



# GET AHEAD

BECOME A MACHINE LEARNING ENGINEER



**MILWAUKEE SCHOOL  
OF ENGINEERING**

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Dwight and Dian Diercks School  
of Advanced Computing

## MACHINE LEARNING GRADUATE PROGRAMS

**Master of Science in  
Machine Learning**

**Graduate Certificate in  
Machine Learning Engineering**

**Graduate Certificate in  
Generative AI Production Systems**

**Graduate Certificate in  
Tiny Machine Learning**

**Graduate Certificate in  
Applied Machine Learning**

**Graduate Certificate in  
Advanced Business Strategy  
Using AI and Analytics**

**Milwaukee School of Engineering** is at the forefront of artificial intelligence and machine learning education and practice. Students learn to develop and incorporate machine learning into customer-facing products and services. MSOE's graduate programs are designed to meet employers' demand for employees who can combine a core engineering discipline with AI to lead in technical innovation. We've been preparing students to solve the complex challenges of today and tomorrow since 1903. Our university was born from industry need. To this day, all of our programs are built to meet the needs of employers, so you are guaranteed that the skills you learn are in demand.

### **Dwight and Dian Diercks School of Advanced Computing**

Established in 2025, the Dwight and Dian Diercks School of Advanced Computing strengthens and grows the MSOE vision of national leadership in AI. It elevates MSOE's already-strong computing programs and builds the infrastructure needed to integrate AI throughout the curriculum.

The Diercks School is named to recognize the incredible and historical philanthropic support and vision Dwight and Dian Diercks have given to MSOE. It serves more than 400 students across three undergraduate programs in Computer Science, Cybersecurity Systems and Software Engineering and nearly 100 students in professional master's degree and graduate certificate programs in Machine Learning, while also creating pathways for AI integration in business, health care, engineering and design.

“Reinforcement learning is my standout favorite thing to teach (and to research!); it is the real AI-stuff. In reinforcement learning, we aim to teach computers to manage complicated tasks over a long period of time. Think ‘self-driving car’ or ‘chess-playing AI.’ Indeed, it is reasonable to think of modern LLMs as reinforcement learning agents. In class, I emphasize building and applying different learning algorithms across a variety of tasks. It’s great fun to hear from my students about the first time the agent they are training successfully navigates a turn in a racetrack or defeats them in a game of battleship.”

**—Dr. Jeremy Kedziora, PieperPower Endowed Chair in AI and Associate Professor**

## WHY LEARN AT MSOE?

- **Industry applications in every course**
- **Use of Rosie, MSOE's supercomputer**
- **Online, synchronous, evening classes that don't interrupt your busy full-time work schedule**
- **Courses are taught by expert, industry-experienced, student-focused faculty**
- **One-on-one mentoring**
- **Small class sizes**

## THE POWER OF EXPERIENCE

MSOE students are known for their work ethic, technical prowess, innovative mindset and ability to contribute on Day 1. Our graduate students learn from industry experts, participate in project-based learning, and are part of a cohort of high-caliber student colleagues.

## BUILT FOR SUCCESS

At MSOE, you will find a caring community of students and faculty. We are passionate about teaching and committed to seeing you succeed. The Machine Learning graduate programs are taught in an online format where you will learn in real-time, engage in thoughtful discussions, and work together on projects with your classmates and expert MSOE faculty. In every class, you will complete multi-week, hands-on, technically focused projects. Faculty-student interaction and mentoring are hallmarks of the program, and the relationships and network you develop will be a lifelong benefit.

## CHOOSE YOUR SPECIALIZATION

The Master of Science in Machine Learning empowers working professionals to leverage their existing skills in programming and application area knowledge, enabling them to dive right into advanced concepts that can be applied immediately. Concurrently, students can earn graduate certificates in Machine Learning Engineering, TinyML and GenAI Production Systems. This allows you to specialize your studies and indicate these specializations to employers. Plus, the certificates are “stackable.”

## PROJECT-BASED LEARNING

Focus on domains of your choosing to apply the skills you learn in class to your current professional work. Examples of projects include visualization and analysis of geospatial distributions of real estate, engineering new features to improve machine learning model prediction performance, object detection and segmentation with deep neural networks, and AI agents for video games.



Each certificate is comprised of two 4-credit courses and count toward the M.S. in Machine Learning. Students pursuing the master's degree must complete six required courses and two electives for a total of 30–32 credits.

### PROGRAM DELIVERY

All classes in the graduate machine learning programs are delivered in a synchronous online format, meaning you are learning alongside your peers in real-time from an industry-experienced faculty member. This allows for rich discussion and interaction. By taking one class per semester, students can expect to complete a graduate certificate in nine months. To earn the master's degree in three years, students should plan to take one class per semester, including summers. Taking two classes per semester (not including summers) will allow students to complete the master's degree in two years.

