amartya

Publications
Oluwafeyisayo Oyeniyi, Shreyansh Dhandhukia, Amartya Sen, Kenneth Fletcher "A
study of artificial intelligence frameworks and their capability to diagnose major
depressive disorder", 2nd International Workshop on AI-enabled Process
Automation, ICSOC, 1-15 (Peer Review).

Amartya Sen, Oluwafeyisayo Oyeniyi, AI-as-a-Service on Edge Platforms,NSF
Center on Pervasive Personalized Intelligence Planning and IAB Workshop, NSF,
Oakland University, April 2022. (Poster)

· Amartya Sen, Damilola Alao, Secure and Dynamic Service Recommendations in
User-centric IoT Applications,NSF Center on Pervasive Personalized Intelligence
Planning and IAB Workshop, NSF, Oakland University, April 2022. (Poster)
· Amartya Sen, AI-as-a-Service on Edge Platforms,the NSF Center on Pervasive
Personalized Intelligence Planning and IAB Workshop,, NSF, Oakland University,
April 2022. (Oral Presentation)

· Amartya Sen, Oluwafeyisayo Oyeniyi, A Study of AI Frameworks for Major
Depressive Disorder Diagnosis,The 2nd International Workshop on AI-enabled
Process Automation, The 20th International Conference on Service-Oriented
Computing, Sevilla, Spain (Virtual), November 2021. (Paper)

· Amartya Sen, Ivan Mo, Benjamin Swanson, CYBERSECURITY RISK
ASSESSMENT FRAMEWORK USING COMPLEX PROBABILITIES,11th annual
Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE),
MSU, Lansing, MI, July 2021. (Poster)

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)

CSI 5240 CSI 5450 CSI 5950	Edge AI, Cloud AI

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Ishwar K. Sethi Title: Professor School: SECS	Office: EC 522	Office Phone 248-370-4625 Office Email isethi@oakland.edu
Degrees – School – Year PhD, Indian Institute of Technology, 1983		**Research Interest** Data mining, deep neural networks and applications, machine learning, pattern recognition, vision based tracking and surveillance

Grants Awarded

Publications

Machine Learning Theory and Applications for Healthcare, Special Issue Co-Editor, *Journal of Healthcare Engineering*, Vol. 2017

Computational Vision and Robotics: Proceedings of ICCVR 2014, Editor, Springer 2015

A Zoned Image Patch Descriptor, *IEEE Signal Processing Letters*, May 2015
Confidence-based Active Learning, *IEEE Trans. Pattern Analysis and Machine Intelligence*, 2006.

Classification of General Audio Data for Content-Based Retrieval, *Pattern Recognition Letters*, April 2001
Convolution-Based Edge Detection for Image/Video in Block DCT Domain, *Journal of Visual Communication and Image Representation*, 1996.

Entropy Net: From Decision Trees to Neural Nets, *Proceedings of the IEEE*, 1991.
Finding Trajectories of Feature Points in a Monocular Image Sequence, *IEEE Trans. Pattern Analysis and Machine Intelligence*, 1987.

Graduate Courses Taught (relevant to new degree	**Prospective Graduate Courses (relevant to new degree)**
AI, Knowledge Discovery	AI, Knowledge Discovery, Machine Learning

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Mohammad-Reza Siadat Title: Associate Professor School: SECS	Office: EC 540	Office Phone 248-370-2230 Office Email siadat@oakland.edu
Degrees – School – Year PhD, Wayne State University, 2008	**Research Interest** medical signal and image processing, computational anatomy and physiology, medical informatics	

Grants Awarded
Urinary Continence Index for Prediction of Urinary Incontinence in Older Women, PI, $650,000, 2011

"Unstructured Medical Image Query using Big Data – An Epilepsy Case Study," *Journal of Biomedical Informatics,* Vol. 59, pp. 218–226, 2016.

"Analysis of Incomplete and Inconsistent Clinical Survey Data," *Journal of Knowledge and Information Systems,* Vol. 46, Issue 3, pp 731-750, 2016.

"Validation of Brain Connectivity Analysis using fMRI Simulation," *Int. J. of Engin. Sys. Modelling and Simulation*, Vol. 7, No. 4, pp. 279–293, 2015.

"Conversion of a Surface Model ... into a Volume Model for Medical Image Retrieval," *Applied Medical Informatics*, Vol. 36, No. 2, pp. 9-30, 2015.

"Continence Index: a New Screening Quest. to Predict Probability of Incont....," *Int. Urology and Nephrology*, Vol. 47, No. 7, pp 1091-1097, 2015.

"Stratification of Clinical Survey Data Using Contingency Tables," *Int. J. of Data Mining and Knowledge Management Process*, Vol.4, No.4, July 2014.

Graduate Courses Taught (relevant to new degree CSI 5007 CSI 5550	Prospective Graduate Courses (relevant to new degree) Visual Computing

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Gautam B. Singh Title: Professor School: SECS	Office: EC 520	Office Phone 248-370-2129 Office Email singh@oakland.edu
Degrees – School – Year PhD, Wayne State University, 1993	**Research Interest** Data mining and innovative discovery, intellectual property and creativity informatics, bioinformatics, cyber laws, forensics and computer crimes, parallel computing and algorithms	
Grants Awarded None.		

Book: Foundations of Computational Biology and Bioinformatics. Springer, January 2015.

"Protecting Innovative Business Methods, Software and Databases," *Global Journal of Business Information Systems, Enriched Publications*. v. 1(1), pp. 1-10, 2013-2013.

"Learning Information Patterns in Biological Databases – Stochastic Data Mining," *Data Mining and Knowledge Discovery Handbook,* 2010

"Modified SACO Algorithm for Productive Emergence," *International Journal of Computers and Their Applications*, 2010

"Using Hidden Markov Models In Vehicle Crash Detection," *IEEE Transactions on Vehicular Technology*, 2009

"Component-Based Approach for Educating Students in Bioinformatics," *IEEE Transactions on Education*, 2009

Graduate Courses Taught (relevant to new degree	**Prospective Graduate Courses (relevant to new degree)**
CSI 5900 - Data Science with Python CSI 5760 - Bioinformatics CSI 5450 - Database Systems I	Visual Computing, Machine Learning

Abbreviated Faculty Vitae

Please include information relevant to the proposed program

Faculty Name: Steven Wilson Title: Assistant Professor School: SECS	Office: EC 518	Office Phone 248-370- Office Email stevenwilson@oakland.edu
Degrees – School – Year PhD, University of Michigan-AA, 2019	Research Interest Natural Language Processing	

Grants Awarded

- Oakland University -- University Research Committee Faculty Fellowship, $10,000

Publications

- **Achyutarama Ganti**, Steven Wilson, Zexin Ma, Xinyan Zhao, Rong Ma "Narrative Detection and Feature Analysis in Online Health Communities", In Proceedings of The 4th Workshop on Narrative Understanding at NAACL 2022, 6, July (3rd Quarter/Summer) 2022 (Peer Review).
- **Ibrahim Abu Farha, Silviu Oprea**, Steven Wilson, Walid Magdy "SemEval-2022 Task 6: iSarcasmEval, Intended Sarcasm Detection in English and Arabic", Proceedings of the 16th International Workshop on Semantic Evaluation (SemEval-2022), 12, July (3rd Quarter/Summer) 2022 (Peer Review).
- **Laura Biester, Vanita Sharma, Ashkan Kazemi, Naihao Deng**, Steven Wilson, Rada Mihalcea "Does Annotator Gender Affect NLP Benchmark Datasets?", In Proceedings of the 1st Workshop on Perspectivist Approaches to Disagreement in NLP at LREC 2022, 10, June 2022 (Peer Review).
- **Mohamed Bahgat**, Steven Wilson, Walid Magdy "LIWC-UD: Classifying Online Slang Terms into LIWC Categories", Proceedings of the 14th International ACM Conference on Web Science, 11, June 2022 (Peer Review).
- **Silviu Oprea**, Steven Wilson, Walid Magdy "Should a Chatbot be Sarcastic? Understanding User Preferences Toward Sarcasm Generation", Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics, 9, May 2022 (Peer Review).
- **Silviu Oprea**, Steven Wilson, Walid Magdy "Chandler: An Explainable Sarcastic Response Generator", Proceedings of the 2021 Conference on Empirical Methods in Natural Language Processing: System Demonstrations, 339--349, November 2021 (Peer Review).

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
NLP	NLP, Ethics of AI

Please include information relevant to the proposed program

Faculty Name: Douglas Zytko Title: Assistant Professor School: SECS	Office: EC 544	Office Phone 248-370-2683 Office Email zytko@oakland.edu
Degrees – School – Year PhD, University of Maryland, 2017	**Research Interest** Ethics of AI, Human-Centered AI	

Grants Awarded

Collaborative Research: HCC: Medium: Understanding Online-to-Offline Sexual Violence through Data Donation from Users
Funding source: National Science Foundation, Human-Centered Computing solicitation
$403,107
PI: Douglas Zytko
Co-PIs: Dongxiao Zhu, Melissa McDonald, Kelly Berishaj, Michele Parkhill Purdie

Publications

Douglas Zytko, Pamela J. Wisniewski, Shion Guha, Eric P. S. Baumer, and Min Kyung Lee. 2022. Participatory Design of AI Systems: Opportunities and Challenges Across Diverse Users, Relationships, and Application Domains. In CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI EA '22). Association for Computing Machinery, New York, NY, USA, Article 154, 1–4. https://doi.org/10.1145/3491101.3516506

Douglas Zytko, Nicholas Mullins, Shelnesha Taylor, and Richard H. Holler. 2022. Dating Apps Are Used for More Than Dating: How Users Disclose and Detect (Non-)Sexual Interest in People-Nearby Applications. Proc. ACM Hum.-Comput. Interact. 6, GROUP, Article 30 (January 2022), 14 pages. https://doi.org/10.1145/3492849

*The ACM Conference on Computer-Supported Cooperative Work & Social Computing (second highest h5-index for HCI publications on Google) has used PACM HCI as its journal publication outlet since 2018.

Caroline Bull, Hanan Aljasim, and **Douglas Zytko**. 2021. Designing Opportunistic Social Matching Systems for Women's Safety During Face-to-Face Social Encounters. In Companion Publication of the 2021 Conference on Computer Supported Cooperative Work and Social Computing (CSCW '21). Association for Computing Machinery, New York, NY, USA, 23–26. https://doi.org/10.1145/3462204.3481751

Nicholas Furlo, Jacob Gleason, Karen Feun, and **Douglas Zytko**. 2021. Rethinking Dating Apps as Sexual Consent Apps: A New Use Case for AI-Mediated Communication. In Companion Publication of the 2021 Conference on Computer Supported Cooperative Work and Social Computing (CSCW '21). Association for Computing Machinery, New York, NY, USA, 53–56. https://doi.org/10.1145/3462204.3481770

Zytko, Douglas, Nicholas Furlo, Bailey Carlin, and Matthew Archer. "Computer-Mediated Consent to Sex: The Context of Tinder." *Proceedings of the ACM on Human-Computer Interaction* 5, no. CSCW1 (2021): 1-26. https://doi.org/10.1145/3449288

Zytko Douglas, Zexin Ma, Jacob Gleason, Nathaniel Lundquist, Medina Taylor. (2021) Immersive Stories for Health Information: Design Considerations from Binge Drinking in VR. In: Toeppe K., Yan H., Chu S.K.W. (eds) Diversity, Divergence, Dialogue. iConference 2021. Lecture Notes in Computer Science, vol 12645. Springer, Cham. https://doi.org/10.1007/978-3-030-71292-1_25

Graduate Courses Taught (relevant to new degree	Prospective Graduate Courses (relevant to new degree)
CSI 5900 - AI-Human Interaction	Ethics of AI

Degree Requirements - Research Track/Professional Track

PREPARATORY COURSES – undergraduate courses

Course	Title	Credits	Prerequisites	
APM 2663 or	Discrete Mathematics	4	MTH 1555	
APM 1663	Mathematics for Information Technology	4	MTH 1222 or 1554	
APM 4777	Computer Algebra (recommended)	4	MTH 2775	
CSI 2290	Introduction to Data Structures in C	4	EGR 1400	
CSI 3610/3640	Design and Analysis of Algorithm	4	APM 2663	
STA 2220	Introduction to Statistical Concepts and Reasoning	4	MTH 062	

