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Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	UMBC

Each action below requires a separate proposal and cover sheet.

- (●) New Academic Program
- ( ) New Area of Concentration
- ( ) New Degree Level Approval
- ( ) New Stand-Alone Certificate
- ( ) Off Campus Program
- ( ) Substantial Change to a Degree Program
- ( ) Substantial Change to an Area of Concentration
- ( ) Substantial Change to a Certificate Program
- ( ) Cooperative Degree Program
- ( ) Offer Program at Regional Higher Education Center

Payment Submitted: (●) Yes ( ) No | Payment Type: (●) R*STARS # 3331684 ( ) Check # | Payment Amount: 850.00 | Date Submitted: 12/15/2(

Department Proposing Program	Department of Computer Science and Electrical Engineering
Degree Level and Degree Type	Graduate, Master of Science (MS)
Title of Proposed Program	Artificial Intelligence
Total Number of Credits	30-33
Suggested Codes	HEGIS: CIP: 11.0102
Program Modality	(●) On-campus ( ) Distance Education (fully online) ( ) Both
Program Resources	(●) Using Existing Resources ( ) Requiring New Resources
Projected Implementation Date (must be 60 days from proposal submisison as per COMAR 13B.02.03.03)	(●) Fall ( ) Spring ( ) Summer Year: 2026
Provide Link to Most Recent Academic Catalog	URL: https://catalog.umbc.edu/content.php?catoid=41&navoid=2971
Preferred Contact for this Proposal	Name: Crystal Williams, PhD Title: Assistant Vice Provost for Curriculum Development Phone: 410-455-3862 Email: Crysw1@umbc.edu
President/Chief Executive	Type Name: Manfred H. M. van Dulmen, PhD, Provost and Senior Vice President of Academic Affairs Signature: Manfred H.M. van Dulmen Date: 12/11/2025 | 2:21 PM E
	Date of Approval/Endorsement by Governing Board:

Revised 4/2025

OFFICE OF THE PROVOST
University of Maryland, Baltimore County
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December 15, 2025

Sanjay Rai, PhD
Secretary
Maryland Higher Education Commission
217 E. Redwood Street
21st Floor
Baltimore, MD 21202

Dear Secretary Rai:

UMBC's Department of Computer Science and Electrical Engineering (CSEE) is pleased to submit a proposal to establish a Master of Science (M.S.) in Artificial Intelligence (AI). This program is offered within existing resources and is consistent with UMBC's mission to emphasize science and engineering at the graduate level.

UMBC's M.S. in AI fills a critical gap in the availability of in-person, thesis/non-thesis, master's level programs in AI in the Baltimore region. With thesis and non-thesis options, this M.S. in AI will prepare graduates for successful careers in research and industry, supporting the growing demand for expertise in this field which affects every major sector. UMBC's program is unique in offering an affordable, accessible, and dedicated M.S. in AI that aligns with the Maryland State Plan for Higher Education and meets the state's high-demand workforce needs. A detailed discussion of master's level AI programs in the state can be found in Appendix 2: Greater Baltimore Metropolitan Region Program Duplication Discussion.

As an R-1 institution and a principal center for AI in the USM, UMBC is ideally positioned to offer this degree. Our CSEE faculty are conducting cutting-edge AI research and have demonstrated UMBC's readiness to equip students with the necessary knowledge and skills for careers in AI now and in the future.

Thank you very much for your consideration.

Sincerely,

DocuSigned by:
Manfred H.M. van Dulmen
4056B1D9D19E460...

Manfred H. M. van Dulmen, PhD
Provost and Senior Vice President for Academic Affairs

Cc: Crystal Williams, Assistant Vice Provost for Curriculum Development
Yonatan Harris, Executive Assistant to the Vice Provost for Academic Affairs

UMBC Master of Science in Artificial Intelligence

A. Centrality to Institutional Mission and Planning Priorities

1. The UMBC Department of Computer Science and Electrical Engineering (CSEE) proposes to offer a Master of Science (MS) in Artificial Intelligence (AI). AI profoundly affects education, computation, energy, data analysis, information systems, and more. In every industry, AI will play a role. Upon completion of the MS in AI degree, students will be able to begin successful careers in research, academia, and industry. The MS in AI at UMBC focuses on AI's fundamental principles. The required course of study includes thesis and non-thesis options to accommodate students with different academic and professional goals. The non-thesis option will require 33 credits of coursework, including two core courses on the principles of artificial intelligence and machine learning, three AI-focused electives related to natural language processing, neural networks, or robotics, and six electives in computation. The thesis option will require 30 credits incorporating the same two core courses, three AI-focused elective courses, and three other computational electives, followed by six credits of thesis work. For more detailed information on the degree requirements, please see Appendix 1: MS in AI Degree Requirements.

UMBC is well-positioned to offer the MS in AI program because of the rigorous nature of our master's and doctoral programs, as well as our role as one of three principal centers for research and doctoral-level training in the University System of Maryland. As a school with an R-1 (Very High) Carnegie classification, our faculty in the CSEE department are at the forefront of innovation in the AI field. This degree aligns with UMBC's mission, because our mission states that, "UMBC emphasizes science, engineering, information technology, human services and public policy at the graduate level." Another part of our mission is that UMBC "contributes to the economic development of the state," and AI will be a major part of Maryland's economy in coming years.

2. UMBC's Strategic Plan expresses the goal that "UMBC contributes to the economic development of the state and region through entrepreneurial initiatives, workforce training, K-16 partnerships, and technology commercialization" (p. 6). The MS in AI supports this strategic goal by providing necessary training in the rapidly growing AI field. Increasing degree offerings in the field of AI is an institutional priority as evidenced by UMBC's commitment to science, engineering, and information technology described in our mission. The DMV region is already a major hub for tech companies and government agencies investing in AI research and development. For example, Maryland hosts key institutions like the National Institute of Standards and Technology (NIST) and the National Institutes of Health (NIH), which are pivotal in AI research for cybersecurity and healthcare, respectively. Washington, D.C., is home to numerous federal agencies investing heavily in AI to enhance their operational capabilities. Virginia is known for its strong tech sector, with companies like Amazon, Google, and Microsoft establishing significant operations in the state, contributing to the local AI ecosystem. UMBC's strategic focus on workforce needs supporting Maryland's economic development aligns with the 2022 MHEC Statewide Plan and the Vision 2030 Plan by the University System of Maryland.

3. UMBC anticipates that the MS in AI will be adequately funded in its first five years of implementation because of very strong anticipated enrollment and high interest in the program from CSEE faculty. Several CSEE faculty specialize in AI, and a total of 25 faculty will teach in the program. Given this level of interest in AI, UMBC will ensure that the program will have full financial and administrative support for the first five years and beyond, and enrolled students will have the opportunity to complete the program.

Additional support services such as technology support, library services, marketing, and related academic/program support will be drawn from UMBC's existing institutional capabilities. Special learning experiences, research opportunities, and/or technologies for students may be funded through faculty-led grant efforts, such as UMBC's federal Scholarship-for-Service program, and/or obtained via internships with local companies or government organizations, including BWTECH@UMBC.

4. UMBC's faculty are committed to advancing the AI field and to supporting matriculated students in the MS in AI program through program completion. UMBC has the institutional resources, including tenured faculty, to continue the program for actively registered students through program completion. As noted in A.3, UMBC's faculty demonstrate strong academic interest in AI, emphasizing UMBC's commitment to the field. For example, Dr. Frank Ferraro secured a $3.8 million DARPA grant to develop an AI-driven tool for assessing scientific claims. Over 20 UMBC students will contribute to creating the tool, gaining experience in cutting-edge AI research. UMBC expects that this level of interest from students and faculty will continue to grow stronger with the MS in AI. Creating the MS in AI responds to a growing need in the state of Maryland, so per UMBC's Strategic Plan, the MS in AI is an important addition to the institution. UMBC is committed to providing the necessary administrative, financial, and technical support to launch, grow, and sustain the MS in AI. Technical support for students and faculty is available through Blackboard and other web-based technologies supported by UMBC's Division of Information Technology (DOIT), in-class time, and faculty office hours.

   UMBC is committed to continuing the MS in AI program for sufficient time to allow enrolled students to complete the program. UMBC anticipates that the program will be popular and will grow quickly, allowing for its continuation for years to come.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan

1. In Maryland, AI has been identified as a growing field because AI revolutionizes how workers approach their work in all industries, including healthcare, education, business, and beyond. More AI specialists are needed to innovate and facilitate this massive shift. UMBC's MS in AI responds to a need for more AI specialists that work in growing industries and support the advancement of academic knowledge. In today's rapidly evolving technological landscape, artificial intelligence (AI) is transforming industries and reshaping the future of work.
   i. The rapid growth in the AI market necessitates a highly trained workforce capable of advancing AI theory and research. The increasing demand for AI researchers and theorists highlights the need for comprehensive educational programs to ensure that AI technologies are developed responsibly and with a deep theoretical foundation. Our MS in AI program will equip students with a strong theoretical understanding of AI principles, enabling them to contribute to cutting-edge AI research. By focusing on core AI concepts and theoretical advancements, our curriculum will prepare students for research roles in academia, industry, and government. Through courses in machine learning, deep learning, natural language processing, robotics, and computer vision, students will gain the necessary knowledge to advance the field.
   ii. The global AI market is projected to reach a staggering $1,811.75 billion by 2030, highlighting its immense growth potential. This represents a compound annual growth rate (CAGR) of 36.6% from 2024 to 2030, underscoring the rapid advancements and investments being made in AI technologies[1,2]. The AI and tech sectors are also experiencing significant growth in the greater DMV area. All three DMV jurisdictions (D.C., Maryland, Virginia) have recognized the importance of AI and issued directives or executive orders promoting AI workforce development[3]. The MHEC Statewide Plan emphasizes the need for quality education to be accessible and affordable to Maryland students. UMBC is an affordable option, and the majority of our students are members of a minority group.