MSOE also offers two graduate certificates for those who may not be ready to start the full master's degree. The Graduate Certificate in Applied Machine Learning builds on existing software development and engineering skills while the Graduate Certificate in Advanced Business Strategy Using AI and Analytics builds on existing business acumen.

### ROSIE, MSOE'S SUPERCOMPUTER

Unique to MSOE, undergraduate and graduate students have access to Rosie, the university's supercomputer. Rosie includes three NVIDIA DGX-1 pods, each with eight NVIDIA V100 Tensor Core GPUs, and 20 servers each with four NVIDIA T4 GPUs. The nodes are joined together by Mellanox networking fiber and share 200TB of network-attached storage. In 2024, Rosie received an upgrade that includes two DGXH100s. MSOE was the first in Wisconsin to deploy this supercomputing hardware. The DGX H100 systems deliver the scale demanded to meet the massive computer requirements of generative AI including large language models, recommender systems, health care research and climate science. Packing eight NVIDIA H100 GPUs per system, connected as one by NVIDIA NVLink®, each DGX H100 provides 32 petaflops of AI performance.

In addition to using Rosie, students have access to an on-premise cloud environment running on MSOE's Ampere cluster. Students use the cluster in classes like CSC 6605 ML Production Systems and CSC 6607 LLMs in Production to deploy and operate the AI-powered software services they design and implement. The cluster is equipped with 480 cores, 1.75TB of RAM and 112TB of raw storage.



## GRADUATE DEGREE

### Master of Science in Machine Learning

The M.S. in Machine Learning prepares you to be a lead architect on complex design and implementation projects involving machine learning and data science while addressing competing ethical and professional concerns. You will build on your foundation of existing programming and software development skills to bring machine learning into practice. The program covers skills in data science, machine learning, deep learning and AI; integration of machine learning into production systems; and deep dives into specific topics through electives.

#### Program Outcomes

The M.S. in Machine Learning is designed to develop competencies in a broad range of topics. You will:

- Analyze complex problems involving advanced applications of machine learning and data science.
- Effectively evaluate and utilize state-of-the-art software and parallel computing hardware in the design and implementation of projects.

- Successfully deploy production-quality solutions involving machine learning and data science techniques using current best practices.

#### Admissions Requirements

The M.S. in Machine Learning is designed for those with a technical bachelor's degree who have experience with object-oriented programming in a modern language such as C#, Java, or Python (a Data Structures course is preferred), and have taken undergraduate course work in integral and derivative calculus (multivariable calculus and/or linear algebra preferred).

**“Models aren’t useful to anyone if they are just sitting on your computer. They need to be incorporated into products like web applications, mobile apps, and smart devices to benefit users.”**

**—Dr. RJ Nowling, Program Director and Associate Professor**

## Master of Science in Machine Learning

### PROJECT

#### Data Science: Spatial Distributions of Real Estate Sales

Students create a dashboard to spatial distributions of real estate based on prices, types, sizes and characteristics like number of bedrooms and bathrooms.

Students are tasked with inferring geographic properties like income ranges and urban vs suburban vs rural.

### TECHNOLOGIES

Pandas, interactive visualization libraries like Bokeh and folium



### PROJECT

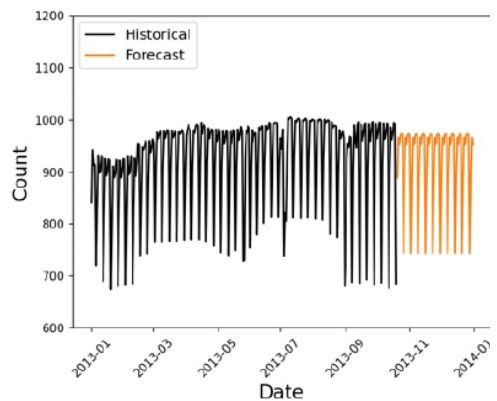
#### Statistical Modeling: Time Series Forecasting

Students learn about time series concepts such as frequency analysis frequency, autocorrelation, and lag variables.

Students create models for encoding time-based patterns and forecast future values.

### TECHNOLOGIES

Numpy, linear regression, statsmodel, Facebook Prophet, ARIMA models, exponential smoothing



# SPECIALIZATIONS

Graduate certificates are a great way to specialize within the M.S. in Machine Learning. All classes count toward your master's degree and you can earn certificates while you are pursuing your master's degree. A certificate provides you with a credential that showcases your specialization to employers.

## Graduate Certificate in Machine Learning Engineering

The Graduate Certificate in Machine Learning Engineering is for those who have completed the Graduate Certificate in Applied Machine Learning or are enrolled in the M.S. in Machine Learning. It provides deep technical content that will enable you to bring machine learning solutions into production in your industry.