FOUNDATION COURSES – graduate courses required prior to core

Course	Title	Credits	Prerequisites	New (x)	% Distance

CORE COURSES

Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5130	Artificial Intelligence	4			
CSI 5170	Machine Learning	4			
CSI 5390	Software Engineering	4			
OR CSI 5220	Object Oriented Analysis Design	4			

CONCENTRATION – master degree
Note: For both research and professional tracks, students must declare one concentration area and select 3 courses

Edge AI and IoT

Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5XXX	Foundations of Edge AI (core course in the concentration area)	4		x	
CSI 5240	Cloud Computing	4			
CSI 5490	Wireless & Industrial Networks	4			
CSI 6470	Advanced Computer Networks	4			
CSI 6480 5460	Information Security	4	CSI 5490 or equivalent Cross-listed 4460		
CSI 5140	Deep Learning & Applications	4			

Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5230	Mobile & Smart Phone Application Development	4			
ECE 6212	Wireless Communication	4			

Embedded AI

Course	Title	Credits	Prerequisites	New (x)	% Distance
~~ECE 4900~~ 5900	ST: Embedded Artificial Intelligence (Core course in the concentration area)	4			
ECWE 5520	Automotive Mechatronics	4			
ECE 5720	Microprocessor-based Systems Design	4			
ECE 5731	Embedded Computing in Mechatronics	4	ECE 5720 or ECE 5732 is recommended		
ECE 5770	GPU Accelerated Computing	4			
ECE 6410	Intelligent Control Systems	4			
ECE 6520	Automotive Mechatronics II	4	ECE 5520 and at least one course from the core and theory group of courses		
ECE 6712	Parallel Embedded Computer Architecture	4			
ECE 6742	DSP in Embedded Systems	4			
ECE 6745	Real-time Computing Systems	4	ECE 5720 or ECE 5710 is recommended		
CSI 5360	Concurrent and Multi-core Programming	4			
CSI 5420	Software Architecture & Components	4			
CSI 5170	Pattern Recognition & Machine Learning	4			

Human-Centered AI, Autonomous Systems & Robotics

Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5900	AI-Human Interaction (Core course in the concentration area)	4			
CSI 5550	Visual Computing				
SYS 5900	ST: Automotive User Experience	4			
CSE 6550	Advanced Visual Computing	4	CSE 5550		
CSI 5140	Deep Learning & Applications	4			
ECE 5500	Robotic Systems & Control	4			
ECE 5532	Autonomous Vehicle Systems I	4			
ECE 6410	Intelligent Control Systems	4			
ECE 6440	Adaptive Control Systems	4			
ECE 6460	Autonomous Vehicle Systems II	4			
ECE 6467	Dynamics & Control of Robot Manipulators	4			
ISE 5442	Robotic Systems	4			
ECE 5551	Human-Robot Interaction	4			

Machine Learning

Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5140	Deep Learning & Applications (Core course in the concentration area)	4			
CSI 5810	Information Retrieval & Knowledge Discovery	4			
ME 5310	Machine Learning Engineering Design	4			
ISE 5002	Engineering Operations Research	4			
ISE 5340	Engineering Operations Research - Deterministic Models	4			
ISE 5341	Engineering Operations Research - Stochastic Models	4			
ISE 5517	Statistical Methods in Engineering	4			
ME 5434	Metamodeling & Optimization Methods in Design	4			
MIS 6900	ST: Deep Learning & Text Analytics	3			

Smart Manufacturing, Machine Vision and Industry 4.0

Course	Title	Credits	Prerequisites	New (x)	% Distance
ISE 5512	Artificial Intelligence in Manufacturing (Core course in the concentration area)	4			
SYS 5900	ST: Virtual & Augmented Reality	4			
CSI 5240	Cloud Computing	4			
CSE ~~6480~~ 5460	Information Security	4			
ISE 5422	Robotic Systems	4			
ISE 5456	Engineering Risk Analysis	4			
ISE 5464	Design for Manufacturing and Assembly Analysis	4			
ISE 5410	Supply Chain Modeling & Analysis	4			
ISE 5002	Engineering Operations Research	4			
ISE 5517	Statistical Methods in Engineering	4			

Artificial Intelligence for IT Operations (AIOps)

Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5XXX	AI for IT Operations (Core course in the concentration area)	4		x	
CSI 5220	Object Oriented Analysis & Design	4			
CSI 5200	Fundamentals of Software Modeling	4			
CSI 5300	Software Prototyping & Validation	4			
CSI 5380	Software Verification & Testing	4			
CSI 5390	Software Engineering	4			
CSI 5410	Software Project Planning, Management & Maintenance	4			
CSI 5720	Software Security	4			
CSI 5140	Deep Learning & Applications	4			

AI for Cyber Security & Trustworthy AI					
Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5XXX	AI in Cybersecurity & Privacy (Core course in the concentration area)	4		x	
CSI 5460	Information Security	4			
CSI 5480	Information Security Practices	4			
CSI 5720	Software Security	4			
CSI 5140	Deep Learning & Applications	4			
Augmented/Virtual Reality					
Course	Title	Credits	Prerequisites	New (x)	% Distance
SYS 5900	ST: Virtual & Augmented Reality (Core course in the concentration area)	4			
SYS 5900	ST: Automotive User Experience	4			
CSI 4900/5900	AI-Human Interaction	4			
ECE 5551	Human-Robot Interaction	4			
Ethics of AI					
Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 5XXX	Ethics & Bias in AI (Core course in the concentration area)	4		x	
CSI 5140	Deep Learning & Applications	4			
CSI 5170	Pattern Recognition & Machine Learning	4			
CSI 5810	Information Retrieval & Knowledge Discovery	4			

RECOMMENDED ELECTIVE COURSES - RESEARCH TRACK 8 credits					
Course	Title	Credits	Prerequisites	New (x)	% Distance
CSI 6998 or	Master's Thesis Research	4-8			
CSI 6999	Project/Independent Study	4			
CSI 7995	Research Initiation	2			
CSI 7940	Research Seminar	2			

RECOMMENDED ELECTIVE COURSES - PROFESSIONAL TRACK 8 credits					
Course	Title	Credits	Prerequisites	New (x)	% Distance
	Any SECS graduate courses listed in the above concentration areas	8			

Typical Plan of Study – Full-Time Schedule

Student Schedule - Research Track, Edge & IoT Concentration area Area

Fall I	Winter I	Summer I
CSI 5130 - Artificial Intelligence (4) CSI 5170 - Machine Learning (4)	CSI 5390 - Software Engineering (4) CSI 5XXX - Foundations of Edge AI (4)	
Fall II CSI 5240 - Cloud Computing (4) CSI 6998 - Thesis Research (4)	**Winter II** CSI 5140 Deep Learning & Applications (4) CSI 6998 - Thesis Research (4)	**Summer II**

Student Schedule - Professional Track, Artificial Intelligence for IT Operations (AIOps)

Fall I	Winter I	Summer I
CSI 5130 - Artificial Intelligence (4) CSI 5170 - Machine Learning (4)	CSI 5220 - Object Oriented Analysis Design (4) CSI 5XXX - AI for IT Operations (4)	
Fall II CSI 5200 - Fundamentals of Software Modeling (4) CSI 5140 - Deep Learning & Applications (4)	**Winter II** ME 5310 - Machine Learning Engineering Design (4) CSI6999 Project/ Independent Study (4)	**Summer II**

Provide New Course Descriptions

CSI 5110-Foundations of Edge AI (4 credits). The course covers many topics including the importance of power efficiency, latency, and bandwidth considerations for AI/ML implementation on edge devices. The course will cover how computing can be distributed between the edge devices and the cloud. The latest trends and applications of Edge AI in automotive, and industrial use cases will also be discussed. This course will also explain and demonstrate how AI/ML logic can be implemented on Edge devices such as smart sensors.

CSI 5150-AI for IT Operations (AIOps). This course introduces participants to MLOps tools and best practices for deploying, evaluating, monitoring and operating production ML systems on the Cloud. MLOps is a discipline focused on the deployment, testing, monitoring, and automation of ML systems in production. The students will learn and use tools for continuous improvement and evaluation of deployed models. The course will cover different best practices to improve the velocity and rigor in deploying the best performing models.

CSI 5580-AI for Cybersecurity & Privacy. Study of AI and machine learning algorithms customized for cyber security problems such as intrusion detection, malware classification, or network analysis. Topics include fundamentals of common machine learning and deep learning algorithms, intelligent threat detection and analysis, user behavior analytics, machine learning in hacking, privacy-preserving machine learning, transparency in machine learning, fairness of machine learning, and automated cybersecurity systems. It will also cover adversarial machine learning and countermeasures through real world problems and datasets. Hands-on lab components will also be developed.

CSI 5100-Ethics & Bias in AI. In this course students will acquire the tools to critically think, read, and write about AI in sociotechnical contexts. They will master the vocabulary and concepts necessary to identify, interrogate, and plan for the ethical implications of AI as a technological, social, and cultural phenomenon. Students will learn rudimentary, but important, aspects of intelligent computational modeling and processing so that they can appreciate the implications of AI on the general public. Topics addressed in the course include the technical, social, safety, and economic implications of AI-enabled automation, including bias in datasets and resultant AI models.

CSI 5110 - Foundations of Edge AI (4)
Course Syllabus

Catalog Description: The course covers many topics including the importance of power efficiency, latency, and bandwidth considerations for AI/ML implementation on edge devices. The course will cover how computing can be distributed between the edge devices and the cloud. Cross-listed with CSI4110.

Prerequisite: Major Standing.

Learning Objectives:

After completing the course, students should be able to:

- Identify different components of IoT
- Select development boards and tool chains for application prototyping
- Program MCU and SoC to read sensor data and control actuators
- Analyze sensor data using machine learning tools
- Use TensorFlow Lite to deploy neural networks on capable MCUs

Required Textbooks and Materials TinyML by Pete Warden and Daniel Situnayake, O'Reilly, 2019

Grading:

Homework: Six homework assignments will be given and completed by students working in groups of two. Assignments will cover the core areas of intrusion detection, malware classification, or network analysis, and will utilize the skills discussed in the lectures.

Project: There will be a semester long project to be completed by students working in groups of 4. A list of potential project topics will be provided, or students may choose their own (with instructor approval).

Course grade Criteria:
- 60% (600 points) — Assignments and labs
- 40% (400 points) — Project

Points	Percentage	Grade
951-1000	95.1%-100%	A
901-950	90.1%-95%	A-
851-900	85.1%-90%	B+
801-850	80.1%-85%	B
751-800	75.1%-80%	B-
701-750	70.1%-75%	C+
651-700	65.1%-70%	C
601-650	60.1%-65%	C-
551-600	55.1%-60%	D+
501-550	50.1%-55%	D
0-500	0%-50%	F

CSI 5150 - AI for IT Operations (4)
Course Syllabus

Catalog Description: This course introduces participants to MLOps tools and best practices for deploying, evaluating, monitoring and operating production ML systems on the Cloud. MLOps is a discipline focused on the deployment, testing, monitoring, and automation of ML systems in production. Cross-listed with CSI4150.
Prerequisites: Major standing.

Learning Objectives:

-     How to reduce the risk of entering bias in our artificial intelligence solutions and how to approach explainable AI (XAI)
-     The importance of efficient and reproduceable data pipelines, including how to manage your company's data
-     An operational perspective on the development of AI models using the MLOps (Machine Learning Operations) approach, including how to deploy, run and monitor models and ML pipelines in production using CI/CD/CT techniques, that generates value in the real world
-     Key competences and toolsets in AI development, deployment and operations

Required Textbooks and Materials: Operating AI: Bridging the Gap Between Technology and Business 1st Edition by Ulrika Jagare

Grading:

Labs: Eight Hands-on labs will be assigned throughout the semester.