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[1] Fortune Business Insight, "Artificial Intelligence." Online. Date of visit: 06/18/2024. https://www.fortunebusinessinsights.com/industry-reports/artificial-intelligence-market-100114

[2] Grand View Research, "Artificial Intelligence Market To Reach $1,811.75 Billion By 2030." Online. Date of visit: 06/17/2024. https://www.grandviewresearch.com/press-release/global-artificial-intelligence-ai-market

[3] Governor Moore Announces Action to Transform Maryland Executive Branch Digital Services. Online. Date of visit: 06/18/2024.https://governor.maryland.gov/news/press/pages/governor-moore-announces-action-to-transform-maryland-executive-branch-digital-services.aspx.

iii. According to the 2025 Stanford Artificial Intelligence Index Report, Generative AI-related job postings in the U.S. have seen a 323% increase since 2023. Similarly, large language modeling saw a 295% increase. Both of these skills require higher education training in programming, and the sectors with these postings included the information sector, scientific sector, and finance sector. The report also showed that Washington, D.C. has a very high overall percentage of AI jobs at 4.44%, as compared with California's 2.67%. [4]The DMV region (DC: 2.61%, VA: 1.82%, MD: 1.05%) collectively dominates AI job intensity in the U.S., driven by federal agencies, defense contracts, and top research institutions[5].

2. The 2022 Maryland State Plan for Higher Education outlines priorities across three categories: Student Access, Student Success, and Innovation. In the Student Success category, under Priority 5: Maintain the commitment to high-quality postsecondary education in Maryland, the plan lays out the action item, "Identify innovative fields of study" (p. 51). The plan specifies that identifying these fields and demonstrating market demand for them can be particularly difficult, but UMBC is confident that the data supports that AI is an innovative and emerging field. This focus on innovative fields appears more than once in the plan. Under the Innovation category, the plan focuses on Priority 8: Promote a culture of risk-taking. This priority comes as a result of the fact that "realities of the student marketplace are changing" (p. 58). In order for Maryland to be "innovative and agile," the plan lists action items for Priority 8, including a very similar action item, to "Identify innovative and emerging fields of study" (p. 59). Maryland's education institutions must prioritize innovative programs, given this strong emphasis throughout the plan. UMBC is responding directly to these priorities and their action items by offering the MS in AI, an in-demand, innovative program in an emerging field of study.

   The plan identifies IT fields as key industries for Maryland (p.46). As such, UMBC's program will enhance affordable opportunities for students in the region (p.28). UMBC's affordability will ensure that the MS in AI is accessible, creating a larger pool of future workers. This MS in AI will provide the state with a highly educated workforce to meet critical future needs, allowing students to upgrade their technical skills to meet the rapidly growing demands of the job market (p. 45). Several state initiatives also support the goal of advancing STEM education, including the establishment of the Maryland Institute for Innovative Computing (MIIC) and the Maryland Technology Internship Program (MTIP). UMBC is committed to preparing students for real-world AI challenges and innovations.

   Governor Moore's 2024 executive order on digital services provides detailed guidance on the responsible and ethical use of AI and data. It also establishes an AI Subcabinet tasked with developing and implementing a comprehensive AI action plan to operationalize the State's AI principles and establish appropriate "guardrails" for agencies' use of AI. Additionally, the AI Subcabinet will promote AI knowledge, skills, and talent in state government, further driving demand for Data Science programs. In the closely related field of AI and Machine Learning, Governor Moore has announced significant initiatives to revitalize state government and modernize Maryland's Department of IT Services and Operations, positioning Maryland at the helm of cutting-edge and emergent technology to better serve the state. This includes the appointment of a first-ever AI advisor to oversee Maryland's AI strategy[6, 7]. These actions by Governor Moore and his administration show a state-wide commitment to AI as an emerging field of study, and it is appropriate that Maryland's higher education institutions also follow suit in accordance with the stated priorities of the Maryland State Plan for Higher Education.

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[4] https://hai-production.s3.amazonaws.com/files/hai_ai_index_report_2025.pdf

[5] University of Maryland, "Where Are the New AI Jobs? Just Ask AI." Online. Date of visit: 06/18/2024. https://today.umd.edu/where-are-the-new-ai-jobs-just-ask-ai

[6] https://governor.maryland.gov/news/press/pages/governor-moore-announces-major-action-to-rebuild-state-government-and-modernize-maryland-department-of-information-technolo.aspx (visited April 23, 2025)

[7] https://baltimorefishbowl.com/stories/marylands-it-department-adds-new-roles-including-leaders-in-ai-and-accessibility/ (visited April 23, 2025)

3. The Vision 2030 Plan by the University System of Maryland emphasizes innovation as a high priority (p. 8). As a mid-term goal, the USM writes that it aims to have “piloted innovative pathways for working professionals that respond to workforce demands” (p. 10) USM recognizes that new technologies will transform education in the coming years, so innovation in creating new programs and adapting to the demands of the job market is incredibly important.

   The USM lists Workforce & Economic Development as a main priority and includes the subpoints of expanding the number of graduates and the pipeline of underrepresented minority students in critical fields like STEM, cyber, and healthcare. AI will drive huge growth in those key areas.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State

1. The MS in AI program responds to the rapidly growing field of AI technology. Graduates can pursue careers in technology, finance, national defense, cybersecurity, healthcare, government, or research. The table below lists some potential job roles and responsibilities. Additional job roles and responsibilities can be found in Appendix 11: Additional AI Job Titles.

Job Title	Job Description
AI Engineer / Machine Learning Engineer	Design, develop, and deploy AI/ML models for real-world applications. Optimize algorithms for performance and scalability, working with frameworks like TensorFlow and PyTorch. Collaborate with data scientists and software engineers to integrate AI into products.
Data Scientist (AI Specialization)	Apply statistical modeling, machine learning, and AI techniques to analyze data. Develop predictive models, recommendation systems, and NLP solutions. Clean and preprocess data while communicating insights to stakeholders.
Research Scientist (AI/ML)	Conduct cutting-edge research in AI, machine learning, or deep learning. Publish papers in top conferences (NeurIPS, ICML) and develop novel algorithms in areas like reinforcement learning or computer vision. Work in academia, corporate R&D, or government labs.
AI Product Manager	Act as a bridge between technical AI teams and business stakeholders. Define AI product roadmaps, prioritize features, and ensure alignment with market needs. Guide the development of AI-driven products from concept to launch.
Computer Vision Engineer	Develop AI models for image and video analysis, including object detection, facial recognition, and medical imaging. Work with CNNs, OpenCV, and deep learning frameworks for applications in autonomous vehicles, healthcare, or surveillance.

2. The proposed MS in AI at UMBC is strongly aligned with current and projected labor market demand. Artificial Intelligence is listed as a “key industry” in the “Be Moved” statewide initiative to attract businesses to Maryland[8]. Data show that both national and regional employers are rapidly increasing their hiring of AI-skilled professionals, creating a significant opportunity for Maryland-based talent development as demonstrated by the data, analysis, and projections below:

[8] Be Moved Initiative: https://business.maryland.gov/key-industries/artificial-intelligence/

- National Leaders in AI Skill Demand: When job postings are analyzed for required skills, D.C., Maryland, and Virginia collectively lead the nation in the percentage of postings requiring AI-related expertise (Handwerker, 2024)[9].
- Second-Highest AI Job Share Nationally: The D.C. metro region, which includes Maryland, accounts for 12.65% of all AI job postings in the United States. This positions the region second only to California (Handwerker, 2024).
- Top 10 for Tech Openings: Maryland ranks among the top ten states nationally for technology-related job postings, underscoring its robust tech industry and the growing need for a skilled workforce in emerging fields such as AI (CompTia, 2024).
- Between 2020 and 2030 in Maryland, Computer and Information Research Scientist job postings will grow by 17%, Software Developer positions will grow by 23%, and Data Scientist positions, including AI Data Scientists, will grow by 31% (O*Net).

The AI field in the U.S. is projected to have a compound annual growth rate (CAGR) of 36.6% from 2024 to 2030. The DMV region hosts major employers investing in AI, including Northrop Grumman, JHU Applied Physics Laboratory, Booz Allen Hamilton, Amazon Web Services, Microsoft, Lockheed Martin, IBM, Google, and T. Rowe Price. All of these factors indicate that UMBC's MS in AI will support the demands of the labor market.

3. Market surveys provide quantifiable and reliable data on the education and training needs and the anticipated number of vacancies over the next 5 years. The U.S. Bureau of Labor Statistics has a 2025 report called, "AI impacts in BLS employment projections," which provides quantifiable and reliable data on the projected growth in occupations attributed to AI between 2023-2033:
- A projected 73,000 data scientist, 59,000 information security analyst, 9,400 computer information research scientist, 300,000 software developer, and 106,000 computer and information systems managers jobs will be created by 2033.
- Selected occupations experiencing growth and vacancies include:
    - Software Developers: Projected growth of 17.9%, much faster than the average (4.0%).
    - Database Administrators: Projected growth of 8.2%, faster than average.
    - Database Architects: Projected growth of 10.8%, much faster than average.

The White House's 2025 report on AI Talent provides evidence of the educational and training need[10]. They found that in the AI software field, job postings grew by about 31.7% per year from 2015 to 2022. But during that time, the number of people earning related degrees grew much more slowly, at only 8.5% for master's and 2.9% for PhDs. As such, there is a need for more AI education to fill these postings. In January 2025, a new Executive Order titled "Removing Barriers to American Leadership in Artificial Intelligence" reaffirmed the United States' commitment to global leadership in AI innovation. This policy emphasizes the need to foster AI systems that promote economic competitiveness and strengthen national security. The order directs federal agencies to revise or revoke prior AI policies that may hinder innovation and to develop a national AI action plan that accelerates the deployment of cutting-edge technology. Our mission is to help meet the national call for innovation by cultivating AI talent that drives regional economic growth and supports America's leadership in AI.