- Successfully deploy production-quality solutions involving machine learning and data science techniques using current best practices.

### Required Courses

#### CSC 5201

Microservices and Cloud Computing

#### CSC 6605

Machine Learning Production Systems

### Program Outcomes

- Employ state-of-the-art AI tools in the design and implementation of projects.

### PROJECT

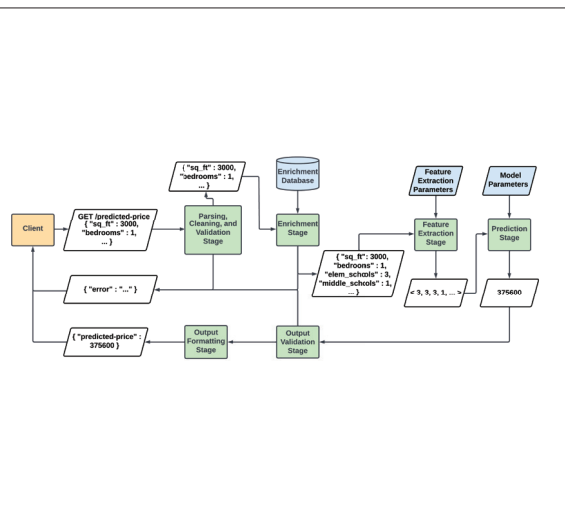
#### Real Estate Price Prediction Service

Students learn how to incorporate a ML model into RESTful service for predicting real estate sales prices and deploy it to a Linux server.

In addition, students implement and deploy supporting components like data pipelines, databases, and monitoring systems.

### TECHNOLOGIES

PostgreSQL, Flask, Scikit Learn, Docker, Linux



## Graduate Certificate in Generative AI Production Systems

The Graduate Certificate in Generative AI Production Systems teaches you how to develop and operate safe, reliable and cost-efficient software systems incorporating generative AI models like large language models (LLMs).

### Program Outcomes

- Incorporate generative AI models like LLMs into software systems
- Make software smarter, more dynamic and more powerful through the creation of LLMs

### Required Courses

#### CSC 6607

Machine Learning Production Systems

#### CSC 6714

Large Language Models

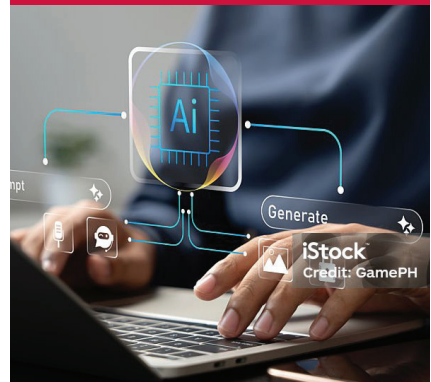
### PROJECT

#### LLM-Powered Interactive AI Assistant

Students learn how to implement and deploy an interactive AI assistant using LLMs and patterns for enhancing the AI's capabilities like retrieval augmented generation (RAG) and tool calling via the model context protocol (MCP).

### TECHNOLOGIES

llama.cpp, PostgreSQL, RESTful services, Docker, Linux



“I teach Deep Learning (CSC 5611) and Large Language Models (CSC 6714). I enjoy the opportunity to share with students cutting edge research and the big picture ideas we can take away from it as we work to understand the future of AI and our role in it. Both courses also give students an opportunity to explore the fundamental ideas of AI and Deep Learning in a hands-on setting.”

—Dr. Josiah Yoder, Associate Professor

## Graduate Certificate in Tiny Machine Learning

The Graduate Certificate in Tiny Machine Learning prepares students to develop and deploy machine learning models for use on embedded systems that use data from on-board sensors and other sources. Students consider tradeoffs in model accuracy, computational power, and energy usage along with security and reliability concerns.

### Program Outcomes

- Successfully develop and deploy machine learning models for use on embedded systems that use data from on-board sensors and other sources.
- Learn about sensor data, embedded systems and machine learning algorithms that form the technological core of Internet of Things (IoT).
- Well positioned for industry roles related to Tiny ML and Internet of Things.

### Required Courses

#### CSC 5616

ML for Signal Processing Applications

#### CSC 5608

ML on Embedded Systems

### PROJECT

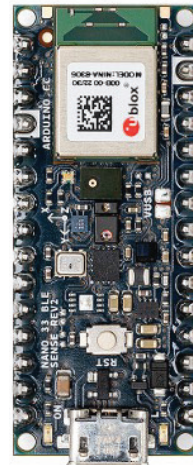
## Real-time Monitoring of Household Appliances with Audio

Not all machine learning is done on supercomputers; sometimes it's done on tiny computers.