Project: There will be two semester long projects to be completed by students working in groups of 2. A list of potential project topics will be provided, or students may choose their own (with instructor approval).

<u>Course grade Criteria:</u>
-     10% (100 points) — Reading Assignments
-     40% (400 points) — Labs
-     25% (250 points) — Project 1
-     25% (250 points) — Project 2

Points	Percentage	Grade
951-1000	95.1%-100%	A
901-950	90.1%-95%	A-
851-900	85.1%-90%	B+
801-850	80.1%-85%	B
751-800	75.1%-80%	B-
701-750	70.1%-75%	C+
651-700	65.1%-70%	C
601-650	60.1%-65%	C-
551-600	55.1%-60%	D+
501-550	50.1%-55%	D
0-500	0%-50%	F

CSI 5100 – Ethics and Bias in AI
Course Syllabus

Catalog Description: In this course students will acquire the tools to critically think, read, and write about AI in sociotechnical contexts. They will master the vocabulary and concepts necessary to identify, interrogate, and plan for the ethical implications of AI as a technological, social, and cultural phenomenon. Cross-listed with CSI5100.
Prerequisites: Major standing.

Learning Objectives:

Students will be able to understand

- the power and impact that analytics and AI/ML have on individuals and society, especially concerning issues such as fairness and bias, ethics, legality, data collection and public use.
- the underlying components of big data, apply basic statistical techniques to data scenarios, and understand the issues faced when learning from big data, ranging from data biases, overfitting, causation vs correlation, etc.
- basic AI/ML techniques to data scenarios, with a focus on identifying fairness and bias issues found in the design of decision-making systems.

Required Textbooks and Materials: Ethics of Artificial Intelligence 1st Edition
by S. Matthew Liao

Grading:

Homework: Ten homework assignments will be given and completed by students working in groups of two. Assignments will cover the core areas of intrusion detection, malware classification, or network analysis, and will utilize the skills discussed in the lectures.

Project: There will be a semester long project to be completed by students working in groups of 4. A list of potential project topics will be provided, or students may choose their own (with instructor approval).

Course grade Criteria:
- 60% (600 points) — Assignments and labs
- 20% (200 points) — Project 1
- 20% (200 points) — Project 2

Points	Percentage	Grade
951-1000	95.1%-100%	A
901-950	90.1%-95%	A-
851-900	85.1%-90%	B+
801-850	80.1%-85%	B
751-800	75.1%-80%	B-
701-750	70.1%-75%	C+
651-700	65.1%-70%	C
601-650	60.1%-65%	C-
551-600	55.1%-60%	D+
501-550	50.1%-55%	D
0-500	0%-50%	F

CSI 5580 – AI for Cybersecurity and Privacy
Course Syllabus

Study of AI and machine learning algorithms customized for cyber security problems such as intrusion detection, malware classification, or network analysis. Topics include fundamentals of common machine learning and deep learning algorithms, intelligent threat detection and analysis, user behavior analytics, machine learning in hacking, privacy-preserving machine learning, transparency in machine learning, fairness of machine learning, and automated cybersecurity systems. It will also cover adversarial machine learning and countermeasures through real world problems and datasets. Hands-on lab components will also be developed.

Catalog Description: Study of AI and machine learning algorithms customized for cyber security problems such as intrusion detection, malware classification, or network analysis. Topics include fundamentals of machine learning and deep learning, intelligent threat detection, user behavior analytics, machine learning in hacking, privacy-preserving machine learning, adversarial machine learning and countermeasures. Cross-listed with 4580.
Prerequisites: Major standing.

Learning Objectives:

• Apply AI technologies including machine learning and natural language processing in an attempt to help in understanding their role in cyber security
• Describe basic concepts for statistical modeling, including principles for model selection for supervised and unsupervised learning tasks in the context of cybersecurity.
• Select the most appropriate models for various cybersecurity scenarios, such as malware classification, botnet detection, and intrusion detection.
• Detect and defend against adversarial attacks on machine learning models in cybersecurity settings at both training and test times
• Identify and understand means of navigating legal and ethical challenges that emerge from gathering data about human subjects and using it to build machine-learning models

Required Textbooks and Materials: No recommended textbook. The instructor will provide the selected articles and research papers.

Grading:

Homework: Ten homework assignments will be given and completed by students working in groups of two. Assignments will cover the core areas of intrusion detection, malware classification, or network analysis, and will utilize the skills discussed in the lectures.

Project: There will be a semester long project to be completed by students working in groups of 4. A list of potential project topics will be provided, or students may choose their own (with instructor approval).

Course grade Criteria:
• 60% (600 points) — Assignments and labs
• 20% (200 points) — Project 1
• 20% (200 points) — Project 2

Points	Percentage	Grade
951-1000	95.1%-100%	A
901-950	90.1%-95%	A-
851-900	85.1%-90%	B+
801-850	80.1%-85%	B
751-800	75.1%-80%	B-
701-750	70.1%-75%	C+
651-700	65.1%-70%	C
601-650	60.1%-65%	C-
551-600	55.1%-60%	D+
501-550	50.1%-55%	D
0-500	0%-50%	F

APPENDIX E

<u>Proforma Budget</u>
Insert Budget using Proforma Budget Template

		Year 1	Year 2	Year 3	Year 4	Year 5
Est. New Students to Program		18	30	40	45	50
1st Year Cohort Revenue		$ 240,192	$ 400,320	$ 533,760	$ 600,480	$ 667,200
2nd Year Cohort Revenue		$ -	$ 240,192	$ 400,320	$ 533,760	$ 600,480
3rd Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
4th Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
Gross Tuition Revenue		$ 240,192	$ 640,512	$ 934,080	$ 1,134,240	$ 1,267,680
Less: Avg Financial Aid (30%)		$ (72,058)	$ (192,154)	$ (280,224)	$ (340,272)	$ (380,304)
Net Tuition Revenue		$ **168,134**	$ **448,358**	$ **653,856**	$ **793,968**	$ **887,376**
Expenses						
Salaries						
Faculty Salaries	6101	$ -	$ 100,000	$ 102,500	$ 105,063	$ 107,689
Visiting Faculty	6101					
Administrative Professionals	6201					
Clerical Technical	6211					
Administrative IC	6221					
Faculty Inload/Replacement Costs	6301	$ 14,000	$ 14,000			
Faculty Overload	6301					
Part-Time Faculty	6301					
Graduate Assistant	6311	$ 15,000	$ 15,000	$ 30,000	$ 30,000	$ 30,000
Casual/Temp	6401					
Out of Classification	6401					
Student Labor	6501					
Total Salary Expense		$ **29,000**	$ **129,000**	$ **132,500**	$ **135,063**	$ **137,689**
Fringe Benefits	6701	$ 2,320	$ 44,620	$ 45,758	$ 46,841	$ 47,952
Total Compensation		$ **31,320**	$ **173,620**	$ **178,258**	$ **181,904**	$ **185,642**
Operating Expenses						
Supplies and Services	7101					
Graduate Tuition	7101	$ 12,400	$ 12,400	$ 24,800	$ 24,800	$ 24,800
E-Learning Support	7102					
Travel	7201					
Equipment	7501					
Maintenance	7110					
Recruitment and advertising	7101	$ 25,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Library	7401	$ 9,500	$ 10,360	$ 11,300	$ 12,325	$ 13,445
Total Operating Expenses		$ 46,900	$ 27,760	$ 41,100	$ 42,125	$ 43,245
Total Expenses		$ **78,220**	$ **201,380**	$ **219,358**	$ **224,029**	$ **228,887**
Net Income (Loss)		$ **161,972**	$ **439,132**	$ **714,723**	$ **910,211**	$ **1,038,793**

[1]The tuition calculations do not account for any attrition of students.

SBRC Proforma Template   FY2023

		Year 1	Year 2	Year 3	Year 4	Year 5
Est. New Students to Program		25	40	50	60	65
1st Year Cohort Revenue		$ 333,600	$ 533,760	$ 667,200	$ 800,640	$ 867,360
2nd Year Cohort Revenue		$ -	$ 333,600	$ 533,760	$ 667,200	$ 800,640
3rd Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
4th Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
Gross Tuition Revenue		$ 333,600	$ 867,360	$ 1,200,960	$ 1,467,840	$ 1,668,000
Less: Avg Financial Aid (30%)		$ (100,080)	$ (260,208)	$ (360,288)	$ (440,352)	$ (500,400)
Net Tuition Revenue		$ 233,520	$ 607,152	$ 840,672	$ 1,027,488	$ 1,167,600
Expenses						
Salaries						
Faculty Salaries	6101	$ -	$ 100,000	$ 102,500	$ 105,063	$ 107,689
Visiting Faculty	6101					
Administrative Professionals	6201					
Clerical Technical	6211					
Administrative IC	6221					
Faculty Inload/Replacement Costs	6301					
Faculty Overload	6301	$ 14,000	$ 14,000			
Part-Time Faculty	6301					
Graduate Assistant	6311	$ 15,000	$ 15,000	$ 30,000	$ 30,000	$ 30,000
Casual/Temp	6401					
Out of Classification	6401					
Student Labor	6501					
Total Salary Expense		$ 29,000	$ 129,000	$ 132,500	$ 135,063	$ 137,689
Fringe Benefits	6701	$ 2,320	$ 44,620	$ 45,758	$ 46,841	$ 47,952
Total Compensation		$ 31,320	$ 173,620	$ 178,258	$ 181,904	$ 185,642
Operating Expenses						
Supplies and Services	7101					
Graduate Tuition	7101	$ 12,400	$ 12,400	$ 24,800	$ 24,800	$ 24,800
E-Learning Support	7102					
Travel	7201					
Equipment	7501					
Maintenance	7110					
Recruitment and advertising	7101	$ 25,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Library	7401	$ 9,500	$ 10,360	$ 11,300	$ 12,325	$ 13,445
Total Operating Expenses		$ 46,900	$ 27,760	$ 41,100	$ 42,125	$ 43,245
Total Expenses		$ 78,220	$ 201,380	$ 219,358	$ 224,029	$ 228,887
Net Income (Loss)		$ 255,380	$ 665,980	$ 981,603	$ 1,243,811	$ 1,439,113

[1]The tuition calculations do not account for any attrition of students.

SBRC Proforma Template

Worst-Case Scenario

		Year 1	Year 2	Year 3	Year 4	Year 5
Est. New Students to Program		13	20	30	35	40
1st Year Cohort Revenue		$ 173,472	$ 266,880	$ 400,320	$ 467,040	$ 533,760
2nd Year Cohort Revenue		$ -	$ 173,472	$ 266,880	$ 400,320	$ 467,040
3rd Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
4th Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
Gross Tuition Revenue		$ 173,472	$ 440,352	$ 667,200	$ 867,360	$ 1,000,800
Less: Avg Financial Aid (30%)		$ (52,042)	$ (132,106)	$ (200,160)	$ (260,208)	$ (300,240)
Net Tuition Revenue		$ **121,430**	$ **308,246**	$ **467,040**	$ **607,152**	$ **700,560**
Expenses						
Salaries						
Faculty Salaries	6101	$ -	$ 100,000	$ 102,500	$ 105,063	$ 107,689
Visiting Faculty	6101					
Administrative Professionals	6201					
Clerical Technical	6211					
Administrative IC	6221					
Faculty Inload/Replacement Costs	6301	$ 14,000	$ 14,000			
Faculty Overload	6301					
Part-Time Faculty	6301					
Graduate Assistant	6311	$ 15,000	$ 15,000	$ 30,000	$ 30,000	$ 30,000
Casual/Temp	6401					
Out of Classification	6401					
Student Labor	6501					
Total Salary Expense		$ **29,000**	$ **129,000**	$ **132,500**	$ **135,063**	$ **137,689**
Fringe Benefits	6701	$ 2,320	$ 44,620	$ 45,758	$ 46,841	$ 47,952
Total Compensation		$ **31,320**	$ **173,620**	$ **178,258**	$ **181,904**	$ **185,642**
Operating Expenses						
Supplies and Services	7101					
Graduate Tuition	7101	$ 12,400	$ 12,400	$ 24,800	$ 24,800	$ 24,800
E-Learning Support	7102					
Travel	7201					
Equipment	7501					
Maintenance	7110					
Recruitment and advertising	7101	$ 25,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Library	7401	$ 9,500	$ 10,360	$ 11,300	$ 12,325	$ 13,445
Total Operating Expenses		$ 46,900	$ 27,760	$ 41,100	$ 42,125	$ 43,245
Total Expenses		$ **78,220**	$ **201,380**	$ **219,358**	$ **224,029**	$ **228,887**
Net Income (Loss)		$ **95,252**	$ **238,972**	$ **447,843**	$ **643,331**	$ **771,913**

[1]The tuition calculations do not account for any attrition of students.