4. According to the 2024 MHEC Trends in Degrees and Awards by Program, only 1 university in Maryland awarded master's degrees in AI last year. Johns Hopkins University (JHU) graduated 50 students as of 2024 and their Fall 2023 enrollment stood at 362. Capitol Technology offers an MPhil and MRes in AI with 4 students enrolled as of 2024. The University of Maryland, Baltimore offers MA in AI for Business, however the 2024 data do not show enrollees or graduates yet. It is evident that the current and projected supply of prospective graduates is unable to meet the vacancy need.

D. Reasonableness of Program Duplication

[9] https://today.umd.edu/where-are-the-new-ai-jobs-just-ask-ai
[10] https://bidenwhitehouse.archives.gov/cea/written-materials/2025/01/14/ai-talent-report/

1. UMBC's MS in AI program is unique from other programs that have AI components in the Baltimore area. The only MS in AI that exists in the Baltimore region is at Johns Hopkins University (JHU). The JHU program is completely online and serves a different subset of students for that reason. Though other master's programs exist in the state that focus on elements of computing including AI, UMBC's specialized program fills a gap in the workforce needs of the state.

   This proposed MS in AI aligns with and supports the 2022 Maryland State Plan for Higher Education and USM's Strategic Plan by providing an affordable option for students to gain expertise in a high-demand sector. While there may be some overlap with other programs in the region, UMBC's goal is to offer flexibility, affordability, and accessibility to students looking to upgrade their skills and meet the growing workforce demands.

2. As stated, there is only one MS in AI program currently being offered in the surrounding area—online at JHU. Similar programs in the geographical area do exist but are fundamentally different from UMBC's MS in AI. A comparison of regional programs at other institutions can be found in Appendix 2.

3. UMBC's MS in AI program is justified because it is fundamentally different from other programs in the state, and UMBC is already conducting cutting-edge AI research. UMBC's existing MS in Computer Science has many students primarily interested in AI as the most innovative technology in the computing space, so this program responds to that academic interest and market need. Innovative research in AI and an institutional commitment to supporting students in AI already exists. For example, a team from UMBC won the Best Artifact Award at the IEEE International Conference on Pervasive Computing and Communication for using AI to analyze over three million messages exchanged by idle smart home devices. Also, UMBC recently launched the Quantum Science Institute, which unites faculty from the CSEE, Physics, Math, and Information Systems departments to advance quantum computing research and workforce development. UMBC is classified as a doctoral university with very high research activity by the Carnegie Classification of Institutions of Higher Education. As a Center for Academic Excellence, UMBC is well-positioned to offer this MS in AI to equip students with the necessary computing skills and theoretical knowledge to support the AI boom. As described in earlier sections, there is a strong market demand in the DMV for trained AI specialists.

E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)

UMBC's MS in AI does not duplicate existing graduate programs at HBIs in the Baltimore-Washington Region or in Maryland.

Morgan State University (MSU) does not offer an MS in AI. MSU has an MS in Advanced Computing, which includes Artificial Intelligence as an interdisciplinary area of focus. The multi-disciplinary nature of MSU's Advanced Computing program allows students to gain experience across several subsects of computing for a well-rounded degree applicable to many different computation careers. UMBC's proposed MS in AI is more specialized and offers courses on AI topics like computer graphics and robotics. UMBC does not anticipate overlap in target students because our program specializes in AI.

Bowie State University (BSU) does not offer an MS in AI. BSU offers an MS in Computer Science, which has classes on AI topics. BSU's program provides a well-rounded education in the computer science field with AI as a possible area of focus. UMBC's program is specialized in AI and is meant for students who wish to focus only on AI. UMBC does not anticipate an overlap in target students because BSU's MS in Computer Science serves a different population of students who may not want to specialize in AI. BSU also primarily serves a different population of students closer to Washington, D.C.

University of Maryland, Eastern Shore (UMES) does not offer an MS in AI. UMES offers an MS in Data Science and Analytics Engineering. UMES's MS has some course offerings relevant to AI and machine learning, but the program centers around data science as a discipline rather than AI. UMES's program offers many courses in data analytics and cyber analytics, ultimately providing students with crucial skills

in the data science discipline. UMES' program is completely online, so it serves a different population of students than UMBC's proposed MS in AI. Therefore, UMBC does not anticipate overlap in target students.

Coppin State University (CSU) does not offer an MS in AI. Coppin State University does not offer any similar computer science-related MS degree. UMBC does not anticipate overlap in target students.

F. Relevance to the identity of Historically Black Institutions (HBIs)

This program does not duplicate existing programs at HBIs, and it is expected to have no impact on the identity or mission of any of the HBIs, whose AI-related MS degrees are described above. MSU, BSU, and UMES offer MS degrees in computation fields that provide well-rounded curricula to their students, with some focus on AI, considering how AI is transforming the computation field overall. CSU does not have an MS degree in a computational field. MSU's MS in Advanced Computing provides students with a wealth of multidisciplinary opportunities to learn, and allows students to choose from four specializations, for which AI is just one. The opportunity to specialize after starting the degree allows students to have more variety. By contrast, UMBC's MS in AI is meant for students who have already decided to specialize in AI by the time of their application. BSU's MS in Computer Science similarly allows students to choose their specialization after beginning the program and provides robust education across the computation field. UMBC's MS in AI, again, serves students who have already decided to specialize in AI in the Baltimore region. UMES's program focuses on data science topics and provides a specialized education in the data science field, with an emphasis on analytics engineering. This degree serves a different field than UMBC's MS in AI. Given that UMES's degree is offered online only, it also differs from UMBC's MS in AI, which will be offered in person.

For the reasons described, UMBC's MS in AI does not pose any impact on the uniqueness and institutional missions of Maryland's HBIs. Since 2017, UMBC has been designated a Minority Serving Institution.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes

1. The faculty within the UMBC Department of Computer Science and Electrical Engineering (CSEE) are well-regarded AI experts. They drew on their industry experience and theoretical expertise to develop the MS in AI, which responds to a need for more AI experts in industry as well as more advanced AI researchers. The program faculty are subject matter experts driving advancements in the field. New developments and emerging trends in AI will inform changes in curriculum and the incorporation of new tools.

The MS in AI will be overseen by a full-time Graduate Program Director, a member of the CSEE faculty with a strong AI background. The GPD, as a direct report to the Chair of Computer Science and Electrical Engineering, will be supported as needed by the Chair in matters related to faculty/program oversight, mentoring, and related issues. The GPD will also work with the UMBC DOIT, CSEE's IT office, and other campus leaders on technology innovations related to the program or any new learning capabilities/platforms deployed, such as AI labs and data analysis and visualization environments. The GPD will be a Computer Science Graduate Committee member and work with that committee on areas of mutual interest and oversight, including recruiting, cross-program collaboration, new course ideas, and program innovations.

2. This program targets students with bachelor's degrees in computer science or another related field. Students with a background in another discipline could be considered if they have strong quantitative or programming skills. Students should have strong mathematical and analytical abilities, which are essential for AI and machine learning.

The MS in AI targets students of varying work experience. This program is appropriate for students seeking to enter research or academia, but it also will be highly applicable for students looking to apply AI techniques to their current fields.

The program will be offered completely in-person. The degree requirements are outlined in Appendix 1.

Students completing the MS in AI will be expected to

a) Acquire a deep understanding of core AI principles, including search algorithms, reasoning, and learning, through Principles of Artificial Intelligence (CMSC 671) and Machine Learning (CMSC 678). (SLO-1)
b) Expand their expertise by selecting electives from Bucket A, covering computer vision, natural language processing, neural networks, and robotics, equipping them with the necessary knowledge to work on specialized AI applications. (SLO-2)
c) Develop strong computational abilities through electives in Bucket B in data visualization, 799algorithm design, numerical computation, symbolic processing, and multi-agent systems, enabling them to solve complex AI-related problems. (SLO-3)
d) Thesis Track: Conduct independent research (CMSC 799), exploring advanced AI methodologies, designing experiments, and contributing to the field through novel findings and technical publications. (SLO-4A)
e) Non-Thesis Track: Complete additional coursework and may participate in independent studies or internships, preparing them for AI-driven roles in industry and applied research. (SLO-4B)
f) Stay updated on emerging AI trends and deepen their technical knowledge in areas of personal or professional interest through special topics courses (CMSC 691) and independent study opportunities (CMSC 696, CMSC 699) (SLO-5)

3. Learning outcomes to assess the success of the program in meeting these objectives are included in Appendix 3: Learning Outcomes. The UMBC Graduate School, College of Engineering and Information Technology, Department of Computer Science and Electrical Engineering, and Provost's Office tracks enrollments, retention, time-to-degree, and graduation rates for all programs. Appendix 4: Student Competencies Assessment describes the mechanisms used by the program to assess and document student learning competencies/outcomes (SLOs) in support of program objectives.

4. The MS in AI will offer thesis and non-thesis options to accommodate students with different academic and professional goals. The non-thesis option will require 33 credits of coursework, including two core courses on the principles of artificial intelligence and machine learning, three AI-focused electives related to natural language processing, neural networks, or robotics, and six electives in computation. The thesis option will require 30 credits incorporating the same two core courses, three AI-focused elective courses, and three other computational electives, followed by six credits of thesis work. Appendix 1 shows the degree requirements, while Appendix 5: Course Names and Descriptions provides the course descriptions.

5. General Education Requirements: N/A

6. Accreditations or Certification Requirements: N/A

7. Other Institutions or Organizations: The department does not currently intend to contract with another institution or non-collegiate organization for this program.

8. Student Support: Detailed in Appendix 6: Student Support.

9. UMBC will advertise its MS in Artificial Intelligence program to individuals with backgrounds in computer science or closely related fields, including early- and mid-career working professionals as well as recent graduates within Maryland.

Local and regional marketing as well as national and international marketing is handled by the UMBC Graduate School. Marketing is accomplished via the program's website, department website, and other local or global marketing sites/activities by the Graduate School, and the College of Engineering and Information Technology (COEIT). All marketing materials and websites are reviewed regularly to ensure currency and accuracy of courses, degree paths, job outlooks, technology requirements, etc. Working

with the Graduate School, and COEIT, the Graduate Program Director is involved in the development and approval of degree marketing outreach to ensure it accurately reflects the program and services available to it at UMBC.

The MS in AI program website, FAQ, advising information, syllabi, and marketing outreach will provide students with clear, complete, timely, and accurate information on the program curriculum, course and degree requirements, how students and faculty will interact (both in class and for advising purposes), the expected/desired technology competencies, minimum technical requirements (e.g., computer and internet capabilities), identifies Blackboard as the program's LMS, and the range of academic policies and support services available (e.g., financial aid, degree completion, payment policies, academic integrity, etc.). Additional information for student may be found on the UMBC Graduate School, Registrar, Student Business Services, and Veterans Affairs websites.

Admission is for fall and spring semesters only. Applicants must have a four-year baccalaureate degree from a regionally accredited U.S. institution, or an equivalent non-U.S. university and a desired minimum cumulative GPA of 3.0 (on a 4.0 scale) in all prior undergraduate and graduate degrees. International applicants must in addition provide evidence of English proficiency, financial certification, and appropriate visa documentation. A narrative statement by the student discussing their background, interests, and goals for their cybersecurity studies and career is required. GRE scores are not required, however the UMBC Graduate School requires the TOEFL or a similar exam for those who do not have a degree from the US or whose prior instructional language was not English. The M.S. in AI Admissions Committee will make a final determination of an applicant's suitability for the program in coordination with the UMBC Graduate School. Maryland residency is not required to enroll, however as a USM institution, Maryland residents pay a reduced in-state tuition rate.

10. The MS in AI will have two degree pathways, thesis or non-thesis, and requires 30 or 33 credits and 10 or 11 total courses, respectively. These pathways are shown in Appendix 3, while Appendix 7 provides course descriptions.

H. Adequacy of Articulation

N/A

I. Adequacy of Faculty Resources

1. Faculty supporting the program are full-time, tenured, or tenure-track and hold terminal degrees in their respective fields. Appendix 7: Faculty List lists faculty supporting the MS in AI. Additional adjunct faculty may be included in the future based on program requirements.
2. Faculty teaching in this program have access to instructional development opportunities available via the UMBC Center for Applied Learning and Teaching (CALT) and other on-campus professional development activities. For any online elements of coursework, faculty can work with UMBC's own instructional design team to incorporate best (and accessible) practices when teaching in the online environment. UMBC's DOIT offers on-demand and in-person assistance to faculty on the use of Blackboard's many features to help ensure the platform helps foster a quality learning experience for students and faculty alike regardless of in-person, hybrid, or online modalities. Program and department faculty also are encouraged to share best pedagogical practices with colleagues in this program and the broader CSEE department. Several internal grant opportunities exist to support innovation in faculty pedagogy as well.

J. Adequacy of Library Resources

1. On behalf of UMBC's President and the Dean of the Library, the Science Librarian of the Albin O. Kuhn Library has assessed library resources required for this program. The assessment concluded that UMBC's library can meet, with its current expansive in-person and online resources, the curricular and research needs of the MS in AI program faculty and students.

2. No additional library resources are required.

K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment

1. UMBC has access to excellent resources and facilities for this program on the main campus. There are sufficient classrooms and conference rooms to accommodate students, all equipped with technology and software to support instruction, collaboration, and communication. UMBC's internet, software, and computing capabilities are more than adequate to meet program needs – including computer labs with strong processing power. The necessary servers and computer rooms are already available at UMBC, and UMBC's DOIT will work to ensure that the program continually has power and bandwidth.
2. All faculty and student are assigned a UMBC institutional email address. Email is the primary form of outreach on campus and in the program.
3. All faculty and students have access to the University's learning management system (Blackboard Ultra) for classroom and research purposes, in addition to other online collaborative tools supported by UMBC's DOIT such as Microsoft Office/360, Google Suite, and Webex. Should it be necessary, UMBC is well-equipped to handle pivots to remote learning, such as due to pandemics or weather emergencies. Faculty who want to take a deliberate and holistic approach to prepare their hybrid courses may be supported by UMBC's Planning Instructional Variety for Online Teaching (PIVOT) program. PIVOT focused on best practices for using online instruction tools such as Blackboard, Panpoto, Voice Thread, etc. To ensure access to instructional, research, and collaboration tools, the minimum computing requirements and technical competency expectations for students will be posted on the program's website.
4. All faculty and graduate students can get access to the UMBC High performance computing (HPC) facility (http://www.umbc.edu/hpcf/). The HPC cluster is multi-core computing infrastructure including number CPUs and GPUs, more than 8TB of main memory, and more than 2PB of network storage. Such a facility will be leveraged for training students on complex deep learning models involving very large datasets.

UMBC is committed to supporting this program academically, administratively, financially, and technically. The MS in AI is comprised of courses already being offered through UMBC's Department of Computer Science and Electrical Engineering.

L. Adequacy of Financial Resources with Documentation

The MS in AI will be self-supported through tuition revenue with the potential of receiving industry and faculty research support over time. As it is anticipated that enrollments will generate sufficient revenue to more than cover expenses, there is no significant financial impact with this proposal. As with all self-supporting graduate programs at UMBC, enrollment growth will be regularly monitored, additional full-time faculty will be hired, and/or existing part-time faculty will be invited to become full-time faculty to facilitate instruction and program activities. See Appendix 8 and 9 for program budget information.

M. Adequacy of Provisions for Evaluation of Program

The MS in AI program faculty will periodically review syllabi, rubrics, readings, labs, and projects to ensure a standard student experience and that materials used and presented remain relevant to and/or aligned with current industry trends, best practices in the discipline (i.e., data security, privacy, transparency, accountability, and ethical AI development), program objectives, and the institutional priorities called for in the *UMBC Strategic Plan*. The CSEE department, and UMBC generally, evaluates full-time faculty through the university's established promotion and tenure process in the traditional areas of teaching, research, and service. This process includes a review of their syllabi, labs, courseware, samples of student products, classroom observation, and student surveys. Adjunct faculty are evaluated by full-time faculty members regularly to ensure quality of instruction, materials, and the student's course experience.

All UMBC faculty are evaluated via the administration of student surveys issued at the end of each semester. The data from this survey are shared with the instructor and publicly available via IRADS, while any qualitative comments received are shared only with the instructor. Additionally, faculty are encouraged to work with their colleagues and the UMBC Center for Applied Teaching and Learning (CALT), or Division of Information Technology (DOIT) for additional opportunities to conduct objective course assessment and/or enhancement. The Graduate Program Director likewise solicits, investigates, and attempts to resolve any student concerns regarding course or instructor quality and/or effectiveness.

N. Consistency with the State's Minority Student Achievement Goals

UMBC will address minority student access and success by continuing to follow through on its commitment to inclusive excellence and continuing to foster an environment where minority students thrive. UMBC President Valerie Sheares Ashby has stated that "excellence without diversity does not exist." Furthermore, UMBC makes progress every year to implement more initiatives that follow through on its cultural diversity plan by launching initiatives like the Working Group on Spiritual and Religious Belonging, which supports greater understanding of the needs of religious and spiritual students, and the Initiative for Identity, Inclusion, and Belonging (i3b), which creates opportunities for students to build awareness of diverse people and belief systems. More information on UMBC's diversity progress can be found in the UMBC Spring 2024 Institutional Programs of Cultural Diversity Report[11].

UMBC was designated a Minority Serving Institution in 2017 and is #1 in the nation for producing the most African American graduates who have gone on to earn MD-PhD degrees, according to the Association of American Medical Colleges (AAMC). According to NSF-NCSES data, from 2010-2019, UMBC was the #1 baccalaureate origin institution in the nation for African American students who go on to earn PhDs in the natural sciences, engineering, life sciences, mathematics, and computer science. As of Spring 2025, UMBC's existing graduate programs in CSEE, which will serve as the foundation for the proposed AI program, are majority-international and majority-minority in terms of student demographics: International: 67%; White: 13%; Black/ African American: 7%; Asian: 7%; Hispanic: 3%; Two or more races: 1%; Not Specified: 1%. The gender distribution of the graduate student population in CSEE is 69% male and 31% female. Compared with the overall computer science field, female representation is stronger at UMBC at 31% vs. 17% more broadly. UMBC anticipates that the proposed graduate program in AI will reflect similar demographics, continuing the institution's commitment to diversity, equity, and inclusion in advanced technology fields.

Among other active efforts to foster greater diversity in our campus community of scholars, UMBC joined the University Innovation Alliance (UIA) in June 2021. The UIA is the leading national coalition of public research universities committed to increasing the number and diversity of college graduates in the U.S., with a specific focus on low income, first-generation, and students of color. In the next phase of its work, the UIA will focus on eliminating disparities in educational outcomes based on race and ethnicity, in addition to disparities by income, first-generation college student status, gender, and geography.

O. Relationship to Low Productivity Programs Identified by the Commission

N/A

P. Adequacy of Distance Education Programs

As the MS in AI will be offered entirely in person, this section is not applicable. Regardless, UMBC ensures that all students have access to technology support resources including those available through DOIT, Career Services, Off-Campus Student Services, the Office of Equity and Inclusion, and the Graduate Student Association. The university's library is well-equipped to support remote research and learning. The university's Office of Accessibility & Disability Services (ADS) ensures that students with

[11] https://provost.umbc.edu/wp-content/uploads/sites/46/2024/05/UMBC-2024-Cultural-Diversity-Report.pdf

disabilities are afforded an equal opportunity to participate in and benefit from the programs, services, and activities of the University through the provision of accommodations and reasonable modifications that result in equal access and full inclusion, reflecting the university's commitment to fostering an accessible and inclusive environment for all members of the community. Assistance from the ADS team is available to all university students regardless of learning modality.