- One (1) assistant professor will be hired in the 2nd year. For details and justification, see staffing needs section.
- One PhD graduate assistant for the first two years and two in the 3rd year were requested for the remaining years
- The library and marketing budgets are included based on the recommendations received from the library and communications

Library Budget Report

September 15, 2022

To: Marouane Kessentini, Professor and Chair, Department of Computer Science and Engineering, School of Engineering and Computer Science (SECS)

From: Helen Levenson, Associate Professor and Collection Development Librarian, University Libraries

James E. Van Loon, Assistant Professor and Liaison Librarian to SECS, University Libraries

Re: Library collection evaluation for proposed M.S. program in Artificial Intelligence

In developing this collection evaluation, we reviewed the draft proposal for the master's program in artificial intelligence, as well as title lists of core journals and resources in the field. Overall, the library is well-positioned to support the proposed program; however, a few resources should be added to strengthen the collection in subject areas related to new course offerings. Below is a brief description of the resources currently available, those that should be acquired, and a five-year cost estimate in support of this proposed program.

Journals and Conference Proceedings

Currently, the library subscribes to the IEEE Library, which includes all journals, proceedings and standards produced by the IEEE. The library also maintains online access to all Association of Computing Machinery (ACM) journals, magazines, transactions and conference proceedings through the ACM Digital Library. The ACM and IEEE digital libraries, along with the library's current subscription to the Springer publisher package, provide full-text access to most of the journal and proceedings literature. Interlibrary loan also provides quick access to any other relevant journal articles. Our review of the major journals (Appendix A) and major proceedings and series (Appendix B) in this subject area lead us to conclude that the library's current holdings of journals and proceedings would provide strong support for the new M.S. program.

Indexes

To access the journal and conference literature in computer science, the University Libraries maintain subscriptions to a number of online indexes. The most important of these are Scopus (an Elsevier product), which indexes journals and conferences across all subjects; Compendex (accessed through Engineering Village), a bibliographic index to journals and conference proceedings in engineering and computing from 1969 to the present; and Science Citation Index

(available online through the Web of Science platform), which indexes journals from 1980 to present in the sciences. The library also provides access to Applied Science and Technology Source, which covers both academic and trade journal literature in science and technology. Other important resources include the ACM Digital Library and IEEE Xplor, both of which index journals and conferences published by their respective societies. No additional indexes are needed to support the program adequately.

Monographs and Reference Sources

The library purchases the complete collection of Springer eBooks each year, which includes the essential book series Lecture Notes in Computer Science (and all its subseries) and other book and book series, totaling more than 29,000 volumes related to computer science. Beyond the Springer eBook collection, the library purchases only a minimal number of books related to artificial intelligence and its applications to manufacturing, robotics, or edge computing. Table 1 shows the library's holdings (total, and recently acquired) in the Library of Congress subject classifications most relevant to artificial intelligence, with gaps in the collection relevant to new course offerings highlighted.

To ensure that the Libraries' monographic collection adequately supports the new proposed master's degree program, we recommend the purchase of approximately five ebooks each year in the five subject areas highlighted in Table 1; these materials would be selected at a level appropriate for graduate use.

Table 1: Monographic titles in subjects relevant to the proposed M.S. in Artificial Intelligence

LC call number	Subject	Number of books owned (all publication years)	Number of books owned (publication 2015-present)
Q325.5 - Q325.787	Cybernetics - Machine learning	477	336
Q334 - Q334.5 Q335 - Q335.7	Artificial intelligence	2550	952
Q334.7	Artificial intelligence - Moral and legal aspects	14	14
Q336	AI - Data processing	44	18
Q337 - Q337.3	Distributed AI	49	36
Q337.5	Pattern recognition systems	163	25
Q342	Computational intelligence	1961	1256
QA76.575	Digital computers - Multimedia systems	303	79
QA76.583	Digital computers - Edge computing	0	0
QA76.585	Digital computers - Cloud computing	257	176
QA76.592	Digital computers - Wearable computers	24	14
QA76.76.E95	Computer software - Expert systems	192	75
QA76.76.I59	Computer software - Interactive media and hypermedia	70	24
QA76.87	Computer science - Neural networks	309	122
QA76.9.A25	Computer science - Computer security	1726	927
QA76.9.A94	Computer science - Augmented reality	21	18
QA76.9.B45	Computer science - Big data	218	196
QA76.9.D343	Computer science - Data mining	616	301
QA76.9.M65	Computer science - Moral and ethical aspects	7	2
QA76.9.S63	Computer science - Soft computing	180	101
T59.6	Information systems - Industry 4.0	7	7
TA347.A78	Artificial intelligence - engineering applications	18	16
TK5105.59	Computer networks - Security measures	220	105
TK5105.8857	Internet of things	123	123
TS155.6 - TS155.67	Production management - Data processing	99	15

Note: Shaded rows indicate subject areas most relevant to new course offerings, and having gaps in the collection.

Library Budget Request

Appendix C provides cost estimates for new resources needed to support the proposed master's level program: funding to purchase approximately five ebooks each year on topics related to new course content (average current cost for these monographs is $180). Because this program will rely largely on existing library resources, we have also included funding to cover anticipated annual inflationary cost increases for the library's current journals and research databases (estimated at ten percent per year) in computer science. Without additional funding, the library cannot guarantee that we will be able to continue to subscribe to our current resources. Therefore, we ask that the library be given funds each year to assist us in continuing to subscribe to these necessary resources for computer science faculty and students.

Appendix A

Major Journals - Artificial Intelligence

Title	Publisher	OU Access
ACM Transactions on Intelligent Systems and Technology	ACM	yes
Applied Intelligence	Springer	yes
Applied Soft Computing	Elsevier	via Interlibrary Loan
Artificial Intelligence In Medicine	Elsevier	yes
Artificial Intelligence Review	Springer	yes
Complex & Intelligent Systems	Springer	yes (open access)
Computational Intelligence And Neuroscience	Hindawi	yes (open access)
Engineering Applications of Artificial Intelligence	Elsevier	via Interlibrary Loan
Expert Systems with Applications	Elsevier	via Interlibrary Loan
IEEE Computational Intelligence Magazine	IEEE	yes
IEEE Intelligent Systems	IEEE	yes
IEEE Internet Of Things Journal	IEEE	yes
IEEE Transactions On Cybernetics	IEEE	yes
IEEE Transactions on Emerging Topics in Computational Intelligence	IEEE	yes
IEEE Transactions on Fuzzy Systems	IEEE	yes
IEEE Transactions On Industrial Informatics	IEEE	yes
IEEE Transactions on Neural Networks and Learning Systems	IEEE	yes
IEEE Transactions on Pattern Analysis and Machine Intelligence	IEEE	yes
IEEE Transactions On Systems, Man And Cybernetics Part B, Cybernetics	IEEE	yes
International Journal of Human-Computer Studies	Elsevier	via Interlibrary Loan
International Journal of Intelligent Systems	Wiley	yes
International Journal Of Machine Learning And Cybernetics	Springer Nature	yes
International Journal of Neural Systems	World Scientific	via Interlibrary Loan
Journal Of Biomedical Informatics	Elsevier	yes (12 month embargo)
Journal of Intelligent Manufacturing	Springer	yes
Journal of Machine Learning Research	JMLR	yes (open access)
Knowledge-Based Systems	Elsevier	via Interlibrary Loan
Machine Learning	Springer Nature	yes
Nature Machine Intelligence	NPG	yes (12 month embargo)
Neural Computing and Applications	Springer	yes
Neural Networks	Elsevier	via Interlibrary Loan
Neurocomputing	Elsevier	via Interlibrary Loan
Science And Engineering Ethics	Springer Nature	yes

Appendix B		
Major Conference Proceedings and Series - Artificial Intelligence		
Title	**Publisher**	**OU Access**
Advances In Intelligent Systems And Computing	Springer	yes
AAAI Conference on Artificial Intelligence	AAAI	yes (open access)
Conference on Robot Learning (CORL)	MLR Press	yes (open access)
Frontiers In Artificial Intelligence And Applications	IOS Press	via Interlibrary Loan
International Conference on Applied Machine Learning (ICAML)	IEEE	yes
International Conference on Artificial Intelligence and Statistics (AISTATS)	MLR Press	yes (open access)
International Conference on Learning Representations (ICLR)	OpenReview	yes (open access)
International Conference on Machine Learning (ICML)	MLR Press	yes (open access)
International Conference on Machine Learning and Applications (ICMLA)	IEEE	yes
International Conference on Machine Learning and Cybernetics (ICMLC)	IEEE	yes
International Joint Conference on Artificial Intelligence (IJCAI)	IJCAI	yes (open access)
Lecture Notes In Artificial Intelligence	Springer	yes
Neural Information Processing Systems (NeurIPS)	ACM	yes (open access)

Appendix C					
Library Budget for Proposed M.S. in Artificial Intelligence Program					
	Year 1	Year 2	Year 3	Year 4	Year 5
Monographs[1]	$ 4,500	$ 4,860	$ 5,250	$ 5,670	$ 6,124
Support for current resources[2]	$ 5,000	$ 5,500	$ 6,050	$ 6,655	$ 7,321
Total	$ 9,500	$ 10,360	$ 11,300	$ 12,325	$ 13,445

[1]Presumes the purchase of 5 ebooks per year in identified LC classifications, with an 8% annual inflationary increase.
[2]Presumes a 10% annual inflation rate.

cc: Polly Boruff-Jones, Dean of University Libraries
        Julia Rodriguez, University Libraries Representative to University Senate

Graduate Assessment Plan
Insert Graduate Assessment Plan following https://www.oakland.edu/oira/
Please contact OIRA for assistance

The Department of Computer Science and Engineering already offers three master's degree programs. The new program would utilize the same assessment procedures.

The assessment plan for the new courses in the MS in Artificial Intelligence degree (including the core courses) will be coordinated by the CSE department and will use both direct and indirect assessment to evaluate how well students are achieving the core outcomes of each individual course.

Regarding direct assessments, they will include an anonymized assessment of student coursework to be sampled at random from the core courses. Thus, the selected work will be cumulative and synthetic to each course, such as final projects, and then the program faculty will develop quality rubrics to assess the outcomes of each course and the level of achievement by current students. Coursework will be sampled annually.

Indirect assessments of the program and new core courses will include standard institutional metrics, including (but not limited to) application statistics, enrollment data, completion and persistence rates, and student surveys (current and graduate). The program will also conduct student interviews (group and individual) to understand student perceptions of program and course operation. Annual assessments of the program will be conducted for the first four years in an effort to continually improve the admissions rubric and to identify curricular gaps and employment trends, as well as program strengths and weaknesses. Table 2 shows a provisional timeline for program assessment. A comprehensive program review will be conducted at the close of the program's fifth year.

A provisional timeline for program assessment

Assessment Plan	Timeline	AY 23/24			AY 24/25			AY 25/26			AY 26/27			AY 27/28		
		F	Sp	Su	F	Sp	Su	F	Sp	Su	F	Sp	Su	F	Sp	Su
Current Student Survey	Every Summer			X			X			X			X			X
Graduate Surveys	Annually after graduation for first cohort		X			X			X			X			X	
Program Data	Every Summer			X			X			X			X			X
Student Coursework	Every Summer			X			X			X			X			X

Graduate students who complete the MS degree will be able to:

Goal 1: Understand representations, algorithms and techniques used across

works in artificial intelligence and be able to apply and evaluate them in applications as well as develop their own.