Appendix 1: MS in AI Degree Requirements

The requirements for the M.S. degree are summarized as follows.

- 24 credits of graduate coursework plus six credits of CMSC 799 (thesis option) or 33 credits of graduate coursework (non-thesis option).
- Completion of two “core” classes, in which a grade of a B or better must be earned, and three electives from Bucket A.
- The thesis must be supervised by an approved CSEE graduate faculty member as the thesis advisor; and must, upon completion of the research, be defended with an oral presentation and accepted by the student’s M.S. thesis committee.
- Certain restrictions apply:
    - A minimum overall GPA of 3.0 is required to graduate
    - Completing the program within a maximum of five years
    - Completing each of the milestones according to the timeline specified below

Core Courses ● CMSC 671 - Principles of Artificial Intelligence ● CMSC 678 - Introduction to Machine Learning
Electives: Bucket A ● CMSC 672 - Computer Vision ● CMSC 673 - Introduction to Natural Language Processing ● CMSC 675 - Introduction to Neural Networks ● CMSC 679 - Introduction to Robotics
Electives: Bucket B ● CMSC 634 - Computer Graphics ● CMSC 636 - Data Visualization ● CMSC 641 - Design and Analysis of Algorithms ● CMSC 655 - Numerical Computations ● CMSC 656 - Symbolic and Algebraic Processing ● CMSC 661 - Principles of Database Systems ● CMSC 663 - Data Privacy ● CMSC 676 - Information Retrieval ● CMSC 691 - Introduction to Data Science (a Special Topics in Computer Science Course) ● CMSC 691 - Special Topics in Computer Science ● CMSC 771 - Knowledge Representation and Reasoning ● ENEE 612 - Digital Image Processing ● ENEE 620 - Probability and Random Processes ● ENEE 621 - Detection and Estimation Theory ● ENEE 712 - Pattern Recognition ● CMSC 791 - Advanced Graduate Seminar ● CMSC 696 - Independent Study for Interns and Co-Op Students (max 3 credits) ● CMSC 699 - Independent Study in Computer Science (max 6 credits)
CMSC 799 - Master’s Thesis Research

Appendix 2: Greater Baltimore Metropolitan Region Program Duplication Discussion

Johns Hopkins University (JHU) offers an MS in AI. This MS allows students to deeply explore AI areas including computer robotics, natural language processing, and image processing. One distinguishing feature of this program is that it's entirely online. It offers courses that focus on particular AI models like ChatGPT, as well as courses on more theoretical topics like autonomy, swarm intelligence, reasoning, and game theory.

UMBC's MS in AI differs because it will be offered entirely in person. UMBC's program emphasizes core computing principles like natural language processing, algorithms, and computer graphics. Additionally, there is a huge difference in cost between UMBC and JHU's programs, which targets different students. JHU costs $5,455 per course, while UMBC costs $2,802 per course with in-state tuition.

Morgan State University (MSU) does not offer an MS in AI. MSU offers an MS in Advanced Computing. The Advanced Computing program offers courses in AI, but the overall program is focused on the intersection between various computing disciplines, providing a well-rounded education in several important facets of computing. The advantage of MSU's program is that students may choose their computing focus after beginning the program.

UMBC's MS in AI is specialized for students who have chosen to focus on AI at the start of the master's degree, following their previous education. UMBC's MS in AI covers more focused AI topics including natural language processing, robotics, computer vision, and algebraic processing.

University of Baltimore (UB) offers an MS in AI for Business. This MS is tailored toward business managers looking to better understand how to design, train, and use artificial intelligence to enhance their business and solve problems.

UB's program targets a completely different group of students with its focus on business. The program includes using the technology for decision making, task automation, and customer experience in a business setting. UMBC's program, by contrast, is for students interested in computer science principles at the core of AI; it is not for students looking to enhance practical applications to business.

Capitol Technology University (CTU) does not offer an MS in AI. CTU offers an MPhil or an MRes in AI. The MPhil program focuses on foundation theory of AI for working professionals. It is a flexible program that allows students to tailor their program to their specific interests and needs. The MRes allows students to conduct original research in an area of interest, providing working professionals with practical research experience. Both degrees are delivered completely online.

The MPhil and MRes at CTU are different degree types from the MS that will be offered at UMBC, so these programs serve a different purpose than UMBC's will.

University of Maryland, Baltimore (UMB) offers an MS in Artificial Intelligence for Drug Development. The degree is housed within the School of Pharmacy and focuses specifically on AI applications to pharmaceuticals.

UMB's program is highly specialized for those interested in pharmaceuticals. UMBC's AI program is tailored toward students looking to understand how AI works through the lens of computer science. Because this program at UMB is for students interested in pharmacy, UMB's program targets a different group of students than UMBC's program.

Bowie State University (BSU) does not offer an MS in AI. BSU offers an MS in Computer Science with an AI and Machine Learning specialization. This program is advantageous for students who have an interest in computer science but want to take a more multidisciplinary approach that incorporates AI as well as cybersecurity and data science. Students can enroll in the program and choose their specialization after some study in the field.

UMBC's program focuses only on AI, and so UMBC's students will have already chosen to specialize in AI. UMBC's program covers topics that BSU does not, including algebraic processing and knowledge representation and reasoning.

University of Maryland, College Park (UMCP) does not yet offer an MS in AI, though it has proposed an MS in AI to MHEC. UMCP's proposed MS in AI is similar to UMBC's. However, UMCP's program will not offer a thesis option. UMBC's MS in AI may be better suited for students seeking to enter academia because UMBC will offer a thesis option and will prioritize opportunities for student research. Additionally, UMCP serves a different geographical region than UMBC.

UMCP currently offers an MS in Applied Machine Learning. In UMCP's Applied Machine Learning program, students will create models and algorithms that learn from and make decisions based on data. The program is designed to accommodate working professionals and emphasizes practical knowledge.

UMBC's MS in AI involves different subject matter and practical applications than UMCP's MS in Applied Machine Learning. While students at UMCP study machine learning as a subset of AI, UMBC's program involves a wider range of coverage on AI topics. Additionally, UMCP's program is more attractive for students in the Washington, D.C. metro area given its location, while UMBC's will attract more students in the Baltimore area.

University of Maryland, Global Campus (UMGC) does not yet offer an MS in Applied Artificial Intelligence, though it has proposed this degree to MHEC. UMGC's proposed MS in Applied Artificial Intelligence is a completely online program that provides students with essential technical AI foundations and specialized preparation for career fields including cybersecurity. UMGC's program targets working adults and career changers that will diversify the workforce.

UMBC's MS in AI is different because its modality will be entirely in person. UMBC's MS in AI targets those of a computer science or similar background who would like to advance their computer science skills in the AI field. UMBC's program will also have a stronger research orientation.

Appendix 3: Learning Outcomes & Assessments

(SLO-1) Students will acquire a deep understanding of core AI principles, including search algorithms, reasoning, and learning, through Principles of Artificial Intelligence (CMSC 671) and Machine Learning.
MEASURE: Performance in CMSC 671 and CMSC 678, including exams, assignments, and course projects.
CRITERION: Students must earn a grade of B or better in both courses to satisfy core competency requirements.
ASSESSMENT: Course instructors will assess students' theoretical and applied understanding of AI and machine learning fundamentals via problem sets, coding assignments, and exams. Program-level assessment will be conducted via review of grade distributions and outcomes from embedded course-level assessments annually.

(SLO-2) Students will expand their expertise by selecting electives from Bucket A, covering computer vision, natural language processing, neural networks, and robotics, equipping them with the necessary knowledge to work on specialized AI applications.
MEASURE: Completion of at least three Bucket A electives with project-based assessments.
CRITERION: Students must earn passing grades (B or higher) in all three required Bucket A electives.
ASSESSMENT: Instructors will evaluate student performance through programming projects, exams, and/or research papers that demonstrate specialized AI application skills. Periodic curriculum reviews will ensure that electives align with current industry and research trends.

(SLO-3) Students will develop strong computational abilities through electives in Bucket B in data visualization, algorithm design, numerical computation, symbolic processing, and multi-agent systems, enabling them to solve complex AI-related problems.
MEASURE: Student performance in selected Bucket B electives through exams and computational projects.
CRITERION: Students must complete relevant coursework with a minimum GPA of 3.0 across all Bucket B electives.
ASSESSMENT: Program faculty will assess outcomes by sampling and evaluating student deliverables (e.g., algorithm design assignments, data visualization reports) and monitor trends through course evaluations and annual student progress reports.

(SLO-4A) Thesis Track Students will conduct independent research (CMSC 799), exploring advanced AI methodologies, designing experiments, and contributing to the field through novel findings and technical publications
MEASURE: Successful completion of 6 credits of CMSC 799, thesis submission, and oral defense.
CRITERION: Thesis must be approved by the student's committee and meet the Graduate School's thesis standards.
ASSESSMENT: Student research will be assessed via the written thesis and oral defense evaluated by the faculty committee. Additional indicators include submission of research papers to conferences or journals and presentations at academic venues.

(SLO-4B) Non-Thesis Track students will complete additional coursework and may participate in independent studies or internships, preparing them for AI-driven roles in industry and applied research.
MEASURE: Completion of 33 graduate credits, including electives from Bucket A and B, and optional independent study (CMSC 696/699).
CRITERION: Students must maintain a GPA of at least 3.0 and complete all course requirements.
ASSESSMENT: GPD will assess outcomes of independent studies or internships through final reports or presentations.

(SLO-5) Students will stay updated on emerging AI trends and deepen their technical knowledge in areas of personal or professional interest through special topics courses (CMSC 691) and independent study opportunities (CMSC 696, CMSC 699)
MEASURE: Enrollment and successful completion of CMSC 691, CMSC 696, or CMSC 699 with passing grades or satisfactory evaluations.
CRITERION: Students must demonstrate engagement with current or advanced AI topics through original work, literature reviews, or project-based deliverables.
ASSESSMENT: GPD and faculty advisors will assess the quality of deliverables in special topics or independent study courses. The GPD will review course content and student feedback to ensure continued relevance and rigor of these offerings.

Appendix 4: Student Competencies Assessment

This appendix describes the quantitative and qualitative ways that M.S. in AI students are assessed in their courses, which are aligned with the program objectives described earlier.

Quantitative assessment

- Maintenance of a 'B' or better cumulative GPA.
- Quizzes, mid-term, and/or final examinations to assess comprehension of theoretical principles and algorithmic techniques.
- Mathematical problem sets requiring derivations, formal proofs, or algorithm analysis.
- Written research papers exploring theoretical models, algorithmic frameworks, or open problems in artificial intelligence.
- Oral presentations on literature reviews, theoretical investigations, or comparative analyses of AI models.
- Critical analysis assignments that evaluate published AI research from a methodological and theoretical standpoint.
- Experiential learning opportunities, such as participation in faculty-led research, independent study projects, or thesis work.
- Thesis option: For students electing the thesis track, completion and successful defense of a faculty-supervised master's thesis, involving original research and theoretical contribution to AI.
- Non-thesis option: Completion of additional coursework that deepens theoretical and methodological knowledge in artificial intelligence.
- Other assessment mechanisms that may become relevant or required by the AI industry.

Qualitative assessment

- Academic advising at the program level to ensure students maintain academic and program expectations to proactively head off potential obstacles to success.
- Individual, peer-group, and/or in-class critiques of student work.
- Direct engagement between faculty and students in classroom, lab, or online platforms.
- Students, who chose the thesis option, conduct a structured research effort to develop a scholarly or professional paper demonstrating their critical thinking skills, analytical capabilities, and/or accumulated technical expertise in AI.

Appendix 5: MS in AI Course Names and Descriptions

CMSC 671 - Principles of Artificial Intelligence (3 cr.)
Course Description: This course will serve as an introduction to artificial intelligence concepts and techniques. Students will use Python as a computational vehicle for exploring the techniques and their application. Specific topics we will cover include the history and philosophy of AI, the agent paradigm in AI systems, search, game playing, knowledge representation and reasoning, more search, logical reasoning, uncertain reasoning and Bayes nets, planning, machine learning, and multi-agent systems, robotics, and natural language processing. If time permits, students may also briefly touch on functional programming, perception, and applications of AI.

CMSC 672 - Computer Vision (3 cr.)
Course Description: Computer vision has the broad goal of understanding visual signals (images and videos) for low/mid/high-level perceptual tasks. This course offers a comprehensive introduction to computer vision, covering first principles, analytical as well as learning-based algorithms, and frontier topics in contemporary computer vision research. We will cover the following topics: understanding the basics of cameras and image formation, image transformations and stereo vision, image filtering and feature extraction, basics of machine learning and neural networks for computer vision, image and video understanding including recognition, detection, and tracking, and a selection of advanced topics such as representation learning, multimodal learning, generative models, and reliability and ethics in computer vision. In addition to lectures by the instructor, this course will also involve invited talks by external speakers to give students a glimpse into new findings, innovative ideas, and trends in computer vision.

CMSC 673 - Introduction to Natural Language Processing (3 cr.)
Course Description: Natural language processing (NLP) is the field of working with language to automatically perform a variety of tasks, instead of or in collaboration with people. NLP can focus on the Generation (NLG) and/or Understanding (NLU) of natural language. Recently, large language models (LLMs) like ChatGPT have gotten the attention of the general public, but they have also greatly changed the landscape of modern NLP research. This course will show you both old & new techniques that are still used today and will give you a basic understanding of why & how we do NLP.

CMSC 634 - Computer Graphics (3 cr.)
Course Description: Introduction to graphics systems, rasterization, clipping, transformations, modeling, viewing, hidden surface removal, illumination, and shading. Emphasis on realistic, 3D image synthesis.

CMSC 635 - Advanced Computer Graphics (3 cr.)
Course Description: A study of advanced topics in computer graphics emphasizing algorithms for display of 3D objects, including wireframe representation, polygon mesh models, shading algorithms, parametric representation of curves, hidden surface elimination, fractals and ray tracing. Other topics include advanced topics from the computer graphics literature, page description languages, CORE, GKS, PHIGS, CGI, the X window system, X window intrinsics, Motif and widget programming.
Prerequisite: CMSC 435, CMSC 634 or consent of instructor.

CMSC 636 - Data Visualization (3 cr.)
Course Description: This course addresses the theoretical and practical issues in creating visual representations of large amounts of data. It covers the core topics in data visualization: data representation, visualization toolkits, scientific visualization, medical visualization, information visualization, and volume rendering techniques. Additionally, the related topics of applied human perception and advanced display devices are introduced. Open to computer science students with a background in computer graphics or students in data-intensive fields who are familiar with the use of the computer for data collection, storage or analysis.
Prerequisite: CMSC 634 (Graduate Computer Graphics)

CMSC 641 - Design and Analysis of Algorithms (3 cr.)
Course Description: This course studies advanced topics and techniques in algorithms, strategies for designing algorithms, and mathematical tools for analyzing algorithms. Algorithm design strategies

include amortized analysis, parallel computation, randomization, greedy algorithms, and dynamic programming. Students will learn to design new algorithms, to analyze the time and space usage and correctness of algorithms, to apply and adapt fundamental algorithms to new problems, and to solve problems and to express their solutions using the language and concepts of algorithms and related mathematical tools.

CMSC 655 - Numerical Computations (3 cr.)
Course Description: This course introduces programming techniques for scientific and numerical computing. Topics include numerical accuracy and stability, numerical linear algebra, interpolation, solving non-linear systems and the numerical solution of differential equations. This course also provides some emphasis on the performance of numerical algorithms and computation in a parallel environment.
Prerequisites:

CMSC 656 - Symbolic and Algebraic Processing (3 cr.)
Course Description: Applications and foundations of symbolic algebra. Applications and examples are studied using at least one large symbolic algebra package. Symbolic algebra combines elements of AI, analysis of algorithms and abstract algebra. Foundations include problems of representation, canonical and normal forms, polynomial simplification, Buchberger's algorithm, G.C.D. in one and several variables, panic methods and formal methods for integration.
Prerequisites: CMSC 203 and CMSC 341 or consent of instructor.

CMSC 661 - Principles of Database Systems (3 cr.)
Course Description: Advanced topics in database management systems: data models and their underlying mathematical foundations, database manipulation and query languages, functional dependencies, physical data organization and indexing methods, concurrency control, crash recovery, database security and distributed databases.
Prerequisite: CMSC 461 or consent of instructor.

CMSC 663 - Data Privacy (3 cr.)
Course Description: Data Protection can be viewed as the combination of Data Security, which focuses on protecting data from internal/external attackers, and Data Privacy, which focuses on governing how data is collected, shared, and used. This course examines the fundamentals of data privacy. In a world where ever-increasing amounts of information is captured about our daily lives, it is necessary for responsible computer scientists to take individuals' privacy into account throughout the whole engineering process. This course will discuss topics which include: history and fundamentals of data privacy, data privacy regulations, privacy-by-design, privacy enhancing technologies, privacy policies, differential privacy, cryptographic techniques (e.g., secure multi-party computation).
In addition to the instructor lectures, the course will involve presentations on the state of the art of different topics in the field by researchers from UMBC and other institutions.

CMSC 675 - Introduction to Neural Networks (3 cr.)
Course Description: This class will offer a comprehensive overview of neural networks and deep learning algorithms. Deep Learning has been a highly successful research field over the last 20 years across a range of domains (vision, language, audio, robotics; "AI" in general). Deep learning has led to significant commercial success and exciting new directions that may previously have seemed out of reach. The class will focus on the core principles of extracting meaningful representations from high dimensional data, a fundamental aspect for several applications in autonomous decision making. Class lectures will cover fundamental topics such as network design, training and optimization, and evaluation. Homework will give students the opportunity to implement algorithms learnt in class for applications in visual recognition, language understanding and other domains. In the term project, students will construct a research hypothesis, propose new techniques and solutions, interpret results, and communicate key findings.

CMSC 676 - Information Retrieval (3 cr.)
Course Description: This course is an introduction to the theory and implementation of software systems designed to search through large collections of text. Did you ever wonder how World-Wide Web search

engines work? Ever wondered why they don't? You'll learn about it here. Information retrieval (IR) is one of the oldest branches of computer science, and has influenced nearly every aspect of computer usage: "search and replace" in a word processor, querying a card catalog, greping through your source code, filtering the spam out of your email, searching the Web. This course will have two main thrusts. The first is to cover the fundamentals of IR: retrieval models, search algorithms, and IR evaluation. The second is to give a taste of the implementation issues by having you write (a good chunk of) your own text search engine and test it out on a sample text collection. This will be a semester-long project, details to follow.

CMSC 678 - Introduction to Machine Learning (3 cr.)
Course Description: This course will cover fundamental concepts, methodologies, and algorithms related to machine learning, including the following: decision trees, perceptrons, logistic regression, linear discriminant analysis, linear and non-linear regression, basis functions, support vector machines, neural networks, genetic algorithms,

CMSC 679 - Introduction to Robotics (3 cr.)
Description: Fundamental concepts, methodologies and algorithms related to autonomous mobile robotics, touching on mechanical, motor, sensory, perceptual and cognitive aspects of the problem of building robots that move and decide what to do on their own. Specific topics covered include legged and wheeled location, kinematic models and constraints, mobile robot maneuverability, motion control, sensors and sensing, perception, localization, belief representations, map representations, probabilistic map-based localization, autonomous map building, planning, reacting and navigation architectures.