Goal 2: Understand and apply machine-learning techniques, in particular to draw inferences from data and help automate the development of AI systems and components.

Goal 3: Understand the various ways and reasons humans are integrated into mixed human-AI environments, whether it is to improve overall integrated system performance, improve AI performance or influence human performance and learning.

Goal 4: Understand the ethical concerns in developing responsible AI technologies.

Goal 5: Implement AI systems, model human behavior, and evaluate their performance.

The mapping of these goals to the core courses is presented in the following table.

Table 7.2: Goals mapping.

Course	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
CIS 5130	***	***	**	**	**
CIS 5170	***	**	***	***	**
CIS 5390	**	**	**	*	***
CIS 5220	*	**	**	*	***

*** considered/developed extensively
** considered/developed substantially
* considered/developed marginally

Program assessment will be coordinated by CSE. Two of the program goals above will be chosen to assess two required courses (core and depth) for two consecutive years. Assessment plans for succeeding years will be developed during the second year of the program and we will follow the university's program assessment and review procedure.

Assessment Plan

for

M.S. in Artificial Intelligence

Department of Computer Science and Engineering

School of Engineering and Computer Science

Oakland University

Overview of the CSE Dept. Assessment Process.

The Assessment process used in the CSE Department has been developed over the years in conjunction with other departments from the school of Engineering and Computer Science and refined to satisfy the relevant accreditation bodies. The assessment plan is driven by the goals and mission of the department which are in line with the goals and missions of Oakland University and those of the SECS.

Goals and Objectives of the M.S. Programs.

1. Oakland University's Goals (from Mission Statement)

Programs and activities within the Computer Science and Engineering (CSE) department are in line with the following goals of the Oakland University extracted from the University mission:

A.   *It offers instructional programs of high quality that lead to degrees at the baccalaureate, master's and doctoral levels as well as programs in continuing education;*

B.   *It advances knowledge and promotes the arts through research, scholarship, and creative activity; and*

C.   *It renders significant public service.*

2. School of Engineering and Computer Science's Goals (from mission statement)

The School of Engineering and Computer Science mission, found in the school website at http://www.oakland.edu/secs/, states that the overall mission of the School of Engineering and Computer Science is threefold:

A.   *To provide high-quality undergraduate and graduate programs of instruction in engineering and computer science to prepare graduates for careers in the coming decades,*

B.   *To advance knowledge through basic and applied research in relevant branches of engineering and computer science, and*

C.   *To provide service to both the engineering profession and public of the State of Michigan.*

3. Department of Computer Science and Engineering's Goals (from mission statement)

The CSE mission, found in the department's website at http://www.cse.secs.oakland.edu/ oakland.edu/secs/, states that the overall mission of the Department of Computer Science and Engineering is threefold:

A.   *To provide high-quality graduate programs of instruction in Computer Science and Engineering to prepare graduates for careers in the coming decades,*

B.   *To advance knowledge through basic and applied research in Computer Science and Engineering, and,*

C.   *To provide service to the Computer Science and Engineering profession.*

4. Learning Outcomes of the Master programs offered by the CSE Department

The AI master program is developed to serve the mission of the department and meet the needs of its main constituents. A set of learning outcomes were identified for the AI master program. Some of the learning outcomes are common to all two programs, whereas others are program-specific. They are listed below.

Learning outcomes common to all Masters programs offered by the CSE department:

The graduates of the two masters programs will

A.   *have a solid knowledge of the key fundamentals in Computer Science and a detailed understanding of current issues and state of the art in computing;*
B.   *have skills in applying their knowledge and understanding to create computing solutions;*
C.   *be proficient in technical communication; and*
D.   *have high standards of professional and ethical responsibility.*

Program-specific Learning outcomes:

The graduates of the M.S. in Artificial Intelligence *will*

E.   *Goal 1: Understand representations, algorithms and techniques used across works in artificial intelligence and be able to apply and evaluate them in applications as well as develop their own.*
F.   *Goal 2: Understand and apply machine-learning techniques, in particular to draw inferences from data and help automate the development of AI systems and components.*
G.   *Goal 3: Understand the various ways and reasons humans are integrated into mixed human-AI environments, whether it is to improve overall integrated system performance, improve AI performance or influence human performance and learning.*
H.   *Goal 4: Understand the ethical concerns in developing responsible AI technologies.*
I.   *Goal 5: Implement AI systems, model human behavior, and evaluate their performance.*

5. How the Learning Outcomes are met

The CSE Dept. faculty has chosen an embedded approach to program assessment. Key courses have been identified the MS in AI program where students have the opportunity to demonstrate the achievement of the program outcomes; the sets of key courses are chosen to ensure that all of the program outcomes are demonstrated. Student materials are collected from the key courses that provide evidence that the outcomes have been achieved. External evaluators, including faculty not directly involved with the course and departmental advisory board members, review these materials to establish whether the students in that class have achieved some or all of the program outcomes. Every semester, the CSE Dept. faculty review the results of these external evaluations and generate appropriate plans to improve the achievement of the program outcomes.

Each CSE course has a set of course outcomes, developed by the instructing faculty and CSE Graduate Committee, which ensure the logical sequence of topics necessary to the eventual achievement of the program outcomes. At the end of each semester, the students and faculty in each course rate how well that particular course section achieved its objectives. The faculty identifies the specific program outcome(s) achieved in the course and provide evidence in support of their contention. In addition, students and faculty are encouraged to comment on how

well the course fits into the overall scheme of the program and to suggest improvements to the course, the course outcomes and the overall program of study. The CSE Dept. holds a faculty meeting at the beginning of each semester to review all external evaluations and end-of-course evaluations from the prior semester and develop any needed plan for improvement.

```
   _____                        _____       _____
  /        \                      | Program        |     | External Evaluation of |
 |  • Core CSE M.S. Courses |     | Outcomes       |     | Program & Course |
 |  • Core CSE E.S. Courses |---->|      &         |<----| Outcomes         |
 |  • Core CSE SE/IT Courses|     | Course         |     |                  |
 |                          |     | Outcomes       |     |_____|
 |   All CSE Courses        |     |_____|
  _____/                            |
                                        v
                           _____
                          | Student End-of-Course Evaluations |
                          |              &                    |
                          | Faculty End-of-Course Evaluations |
                          |_____|
                                        |
                                        v
                          _____
                         | CSE Chair                    |
                         | CSE Graduate Committee        |
                         | CSE Faculty                   |
                         |_____|
```
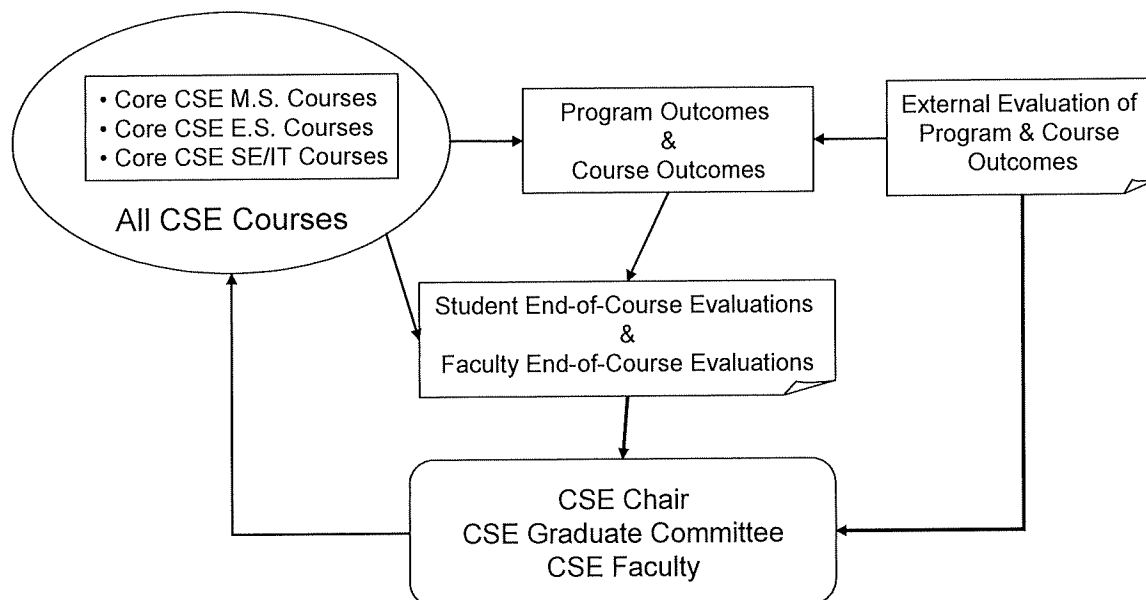
Measures.

The overall success of the M.S.s in CSE is measured by whether the students can demonstrate achievement of all learning outcomes as they graduate. In order to assess the students' achievement, the CSE Dept. faculty have selected one direct measure and one indirect measure.

Direct Measure. Key courses are identified in each of the M.S. programs where students have the opportunity to demonstrate the achievement of the program learning outcomes. These courses are chosen to ensure that all of the learning outcomes are demonstrated.
When a key course is under review, student materials are collected that provide evidence that the outcomes have been achieved, such as homework assignments, laboratory assignments, project assignment and exams. External evaluators (faculty not directly involved with the course, engineers from industry and CSE Dept. Advisory Board members) review these materials to establish whether the students in that class have achieved some or all of the program outcomes.

The rubric used by the external evaluators is presented in the following. Note that every assignment is not expected to demonstrated competency in all learning outcomes. Hence, a customized rubric containing only the appropriate learning outcomes is generated for each assignment. The rubrics are generated by any CSE Dept. faculty member from the SECS assessment website. The CSE Dept. faculty meet to review the results of these external evaluations and generate appropriate plans to improve the achievement of the program outcomes.

Indirect Measure. Each CSE M.S. course has a set of course outcomes, developed by the instructing faculty and the CSE Dept. Graduate Committee, which ensure the logical sequence of topics necessary to the eventual achievement of the program outcomes. At the end of each semester, the students in each course rate how well that particular course section achieved its outcomes (Appendix contains an example rubric for CSE 550). The CSE faculty review all of these course evaluations each semester at a department faculty meeting and generate appropriate plans to improve the achievement of the program outcomes.

Documentation of Assessment Process.

All actions taken at each step of the assessment process are documented properly. This record is used by the CSE faculty to evaluate and improve the assessment process.

CSE Dept. Faculty Involved in the Assessment Process.

All CSE Dept. faculty members are involved in the assessment process.

Example External Evaluation Form (Direct Measure)

SECS External Evaluation of Program Outcomes - Graduate
Example Assignment
Fall 2007

Evaluator: _____ Date: _____

Identification of student(s) or group:

Please rate how well the student work presented demonstrates the following program outcomes, using a scale from 0-100. Ratings of 70 or higher are considered acceptable levels of accomplishment. Include any comments to justify or explain your ratings.

An ability to design and analyze a product or process to satisfy a client's needs subject to constraints.	
Comments:	

An ability to apply the skills and knowledge necessary for mathematical, scientific, and engineering practices.	
Comments:	

An ability to interpret graphical, numerical, and textual data.	
Comments:	

An ability to use modern engineering tools.	
Comments:	

An ability to recognize when information is needed and to have the ability to locate, evaluate, and use effectively the needed information.	
Comments:	

Evaluators:

Thank you for volunteering to assess the graduate engineering programs of the SECS. This service helps us continuously improve our programs of study in order to better serve our students.

You will be examining student work which has been selected by the instructor because (s)he believes that it demonstrates one or more of the outcomes of the program of study. Your task is to rate how well the student work that you are examining demonstrates the program outcomes. In order to focus your evaluation, the instructor may have provided examples of what (s)he thinks may be relevant material or topics to consider or look for. As a guide to assigning ratings, 70% or above is considered to be an acceptable level of accomplishment. Include comments to explain or justify your ratings.

It is important to understand that you are not grading the student work. The students will receive, or have already received, their grades from their instructor.

Department Graduate Curriculum Committee Chairs:

Please compute the averages of all of the rating sheets for all evaluators, and enter them in the online External Evaluation of Program Outcomes database. You must keep the original evaluation sheets, and the student work that has been evaluated, for a period of three years.

Score	Rating	Description
90-100	Excellent	All assumptions, justifications and arguments are based on thorough and exhaustive mathematical analysis, experiments, computer simulations and/or research; research appears thorough and complete and is thoroughly documented; presentations are very well organized, easy to follow and exhibit thorough command of English.
80-89	Very Good	Most assumptions, justifications and arguments are based on thorough mathematical analysis, experiments, computer simulations and/or research; research appears complete and is well documented; presentations are well organized and exhibit good use of English.
70-79	Good	Some assumptions, justifications and arguments are based on thorough mathematical analysis, experiments, computer simulations and/or research; research appears complete and is documented; presentations are organized and exhibit standard use of English.
60-69	Below Average	Most assumptions, justifications and arguments do not appear based on mathematical analysis, experiments, computer simulations and/or research; research is missing, and/or undocumented; presentations are not organized well and exhibit sub-standard use of English.
50-59	Poor	Assumptions, justifications and arguments are not based on mathematical analysis, experiments, computer simulations and/or research; research is missing and/or undocumented; presentations are poorly organized and exhibit poor use of English.

Example Student Evaluation Results (Indirect Measure)

EVALUATION RESULTS

Below are the Course Objectives, Ratings: (E=EXCELLENT; G=GOOD; A=AVERAGE; P=POOR; U=UNSATISFACTORY; NA=DOES NOT APPLY), Total Ratings, the Average Grade, and the Total Average Grade for course objectives. The numbers below each rating are the total number of students who gave that rating for the course objective.

Course Objectives	E	G	A	P	U	NA	Total Ratings	Median	Standard Deviation	Avg Grade
1. Describe what characterize an OS, what they do and how they are designed and constructed										
2. Recognize and distinguish the hardware parts that are necessary to understand an OS										
3. Define a process (or a thread) and the notion of concurrency correctly since they are the heart of modern operating systems										
4. Distinguish between OS processes and user processes										
5. Describe methods for process scheduling, inter-process communication, process synchronization and deadlock handling										
6. Describe the role of the main memory for a process execution and the algorithms related to memory management including virtual memory										
7. Compass the file-system interface features such as file attributes, directory structure, acyclic graph directories and file sharing										
Total Average Grade for Course Objectives =										

Below are the Section Objectives, Ratings: (E=EXCELLENT; G=GOOD; A=AVERAGE; P=POOR; U=UNSATISFACTORY; NA=DOES NOT APPLY), Total Ratings, the Average Grade, and the total grade for the section objectives. The numbers below each rating are the total number of students who gave that rating for the section objective.

Section Objectives	E	G	A	P	U	NA	Total Ratings	Median	Standard Deviation	Avg Grade

Below are the Evaluation Questions, Ratings: (E=EXCELLENT; G=GOOD; A=AVERAGE; P=POOR; U=UNSATISFACTORY; NA=DOES NOT APPLY), Total Ratings, Your Rank, the Average Grade, and the Total Average Grade for each question. The numbers below each rating are the total number of students who gave that rating for the question. The Rank column provides your ranking for that specific question out of the total number of rankings (not necessarily the total number of instructors) for that question. For instance, if there are 5 instructors and 2 of them receive a rank of 1, then the total number of rankings is 4.

Evaluation Questions (Ratings)	E	G	A	P	U	NA	Total Ratings	Rank	Median	Standard Deviation	Avg Grade
1. Making the objectives of the course clear to me.											
2. Developing and presenting the course material in a clear and organized manner.											
3. Stimulating and deepening my interest in the subject.											
4. Motivating me to do my best work.											
5. Explaining and clarifying difficult material and problem solutions.											
6. Willingness to provide individual assistance to students outside of classroom hours.											
7. Ability to handle questions from the class.											
8. Utilization of class time.											
9. Utilization of instructional aids such as blackboard, slides or viewgraph.											
10. Uniformity and impartiality in grading.											
11. Promptness in returning homework, laboratory reports and examinations.											
12. Overall rating as a teacher											
13. Value of the textbook contribution to the course											
14. Value of the recitation component of the course.											

15. Value of the laboratory component of the course.										
16. Adequacy of the computing and/or laboratory facilities.										
17. Overall rating of this course as a learning experience.										
Total Average Grade for Instructor Evaluation Questions =										

*Note: Again, more than 1 instructor can have the same rank. (For example: If 4 out of 100 instructors receive a grade of 4.0, then all 4 instructors receive a rank of 1.)

Below are the Evaluation Questions and the students responses to each question.

Evaluation Questions (Comments)
18. INSTRUCTOR
19. COURSE
20. GRADING AND EVALUATION
21. OTHER

Below is the Student Profile section.

Student Profile						
1. Hours spent per week outside the classroom for this course.	Over 9	6-9	4-6	2-4	0-2	Total Answer
2. Your assessment of the amount of material covered in this course.	Much Too Much	Too Much	Just Right	Too Little	Much Too Little	Total Answer
3. What grade do you expect to receive in this course?	3.50-4.00	3.00-3.49	2.50-2.99	2.00-2.49	Below 2.00	Total Answer
4. What is your approximate cumulative grade point average?	3.50-4.00	3.00-3.49	2.50-2.99	2.00-2.49	Below 2.00	Total Answer

Below are the final grades for this course section

Course Objective =	
Section Objective =	

Evaluation Questions =	
Final Grade =	

Attachment A

Goal Cited in OU Mission	Relevant Goal of Unit	Student Learning Outcomes	Methods of Assessment	Individual(s) Responsible for Assessment Activities	Procedures for Using Assessment Results to Improve Program
Programs and activities within the Computer Science and Engineering (CSE) department are in line with the following goals of the Oakland University: A. It offers instructional programs of high quality that lead to degrees at the baccalaureate, master's and doctoral levels as well as programs in continuing education; B. It advances knowledge and promotes the arts through research, scholarship, and creative activity; and C. It renders significant public service.	A. To provide high-quality graduate programs of instruction in Computer Science and Engineering to prepare graduates for careers in the coming decades, B. To advance knowledge through basic and applied research in Computer Science and Engineering, and, C. To provide service to the Computer Science and Engineering profession.	The graduates of the two masters programs will A. have a solid knowledge of the key fundamentals in Computer Science and a detailed understanding of current issues and state of the art in computing;	External evaluation; Student end-of-course evaluations	Course instructors and CSE Dept. faculty	The CSE Dept. faculty meet each semester to review external and end-of-course evaluations and develop plans for improvement.
		B. have skills in applying their knowledge and understanding to create computing solutions;	External evaluation; Student end-of-course evaluations	Course instructors and CSE Dept. faculty	The CSE Dept. faculty meet each semester to review external and end-of-course evaluations and develop plans for improvement.
		C. be proficient in technical communication; and	External evaluation; Student end-of-course evaluations	Course instructors and CSE Dept. faculty	
		D. have high standards of professional and ethical responsibility. Program-specific Learning outcomes: The graduates of the M.S. in Computer Science will	External evaluation; Student end-of-course evaluations	Course instructors and CSE Dept. faculty	The CSE Dept. faculty meet each semester to review external and end-of-course evaluations and develop plans for improvement.
		E. be prepared to perform research in the area of computer science; and	External evaluation; Student end-of-course evaluations	Course instructors and CSE Dept. faculty	The CSE Dept. faculty meet each semester to review external and end-of-course evaluations and develop plans for improvement.
		F. be able to design, verify and certify software-based.	External evaluation; Student end-of-course evaluations	Course instructors and CSE Dept. faculty	

Support Letters

OAKLAND
UNIVERSITY.

MEMO

To: Prof. Marouane Kessentini, CSE Dept. Chair

From: Prof. Osamah Rawashdeh, ECE Dept. Chair

Date: 08/23/2022

Subject: **MS in Artificial Intelligence Proposal Support**

I write in my capacity as the chair of the Electrical and Computer Engineering (ECE) department to express my strong support for the Master of Science in Artificial Intelligence program that you are developing.

The proposed program will provide students with the strong technical skills necessary to engage in ever-growing opportunities in Artificial Intelligence. I particularly appreciate the interdisciplinary approach taken in this proposal. The focus on Embedded AI and on autonomous systems (as two of the concentrations of the program) is of particular interest to students, faculty, and employers on the ECE side.

Please let me know if I can provide any additional support.

**OAKLAND
UNIVERSITY.**

Department of Industrial and Systems Engineering

8/23/2022

MEMO

To: Prof. Marouane Kessentini, CSE Dept. Chair

From: Prof. Vijitashwa Pandey, ISE Dept. Chair

Subject: Support letter for MS in Artificial Intelligence

Dear Professor Kessentini,

I am delighted to write this letter of support for the new MS program proposal in Artificial Intelligence. The program includes critical courses from the ISE department and several relevant concentrations to our department such as Augmented and Virtual Reality, and also Smart Manufacturing. It will prepare students in the school for the critical current and future needs of industry located in Michigan, and elsewhere in the United States. I strongly support this program.

Please let me know if I can be of assistance in any way.

School of Engineering and Computer Science

Engineering Center, Room 502 | 115 Library Drive, Rochester, Michigan 48309-4479
(248) 370-2989 | Fax: (248) 370-4625 | oakland.edu/ise

eBay™

August 21, 2022

To: Dr. Marouane Kessentini, Professor and CSE department chair

Subject: New Master of Science in Artificial Intelligence at Oakland University

I am pleased to advise you that eBay has been in discussion with Dr. Kessentini and the SECS interdisciplinary committee on AI and DS. I attended the advisory board meeting to discuss and review the MSc in AI proposal. I was really very impressed by the quality of the proposal and the great matching with the needs of industry in AI.

eBay is interested in supporting the program should the master proposal is approved Oakland University.

Our intention is to be active partners for this new program. We will encourage several of our engineers and scientists to join our program and I am committed to provide continuous feedback on the program including the critical stackable certificates which are very important for us.

We welcome the opportunity to work with you in this exciting new program on the MSc in AI and look forward to continuing and extending our relationship with Oakland University.

Sincerely,

Sami

Sami Ben Romdhane eBay

VP & Fellow of Platform Architecture and Data Infrastructure 408-759-2081

Oakland University
Graduate Council

August 19, 2022

Dear Dr. Kessentini,

I reviewed the proposal of the MSc in AI at Oakland University and I engaged in the advisory board meetings to establish this exciting program.

I strong support the program since it is really addressing critical needs for the automotive industry especially in Edge AI, Embedded AI and AIOps. We are really finding a lot of challenges to find qualified engineers in those areas within the state of Michigan. Thus, I am looking forward to see this program approved so we can start hiring your graduates as soon as possible based on the huge demand in that area.

All the very best,

Ali Husain
Director – Software Research & AI, Ford Motor Co.
alhusain4@ford.com

CSL Behring

Biotherapies for Life™

August 23, 2022

Letter of Support for the new Master of Science in Artificial Intelligence

I am very excited to support the proposal of the new master of science in AI at Oakland University. I carefully reviewed the proposal and enjoyed the great discussions around the concentrations of the proposal with other industry leaders of the advisory board.

I found the program very unique as I did not see similar programs in the US with a focus on the Ethics of AI, Edge AI and Embedded AI. Those areas are very important for almost every industry nowadays. I look forward to contributing to the program once it is approved.

Good luck,

John Thompson

Global Head of Advanced Analytics and AI, CSL Behring

thompsonjohn@cslbehring.com

Oakland University
Graduate Council

August 18, 2022

New MSc in AI program at Oakland University: Letter of Support

It is a great pleasure to support this important initiative to establish a master of science in AI based on the concepts of stackable certificates. To the best of my knowledge, this is the first time that I see stackable certificates in AI offered in a US university. I reviewed the proposal and participated in the discussions of the courses and concentrations as part of the advisory board. My conclusion is that this program is very much aligned with the industry needs and it will attract a lot of qualified students. IBM signed an agreement with Oakland University to expand AI at your school thus we are fully committed to support your great effort.