CMSC 691 - Introduction to Data Science (3 cr.)
Course Description: Data science is a field that involves data manipulation, analysis, and presentation, all at scale. Data scientists are the bridge between the idea and the data and help extract latent value, often uncovering novel insights and novel beneficial ways to use the data in the process. The goal of this class is to give students hands on experience with all phases of the data science process using real data and modern tools. Topics that will be covered include data formats, loading, and cleaning; data storage in relational and non-relational stores; data analysis using supervised and unsupervised learning, and sound evaluation methods; data visualization; and scaling up with cloud computing, MapReduce, Hadoop, and Spark**.**

CMSC 691 - Special Topics in Computer Science (1-3 cr.)
Course Description: A set of CMSC 691 courses on various specialized computer science topics are typically offered each semester.

CMSC 771 - Knowledge Representation and Reasoning (3 cr.)
Course Description: This course covers advanced issues in representing and reasoning with knowledge. Topics include determining features for and carrying out belief description; naive and logic-oriented approaches to the formal representation of knowledge; logic-based and economic-oriented reasoning mechanisms; statistical and probabilistic representations, and algorithms for implementing reasoning, decision-making and communication, including methods for dealing with incomplete, unsound or time-sensitive knowledge and limited computational resources.
Prerequisite: CMSC 671 or consent of instructor

ENEE 612 - Digital Image Processing (3 cr.)
Course Description: Principles of two-dimensional processing of image data: fundamentals of 2D signal processing, image transforms, image enhancement, image filtering and restoration, color image processing, image coding and wavelet quantization, image thresholding and segmentation, image interpretation and recognition, applications of image processing.
Prerequisite: MATLAB or consent of instructor.

ENEE 620 - Probability and Random Processes (3 cr.)
Course Description: Fundamentals of probability theory and random processes for electrical engineering applications and research: set and measure theory and probability spaces; discrete and continuous random variables and random vectors; probability density and distribution functions and probability

measures; expectation, moments and characteristic functions; conditional expectation and conditional random variables; limit theorems and convergence concepts; random processes (stationary/non-stationary, ergodic, point processes, Gaussian, Markov and second order); applications to communications and signal processing.
Prerequisite: Undergraduate probability course work or consent of instructor.

ENEE 621 - Detection and Estimation Theory (3 cr.)
Course Description: Fundamentals of detection and estimation theory for statistical signal processing applications; theory of hypothesis testing (binary, multiple and composite hypotheses and Bayesian, Neyman Pearson and minimax approaches); theory of signal detection (discrete and continuous time signals; deterministic and random signals; white Gaussian noise, general independent noise and special classes of dependent noise, e.g. colored Gaussian noise, signal design and representations); theory of signal parameter estimation; minimum variance unbiased (MVU) estimation; Cramer-Rao lower bound; general MVU estimation, linear models; maximum likelihood estimation, least squares; general Bayesian estimators (minimum mean-square error and maximum a posterior estimators); linear Bayesian estimators (Wiener filters) and Kalman filters.
Prerequisite: ENEE 620 or consent of instructor.

ENEE 712 - Pattern Recognition (3 cr.)
Course Description: Principles of statistical pattern recognition; hypothesis testing and decision theory; parametric estimation (Bayesian estimation, maximum-likelihood estimation, Gaussian mixture analysis); non-parametric estimation (nearest-neighbor rule and Pazen's window method); density approximation; linear discriminant functions; feature extraction and selection; feature optimization; neural networks (single-layer perceptrons, multi-layer neural networks); and applications in pattern classification.
Prerequisite: ENEE 612, ENEE 620 and ENEE 621 or consent of instructor.

CMSC 791 - Advanced Graduate Seminar (3 cr.)
Course Description: Topics central to designing distributed computing systems, including distributed synchronization and resource sharing, concurrency control in distributed databases, distributed simulations, languages for distributed computing, proof techniques for distributed systems and distributed operating systems.
Prerequisite: Prerequisites: CMSC 621 and CMSC 681 or consent of instructor.

CMSC 696 - Independent Study for Interns and Co-Op Students (1-3 cr.)
Description: Independent study related to internship and co-op opportunities in computer science. Consent of instructor required.

CMSC 699 – Independent Study in Computer Science (1-4 cr.)
Description: Independent study work will consist of individualized research work with a faculty member.

CMSC 799 - Master's Thesis Research
Description: This course is for students in the CMSC master's program engaged in master's thesis research. Note: The faculty instructors for this particular course will vary based on thesis topic and area of expertise.
Prerequisite: Open only to MS AI thesis-option students.

Appendix 6: Student Support

Advising for students in the M.S. in AI program will be provided by multiple faculty members in the CSEE Department, who are active in AI research. These faculty members will serve as academic advisors and mentors, helping students navigate course selections, thesis planning (for thesis-track students), and broader academic and professional goals.
The M.S. in AI program will be administered entirely within the CSEE department, which will handle all relevant administrative tasks associated with program management.
Students will have access to a comprehensive array of UMBC resources designed to support academic, technical, and personal success. These include:

- UMBC's Division of Information Technology (DOIT), which provides technical support for campus computing systems, email, and the official Learning Management System (Blackboard), which is used for coursework and communication in both in-person and online settings.
- UMBC's Career Center, which offers career advising, resume workshops, job fairs, and employer networking events relevant to AI and related fields.
- UMBC's Office of Accessibility & Disability Services (ADS), which ensures equal access to educational opportunities for students with disabilities. ADS provides academic accommodations and support regardless of learning modality or campus location.
- UMBC's Graduate Student Association (GSA), which supports graduate student life, organizes academic and professional development events, and offers funding opportunities for travel and research.

Communication with students regarding program updates, deadlines, course offerings, and policy changes will occur via the program's official email listserv, as well as through UMBC's Graduate School, Registrar, and other campus systems. Faculty and students are also encouraged to collaborate and share information using Google Drive, Box, and other officially supported platforms.
Students will have consistent access to high-speed internet to support their coursework. Finally, UMBC offers extensive high-performance computing (HPC) facilities to support faculty and student research in AI. These resources provide robust computational capabilities necessary for training and evaluating complex AI models and conducting large-scale simulations, facilitating cutting-edge research as part of both coursework and thesis projects.

Appendix 7: Full-Time Faculty Supporting the MS in AI

The CSEE faculty listed below supporting the M.S. in AI are full-time regular faculty with AI expertise. Specific course/teaching assignments typically change on a regular basis. Additional faculty, including full-time, part-time, and/or adjuncts may be included in the future to support instructional activities as needed. The faculty instructors for CMSC 799 will vary based on thesis topic and area of expertise.

Name	Highest Degree Earned, Field, Institution	Rank	Status	Course(s)
Anupam Joshi	Ph.D., Computer Science, Purdue University	Professor	Full-time	CMSC 671, CMSC 699
Frank Ferraro	Ph.D., Computer Science, Johns Hopkins University	Associate Professor	Full-time	CMSC 678, CMSC 691
Sanorita Dey	Ph.D., Computer Science, University of Illinois at Urbana-Champaign	Assistant Professor	Full-time	CMSC 673, CMSC 771
Rebecca Williams	Ph.D., Engineering Science, Dartmouth University	Assistant Professor	Full-time	CMSC 636, CMSC 699
Don Engel	PhD., Computer Engineering, University of Tehran	Assistant Professor	Full-time	CMSC 636, CMSC 699
Manas Gaur	Ph.D., Artificial Intelligence, University of South Carolina	Assistant Professor	Full-time	CMSC 673, CMSC 691
Cynthia Matuszek	Ph.D., Computer Science, University of Washington	Associate Professor	Full-time	CMSC 679, CMSC 699
Tim Oates	Ph.D., Computer Science, University of Massachusetts	Professor	Full-time	CMSC 678, CMSC 699
Roberto Yus	Ph.D., Computer Science, University of Zaragoza	Assistant Professor	Full-time	CMSC 663, CMSC 699
Khaled Solaiman	Ph.D., Computer Science, Purdue University	Assistant Teaching Professor	Full-time	CMSC 678, CMSC 699
Tejas Gokhale	Ph.D., Computer Science, Arizona State University	Assistant Professor	Full-time	CMSC 672, CMSC 675
Lara J. Martin	PhD in Human-Centered Computing, Georgia Institute of Technology	Assistant Professor	Full-time	CMSC 675, CMSC 691
Adam Bargteil	Ph.D. in Computer Science, University of California at Berkeley	Associate Professor	Full-time	CMSC 634, CMSC 641

Marc Olano	Ph.D. in Computer Science, University of North Carolina	Associate Professor	Full-time	CMSC 634, CMSC 691
Christopher Marron	Ph.D., in Mathematics, University of Virginia	Professor of the Practice	Full-time	CMSC 641
Charles K. Nicholas	Ph.D. in Computer Science, Ohio State University	Professor	Full-time	CMSC 676, CMSC 696, CMSC 791
Samuel J. Lomonaco	Ph.D. in Mathematics, Princeton University	Professor	Full-time	CMSC 656
Tyler A. Simon	PhD in Computer Science, University of Maryland Baltimore County	Adjunct Professor	Part-time	CMSC 655
Ergun Simsek	Ph.D. in Electrical and Computer Engineering, Duke University	Assistant Professor	Full-time	CMSC 655
Konstantinos Kalpakis	PhD in Computer Science, University of Maryland Baltimore County	Associate Professor	Full-time	CMSC 661
Abhijit Dutt	Ph.D., Management Science, University of Wisconsin-Milwaukee	Professor of the Practice	Full-time	CMSC 691
Richard Chang	PhD in Computer Science, Cornell University	Associate Professor	Full-time	CMSC 641
Chein-I Chang	PhD in Electrical Engineering, University of Maryland College Park	Professor	Full-time	ENEE 612, ENEE 620, ENEE 712
Tulay Adali	PhD in Electrical Engineering, North Carolina State University	Professor	Full-time	ENEE 620, ENEE 621
Seung Jun Kim	PhD in Electrical & Computer Engineering, University of California, Santa Barbara	Associate Processor	Full-time	ENEE 620, ENEE 621

Appendix 8: Program Budget

Table 1: Program Resources					
Resource Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Reallocated funds	$0	$0	$0	$0	$0
2. Tuition/fee Revenue (c + g below)	$274,411	$616,990	$772,736	$850,401	$875,300
a. Number of F/T Students	18	39	47	50	50
b. Annual Tuition/Fee Rate	$802	$826	$851	$877	$903
Annual Credit Hour Rate	18	18	18	18	18
c. Total F/T Revenue (a x b)	$259,968	$580,162	$720,144	$789,094	$812,767
d. Number of P/T Students	2	5	7	8	8
e. Credit Hour Rate	$802	$818	$835	$851	$869
f. Annual Credit Hour Rate	9	9	9	9	9
g. Total P/T Revenue (d x e x f)	$14,443	$36,829	$52,592	$61,307	$62,533
3. Grants, Contracts & Other External Sources	$0	$0	$0	$0	$0
4. Other Sources*	$54,882	$123,470	$154,754	$170,444	$175,558
TOTAL (Add 1-4)	**$329,293**	**$740,461**	**$927,490**	**$1,020,845**	**$1,050,858**

The proposed program is expected to generate a steady increase in tuition and fee revenue over its first five years, reflecting stable enrollment trends in both full-time and part-time student categories. Based on historical enrollment patterns, our graduate programs related to computer science are popular and grow quickly. We anticipate sustained demand in this growing field of artificial intelligence.

In Year 1, total revenue is projected at $329,293, with contributions from 18 full-time students and 2 part-time students, as well as some international students. Full-time enrollment will increase steadily, with the sharpest increase between year 1 and year 2. We anticipate that the program's enrollment will grow steadily to an average of 50 students by year 4. Correspondingly, full time tuition revenue will increase from $259,968 in Year 1 to $812,676 in Year 5.

Part-time student enrollment is projected to begin with 2 students and hold at around 8 students per year, with tuition calculated based on a per-credit-hour rate that increases incrementally from $802 in Year 1 to $869 in Year 5. Assuming an average of 9 credit hours per year per part-time student, revenue from this segment is expected to grow from $14,443 in Year 1 to $62,533 in Year 5.

Other external sources shown in the budget refer to tuition and fees collected from international student populations. We anticipate that this program will have substantial interest from international students. The funding collected from tuition and fees for full-time, part-time, and international students will fully support

the program’s financial sustainability. By Year 5, total revenue is projected to reach $1,050,858, reflecting both modest tuition adjustments and consistent enrollment patterns.

Appendix 9: Program Expenditures

TABLE 2: Program Expenditures					
Expenditure Categories	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Faculty (b + c below)	$0	$167,500	$345,050	$355,402	$366,064
a. Number of FTE	0	1	2	2	2
b. Total Salary	$0	$125,000	$128,750	$132,613	$136,591
c. Total benefits	$0	$42,500	$43,775	$45,088	$46,441
2. Admin. Staff (b + c below)	$107,200	$110,416	$113,728	$117,140	$120,655
a. Number of FTE	1	1	1	1	1
b. Total Salary	$80,000	$82,400	$84,872	$87,418	$90,041
c. Total benefits	$27,200	$28,016	$28,856	$29,722	$30,614
3. Support Staff (b + c below)	$0	$0	$0	$0	$0
a. Number of FTE					
b. Total Salary					
c. Total benefits					
4. Technical Support and Equipment	$3,080	$3,172	$3,268	$3,366	$3,467
5. Library	$0	$0	$0	$0	$0
6. New or Renovated Space	$0	$0	$0	$0	$0
7. Other Expenses	$140,385	$254,277	$261,905	$269,762	$277,855
TOTAL (add 1-7)	**$250,665**	**$535,365**	**$723,951**	**$745,669**	**$768,040**

To ensure the program's success and long-term sustainability, we have carefully projected expenditures across key categories, accounting for faculty, technical support, and operational needs.

1. Faculty: The program will be supported by one full-time faculty member starting in Year 2, responsible for developing and teaching core courses, advising students, and contributing to program administration. The associated costs include:

- Salary Expenditures: Beginning at $125,000 in Year 1, with annual increases to accommodate cost-of-living adjustments and merit raises, reaching $136,591 by Year 5.
- Fringe Benefits: Estimated at approximately 34% of salary, starting at $42,000 in Year 1 and growing to $46,441 by Year 5.

2. Administrative Staff: The program will be supported by one full-time administrative staff member starting in year 1, responsible for operational management.

- Salary Expenditures: Beginning at $80,000 in Year 1, with annual increases to accommodate cost-of-living adjustments and merit increases, reaching $90,041 by Year 5.
- Fringe Benefits: Estimated at approximately 34% of salary, starting at $27,200 in Year 1 and growing to $30,614 in Year 5.

3. Support Staff: The program will utilize existing support staff within the department, eliminating the need for additional hires.

4. Technical Support and Equipment: To provide the GPD with basic computing needs, funds will be allocated for software licenses, computing resources, and necessary upgrades. To keep pace with inflation and evolving technological needs, expenditures will start at $3,080 in Year 1 and increase to $3,467 by Year 5.

5. Library Resources: No additional library expenses are anticipated. The university's existing digital and physical library resources sufficiently support faculty and student research needs.

6. New or Renovated Space: The program will be housed within existing facilities, requiring no new construction or renovation.

7. Other Expenses: Faculty development, conference travel, memberships, marketing, office supplies, and technology services. Initial expenditures are projected at $140,385 in Year 1, rising to $277,855 by Year 5 to support program growth, faculty engagement, and continuous improvement.

Total Expenditures: Overall, total program expenditures will increase from $250,655 in Year 1 to $768,040 in Year 5, ensuring financial sustainability while maintaining high-quality instruction and student support.

Appendix 10: Educational Assessment Methods

Program evaluation is carried out through assessment of learning outcomes in accordance with UMBC's existing policies and procedures.

AI program faculty periodically reviews syllabi, rubrics, labs, and projects to ensure a standard student experience and that materials used and presented remain relevant viz-a-viz current industry trends.

The CSEE department, and UMBC generally, evaluates full-time faculty through the university's established promotion and tenure process in the traditional areas of teaching, research, and service. This process includes a review of their syllabi, labs, courseware, samples of student products, classroom observation, and student surveys.

Qualified adjunct faculty, upon verification of their academic and professional credentials, are appointed members of the University of Maryland Baltimore Graduate School. Adjunct faculty are evaluated by full-time faculty members through regular curriculum reviews, mentoring, periodic classroom observation, and addressing student feedback promptly to ensure quality of instruction and the student's educational experience.

All UMBC faculty (regular and adjunct) are evaluated via the administration of online student surveys issued at the end of each semester. The data from this survey is shared with the instructor and publicly available via IRADS, while any qualitative comments received are shared only with the instructor. Faculty are encouraged to work with their program director, colleagues, UMBC's Center for Applied Learning and Teaching (CALT), or Division of Information Technology (DOIT) to conduct objective course assessment and/or pedagogical enhancement.

The Department of Computer Science and Electrical Engineering (CSEE) Chair and College of Engineering and Information Technology (COEIT) Dean regularly review student enrollment, retention, culture, and financial data from a strategic perspective to ensure program outcomes are aligned with Departmental and College priorities under UMBC's *Strategic Plan*. UMBC's Provost Office also engages in strategic and financial reviews of all UMBC programs.
The University System of Maryland's accountability obligation includes a requirement that each academic program be reviewed every seven years. Accordingly, UMBC conducts academic program reviews (APR) to gauge program effectiveness, quality, and culture. As recognized by USM and the Council of Graduate Schools, the APR process has five general purposes: quality assurance, quality improvement, accountability, identification of strategies for improvement, and providing the institution with information for prioritization of resources. CSEE's graduate programs successfully completed their last APR in 2018.

Taken together, UMBC has a robust, multi-stakeholder method to assess academic program effectiveness, learning outcomes, student retention, student/faculty satisfaction, cost-effectiveness, and workforce relevance. These methods are supported by continual internal UMBC evaluation of industry trends and needs to ensure its programs continue to meet current and anticipated industry and workforce requirements in Maryland and beyond.

Appendix 11: Additional AI Job Titles

Below, additional unique job titles for AI specialists are listed.

NLP Engineer	Build AI models for natural language processing, including chatbots, translation, and sentiment analysis. Work with transformer models (BERT, GPT) and optimize text/speech processing systems for scalability.
Robotics Engineer (AI Focus)	Develop AI algorithms for autonomous robots, including path planning, SLAM, and reinforcement learning. Integrate perception systems (LiDAR, cameras) with decision-making for use in manufacturing, logistics, or space exploration.
AI Ethics & Fairness Specialist	Ensure AI systems are unbiased, transparent, and ethically deployed. Develop fairness metrics, audit algorithms, and advise organizations on responsible AI practices and compliance.
AI Consultant	Advise businesses on AI adoption, strategy, and implementation. Identify use cases, assess feasibility, and recommend AI solutions across industries like finance, healthcare, and retail.
Deep Learning Engineer	Specialize in neural networks, GANs, and advanced deep learning techniques. Optimize models for GPUs/TPUs and deploy them at scale for applications like generative AI, drug discovery, or game development.
AI Solutions Architect	Design end-to-end AI systems for enterprises, selecting appropriate tools (cloud AI, on-prem solutions). Ensure scalability, security, and seamless integration with existing infrastructure.
Autonomous Systems Engineer	Develop AI for self-driving cars, drones, or industrial automation. Work on sensor fusion, real-time decision-making, and control systems for companies in automotive, aerospace, or defense.
AI in Healthcare Specialist	Apply AI to medical imaging, drug discovery, or patient data analysis. Ensure compliance with healthcare regulations (HIPAA, FDA) while developing AI solutions for hospitals, pharma, or biotech firms.
AI Cybersecurity Specialist	Use AI for threat detection, anomaly detection, and fraud prevention. Develop adversarial machine learning defenses to protect systems in finance, government, or tech.
AI Educator / Trainer	Teach AI/ML concepts at universities, bootcamps, or corporate training programs. Develop courses, tutorials, or certification materials to train the next generation of AI professionals.