Sincerely,

Seth Dobrin

Chief AI Officer, IBM

sdobrin@us.ibm.com

Oakland University
Graduate Council

Survey Data

Survey with Current Students, Alumni and Industry

During the Winter and Summer terms of 2022, the SECS interdisciplinary committee on AI and DS conducted surveys with 157 participants including our current students, alumni and industry/government. As described in Figure 1, almost half of the participants were from our current OU students in SECS and the other half represented industry participants.

- ● Executive
- ● Director
- ● Manager/Supervisor
- ● Students
- ● Engineers/Practitioners
- ● Alumni
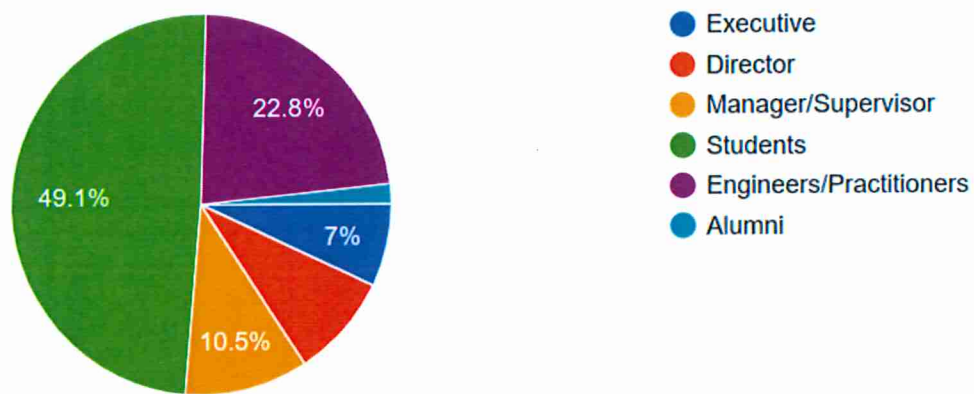
Figure : Distribution of the participants

Depending on the position of the participants, we prepared two surveys where the first survey was for industry/government executives to gather interest in a new master in AI and the needed skills, while the second survey was for students to evaluate their interest to join the program, why they would be interested and the preferred teaching modalities.

Q3. Is there a need in your organization for personnel with the knowledge, training, and skills acquired by those who complete a graduate degree (Master or Certificates) in AI?
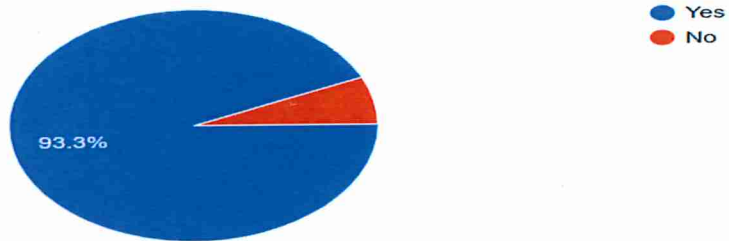
If Yes - Is this need expected to increase over the next 5-10 years?
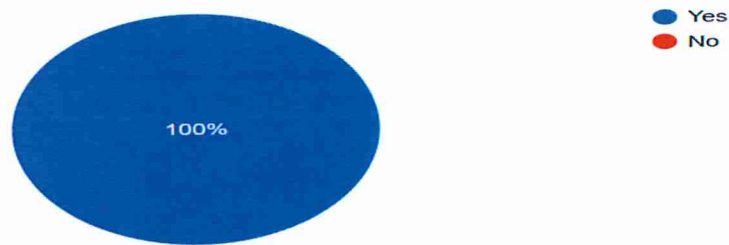
Figure 2: Executives opinion on their needs for AI graduates

Figure 2 shows a very strong interest from executives in leading national companies to train their employees in the master in AI for now and at least the next 10 years. They highlighted in Figure 3, the most need skills especially in Machine Learning, Human-Centered AI/AI Ethics, Edge AI, etc. Those needs guided our choices in terms of the concentrations for the new master in AI.

Q4. From the following topics, please indicate any topics or subject matter that you think should be considered for inclusion

15 responses
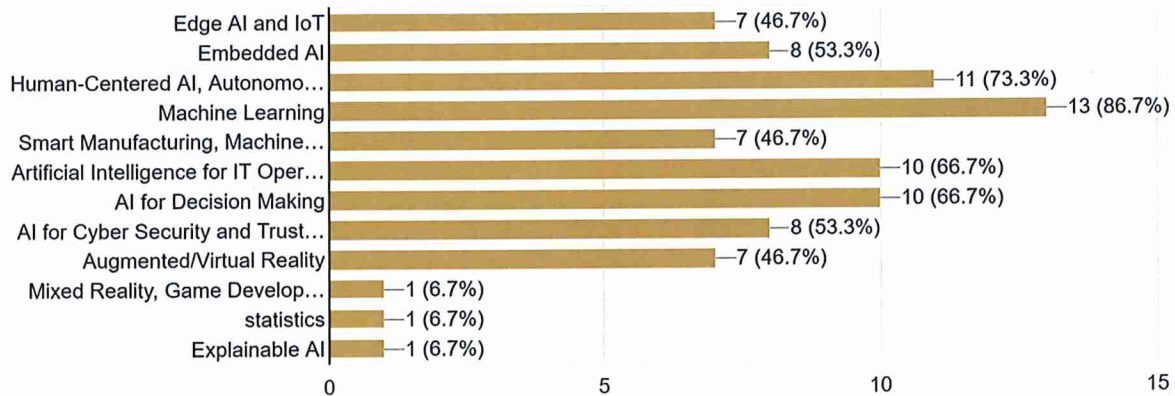
Figure 3: Industry executives opinions on the needed AI skills

Figure 3 describes a huge interest from our students and alumni to join the master in AI with over 90% of them very likely to apply when the program is offered. The flexibility/modularity of the program and the teaching modality/flexibility are among the most important factors that the student would consider joining the program, as described in Figures 4 and 5.

Q1. Please rate your level of interest in stackable certificates or a master of science degree in AI? (very high, somewhat high, neither high nor low, somewhat low, very low)
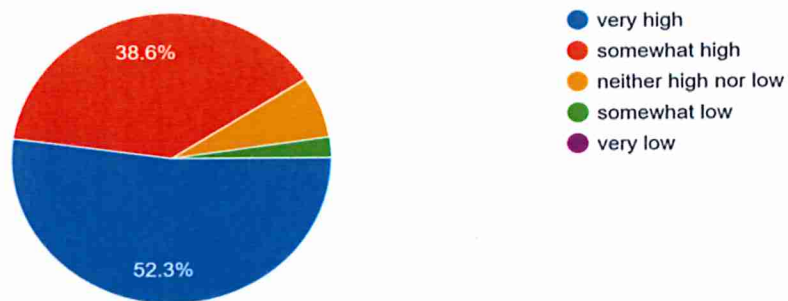
Figure 4: Potential students interest in the Master in AI

Oakland University
Graduate Council

Q2. Rate the likelihood of submitting an application for admission to the proposed program if it were launched within the next 1-2 years? (almost c...somewhat likely, somewhat unlikely, very unlikely)

- almost certain
- very likely
- somewhat likely
- somewhat unlikely
- very unlikely

43.2%
9.1%
22.7%
20.5%

Q5. Is your interest in the program influenced by the following (check all that apply)

Category	Value
Mode of delivery: on-site face-t...	27 (61.4%)
The program structure (modula...	33 (75%)
Flexibility in enrolment status (i....	33 (75%)
Estimated program cost	26 (59.1%)
Influenced by my current emplo...	1 (2.3%)
Job placment or internship	1 (2.3%)
Will prefer only online or hybrid...	1 (2.3%)
Online Mode	1 (2.3%)
The availability of projects/han...	1 (2.3%)

Oakland University
Graduate Council
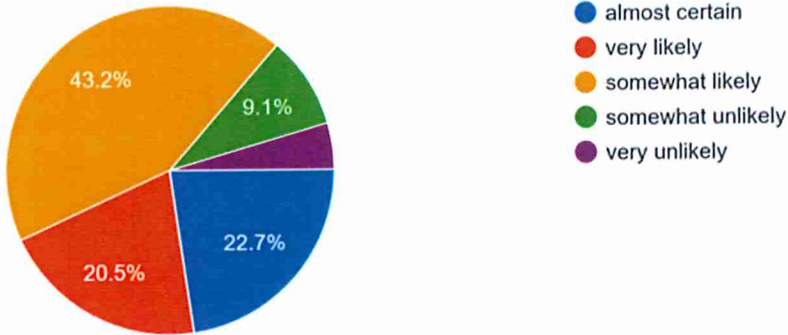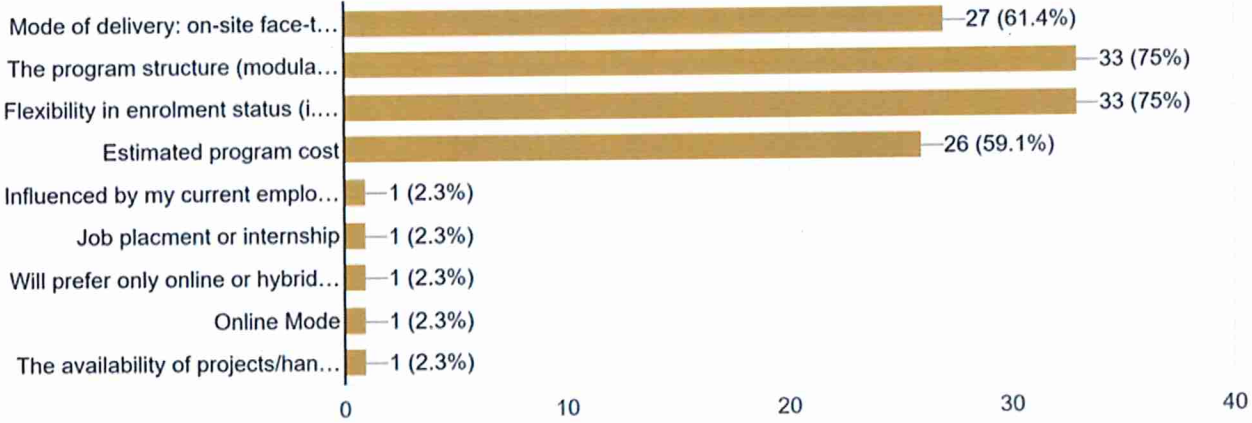
Q6. What is your preferred mode of delivery?

Figure 5: Outcomes of the survey with potential students

To conclude, the survey with different stakeholders shows a large interest in this new proposal of the MSc in AI.

Oakland University
Graduate Council

Marketing Documentation

Marketing Materials
Determine contributions of college/unit and what is provided, and if the unit has a marketing coordinator to provide suggested marketing services.
- Create student and faculty stories, including original photoshoots in labs/classrooms. Stories to be used on website, marketing pieces and ad creative
- Write marketing copy to promote program to add to webpage
- Create list of keywords for search engine optimization and use in program information and ads
- Design and print supply of fliers with program details for use at events
- Participate in appropriate academic visit days
- Involve faculty in any available PR/media stories related to program

Goals/Measurement
Define goals and timeline. Create and define a strategic call-to-action (request information, apply, visit) to measure interest in program and effectiveness of campaign. Roll-out campaign in phases to maximize exposure, and grow program.

Paid Media Campaign
Work with UCM/Brogan to place paid media campaigns in coordination with general OU marketing campaign and/or event marketing, including a mix of social media (Facebook, Instagram, LinkedIn, Reddit, YouTube), search marketing (added to currently running campaign) and digital ad placement (to run on Reddit). Suggested campaign budget of $25,000 for first year, split into two flights (fall and spring), with supporting campaigns the following years.

Needs and Costs of the Program
Marketing Expenses include photography, material printing, media placement and agency fees. Estimated costs $25,000 first year, plus $5,000/year for next 3 years of program.

Oakland University
Graduate Council

Typical Timeline for Approving Program Proposal

Date	Event	Materials Needed
September-October 2022	Review and approval of complete proposal by School of College	Completed proposal
June 2022 through November 2022	Informal review by Graduate School	Completed proposal
August 2022	Completion of Library Report	Completed proposal
October-November 2022	review of complete proposal by the Graduate Council. (2 readings)	Completed proposal
January 2023	Final reviews of revised proposals by the Senate Planning Review Committee and by the Senate Budget Review Committee.	Completed proposal
February 2023	Review by the University Senate (2 readings)	Final proposal and final cost estimate
April 2023	Review by Board of Trustees	Final proposal
May 2023	Release by Provost to advertise	Final proposal
June 2023	Presentation to Academic Affairs Officers Committee of the Presidents Council of State Colleges and Universities	Final proposal
Sept. 2023	Approval for program start	Release curriculum code

SBRC Proforma Template

FY2024

Most Likely Scenario

		Year 1		Year 2		Year 3		Year 4		Year 5
Est. New Students to Program		18		30		40		45		50
1st Year Cohort Revenue		$ 240,192	$	400,320	$	533,760	$	600,480	$	667,200
2nd Year Cohort Revenue		$ -	$	240,192	$	400,320	$	533,760	$	600,480
3rd Year Cohort Revenue		$ -	$	-	$	-	$	-	$	-
4th Year Cohort Revenue		$ -	$	-	$	-	$	-	$	-
Gross Tuition Revenue		$ 240,192	$	640,512	$	934,080	$	1,134,240	$	1,267,680
Less: Avg Financial Aid (30%)		$ -	$	-	$	-	$	-	$	-
Net Tuition Revenue		$ 240,192	$	640,512	$	934,080	$	1,134,240	$	1,267,680
Expenses										
Salaries										
Faculty Salaries	6101	$ -	$	100,000	$	100,000	$	100,000	$	100,000
Visiting Faculty	6101									
Administrative Professionals	6201									
Clerical Technical	6211	$ 46,834	$	46,834	$	46,834	$	46,834	$	46,834
Administrative IC	6221									
Faculty Inload/Replacement Costs	6301	$ 8,000	$	8,000	$	8,000	$	8,000	$	8,000
Faculty Overload	6301									
Part-Time Faculty	6301									
Graduate Assistant	6311	$ 15,000	$	15,000	$	30,000	$	30,000	$	30,000
Casual/Temp	6401									
Out of Classification	6401									
Student Labor	6501									
Total Salary Expense		$ 69,834	$	169,834	$	184,834	$	184,834	$	184,834
Fringe Benefits	6701	$ 24,835	$	67,135	$	68,335	$	68,335	$	68,335
Total Compensation		$ 94,669	$	236,969	$	253,169	$	253,169	$	253,169
Operating Expenses										
Supplies and Services	7101									
Graduate Tuition	7101	$ 12,400	$	12,400	$	24,800	$	24,800	$	24,800
E-Learning Support	7102									
Travel	7201									
Equipment	7501									
Maintenance	7110									
Recruitment and advertising	7101	$ 25,000	$	5,000	$	5,000	$	5,000	$	5,000
Library	7401	$ 9,500	$	10,360	$	11,300	$	12,325	$	13,445
Total Operating Expenses		$ 46,900	$	27,760	$	41,100	$	42,125	$	43,245
Total Expenses		$ 141,569	$	264,729	$	294,269	$	295,294	$	296,414
Net Income (Loss)		$ 98,623	$	375,783	$	639,811	$	838,946	$	971,266

SBRC Proforma Template

Best-Case Scenario

		Year 1		Year 2		Year 3		Year 4		Year 5
Est. New Students to Program		25		40		50		60		65
1st Year Cohort Revenue	$	333,600	$	533,760	$	667,200	$	800,640	$	867,360
2nd Year Cohort Revenue	$	-	$	333,600	$	533,760	$	667,200	$	800,640
3rd Year Cohort Revenue	$	-	$	-	$	-	$	-	$	-
4th Year Cohort Revenue	$	-	$	-	$	-	$	-	$	-
Gross Tuition Revenue	$	333,600	$	867,360	$	1,200,960	$	1,467,840	$	1,668,000
Less: Avg Financial Aid (30%)	$	-	$	-	$	-	$	-	$	-
Net Tuition Revenue	$	333,600	$	867,360	$	1,200,960	$	1,467,840	$	1,668,000

Expenses

Salaries

			Year 1		Year 2		Year 3		Year 4		Year 5
Faculty Salaries	6101	$	-	$	100,000	$	100,000	$	100,000	$	100,000
Visiting Faculty	6101										
Administrative Professionals	6201										
Clerical Technical	6211	$	46,834	$	46,834	$	46,834	$	46,834	$	46,834
Administrative IC	6221										
Faculty Inload/Replacement Costs	6301										
Faculty Overload	6301	$	8,000	$	8,000	$	8,000	$	8,000	$	8,000
Part-Time Faculty	6301										
Graduate Assistant	6311	$	15,000	$	15,000	$	30,000	$	30,000	$	30,000
Casual/Temp	6401										
Out of Classification	6401										
Student Labor	6501										
Total Salary Expense		$	69,834	$	169,834	$	184,834	$	184,834	$	184,834
Fringe Benefits	6701	$	24,835	$	67,135	$	68,335	$	68,335	$	68,335
Total Compensation		$	94,669	$	236,969	$	253,169	$	253,169	$	253,169

Operating Expenses

			Year 1		Year 2		Year 3		Year 4		Year 5
Supplies and Services	7101										
Graduate Tuition	7101	$	12,400	$	12,400	$	24,800	$	24,800	$	24,800
E-Learning Support	7102										
Travel	7201										
Equipment	7501										
Maintenance	7110										
Recruitment and advertising	7101	$	25,000	$	5,000	$	5,000	$	5,000	$	5,000
Library	7401	$	9,500	$	10,360	$	11,300	$	12,325	$	13,445
Total Operating Expenses		$	46,900	$	27,760	$	41,100	$	42,125	$	43,245
Total Expenses		$	141,569	$	264,729	$	294,269	$	295,294	$	296,414
Net Income (Loss)		$	192,031	$	602,631	$	906,691	$	1,172,546	$	1,371,586

		Year 1	Year 2	Year 3	Year 4	Year 5
Est. New Students to Program		13	20	30	35	40
1st Year Cohort Revenue		$ 173,472	$ 266,880	$ 400,320	$ 467,040	$ 533,760
2nd Year Cohort Revenue		$ -	$ 173,472	$ 266,880	$ 400,320	$ 467,040
3rd Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
4th Year Cohort Revenue		$ -	$ -	$ -	$ -	$ -
Gross Tuition Revenue		$ 173,472	$ 440,352	$ 667,200	$ 867,360	$ 1,000,800
Less: Avg Financial Aid (30%)		$ -	$ -	$ -	$ -	$ -
Net Tuition Revenue		$ 173,472	$ 440,352	$ 667,200	$ 867,360	$ 1,000,800
Expenses						
Salaries						
Faculty Salaries	6101	$ -	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Visiting Faculty	6101					
Administrative Professionals	6201					
Clerical Technical	6211	$ 46,834	$ 46,834	$ 46,834	$ 46,834	$ 46,834
Administrative IC	6221					
Faculty Inload/Replacement Costs	6301	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
Faculty Overload	6301					
Part-Time Faculty	6301					
Graduate Assistant	6311	$ 15,000	$ 15,000	$ 30,000	$ 30,000	$ 30,000
Casual/Temp	6401					
Out of Classification	6401					
Student Labor	6501					
Total Salary Expense		$ 69,834	$ 169,834	$ 184,834	$ 184,834	$ 184,834
Fringe Benefits	6701	$ 24,835	$ 67,135	$ 68,335	$ 68,335	$ 68,335
Total Compensation		$ 94,669	$ 236,969	$ 253,169	$ 253,169	$ 253,169
Operating Expenses						
Supplies and Services	7101					
Graduate Tuition	7101	$ 12,400	$ 12,400	$ 24,800	$ 24,800	$ 24,800
E-Learning Support	7102					
Travel	7201					
Equipment	7501					
Maintenance	7110					
Recruitment and advertising	7101	$ 25,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Library	7401	$ 9,500	$ 10,360	$ 11,300	$ 12,325	$ 13,445
Total Operating Expenses		$ 46,900	$ 27,760	$ 41,100	$ 42,125	$ 43,245
Total Expenses		$ 141,569	$ 264,729	$ 294,269	$ 295,294	$ 296,414
Net Income (Loss)		$ 31,903	$ 175,623	$ 372,931	$ 572,066	$ 704,386

Master of Science in Artificial Intelligence

Proposed by:

Department of Computer Science and Engineering (CSE),
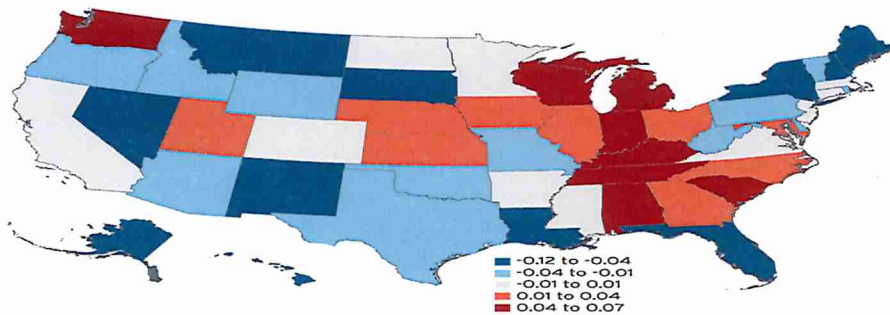*School of Engineering and Computer Science*

OAKLAND
UNIVERSITY.

Rationale

Home > Special Report

January 19, 2020 12:01 AM

Michigan will be more impacted by AI and automation than most states. Are we ready?

Map 1. Average standardized AI exposure by state

-0.12 to -0.04
-0.04 to -0.01
-0.01 to 0.01
0.01 to 0.04
0.04 to 0.07

Source: Brookings analysis of Webb (2019) and OES data

Q1. Please rate your level of interest in stackable certificates or a master of science degree in AI? (very high, somewhat high, neither high nor low, somewhat low, very low)

38.6%

52.3%

- very high
- somewhat high
- neither high nor low
- somewhat low
- very low

- AI is a priority area for CSE, SECS and OU:
  - New NSF IUCRC Center on Pervasive AI
  - New Augmented Reality Center
  - Multiple recent large grants from federal agencies and industry on AI including $3M+ grant from DoD
  - Cluster of faculty hiring in Machine Learning, Human Centered AI, Edge AI, Embedded AI, Robotics, IoT and Smart Manufacturing.
  - New distinguished executives advisory board on AI and Data Science

Proposed Curriculum Design

Core requirements (12 credits)

All students must complete first the following three course:

- CSI 5130 - Artificial Intelligence (4 credits)
- CSI 5170 - Machine Learning (4 credits)
- CSI 5390 - Software Engineering OR CSI 5220 - Object Oriented Analysis Design (4 credits)

- 9 Concentration areas (12-20 credits for the selected concentration):
  - (1) Edge AI and IoT,
  - (2) Embedded AI,
  - (3) Human-Centered AI, Augmented/Virtual Reality and Robotics,
  - (4) Machine Learning,
  - (5) Smart Manufacturing and Industry 4.0,
  - (6) Artificial Intelligence for IT Operations (AIOps),
  - (7) AI for Cyber Security and Trustworthy AI,
  - (8) Augmented/Virtual Reality,
  - (9) Ethics of AI.

Q4. From the following topics, please indicate any topics or subject matter that you think should be considered for inclusion

15 responses

Topic	Value
Edge AI and IoT	7 (46.7%)
Embedded AI	8 (53.3%)
Human-Centered AI, Autonomo...	11 (73.3%)
Machine Learning	13 (86.7%)
Smart Manufacturing, Machine...	7 (46.7%)
Artificial Intelligence for IT Oper...	10 (66.7%)
AI for Decision Making	10 (66.7%)
AI for Cyber Security and Trust...	8 (53.3%)
Augmented/Virtual Reality	7 (46.7%)
Mixed Reality, Game Develop...	1 (6.7%)
statistics	1 (6.7%)
Explainable AI	1 (6.7%)