Students learn how to combine digital signal processing, machine learning, and embedded systems concepts to implement a system for real-time monitoring of household appliances using audio samples.

### TECHNOLOGIES

Microcontrollers, Scikit Learn, C++



“I really enjoy teaching our ‘production systems’ courses because I get to show students how to incorporate the models they’ve built into services and products that make them useful to other people. These classes set students up for industry careers as ML engineers.”

—Dr. RJ Nowling, Program Director and Associate Professor

## Master of Science in Machine Learning

To earn the M.S. in Machine Learning, students must complete six required courses plus 6–8 credits of electives for a total of 30–32 electives. Graduate certificates can be earned as part of the M.S. In Machine Learning studies by taking courses as noted.

### Required Courses

Need a total of 24 credits

- CSC 5201    Microservices and Cloud Computing
- \* CSC 5610    AI Tools and Paradigms
- \* CSC 6621    Applied Machine Learning
- MTH 5810    Mathematical Methods for Machine Learning
- PHL 6001    AI Ethics and Governance

One of the below (production systems restricted elective):

- CSC 6605    Machine Learning Production Systems
- ‡ CSC 6607    LLMs in Production
- † CSC 6608    ML on Embedded Systems

### Electives

Need a total of 6–8 credits

- BME 5210    Medical Imaging Systems
- BUS 5900    AI Tools for Organizational Efficiency and Success
- BUS 6141    Analytics Leadership and Strategy
- CSC 5120    Software Development for Machine Learning
- CSC 5601    Theory of Machine Learning
- CSC 5611    Deep Learning
- † CSC 5616    ML for Signal Processing Applications
- CSC 5661    Reinforcement Learning
- CSC 6605    Machine Learning Production Systems
- ‡ CSC 6607    LLMs in Production
- † CSC 6608    ML on Embedded Systems
- CSC 6711    Recommendation Systems
- CSC 6712    Distributed Storage Systems
- ‡ CSC 6714    Large Language Models
- CSC 7901    Machine Learning Capstone
- EGR 6110    PDEs and Numerical Methods

Other courses as approved by the program director.

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\* Denotes course for Applied Machine Learning Graduate Certificate

◦ Denotes course for Machine Learning Engineering Graduate Certificate

† Denotes course for Tiny Machine Learning Graduate Certificate

‡ Denotes course for Generative AI Production Systems Graduate Certificate

Notes: CSC 5201 may be substituted with an elective for students with recent relevant course credit or industry experience; MTH 5810 may be substituted with an elective for students who have taken multivariable calculus and linear algebra.

## GENERAL INTEREST CERTIFICATES

The general interest graduate certificates are geared toward students who may not be ready to start the full Master of Science in Machine Learning. Each one helps you stand out to employers and highlights your AI knowledge and skills.

### Graduate Certificate in Applied Machine Learning

The Graduate Certificate in Applied Machine Learning builds on your existing software development and engineering skills and your valuable professional experience. It provides an accelerated, in-depth introduction to machine learning concepts and theory using practical, hands-on exercises.

#### Program Outcome

- Analyze complex problems involving advanced applications of machine learning and data science.
- Design solutions that meet relevant business and technical standards.
- Apply a rigorous, scientific approach to make informed judgements.
- Employ state-of-the-art AI tools in the design and implementation of projects.
- Effectively describe solutions and their implications and communicate results to technical and non-technical audiences.

#### Required Courses

##### CSC 5610

AI Tools and Paradigms

##### CSC 6621

Applied Machine Learning

“The depth of analytical knowledge I gained from the program gives me the context for continued independent learning. Now, I know how to ask the right questions.”

—Max M., Graduate Certificate in Applied Machine Learning '22

## Graduate Certificate in Advanced Business Strategy Using AI and Analytics

The Graduate Certificate in Advanced Business Strategy Using AI and Analytics is for seasoned business leaders looking to take their organizations to new heights by using data-driven decision making. A bachelor's degree and three years of experience in your field are required to enroll in this program where you will elevate your skills to the next level with the transformative potential of AI and analytics.

MSOE's Rader School of Business offers business leaders the ability to unleash the power of data-driven decision making. Designed for those who don't necessarily have a technical background, this graduate certificate builds on existing business acumen.



### Program Outcomes

- Use data visualization techniques to gain insight into the meaning of the data
- Leverage analytics as a strategic asset
- Evaluate ethical dilemmas that arise within analytics
- Create an analytics strategy aligned with organizational goals
- Develop a framework for analytics-enabled decision making

### Program Delivery

All classes are delivered in an asynchronous online format. The certificate is comprised of three 3-credit courses that can be completed in 6 months of part-time study to accommodate working professionals.

### Required Courses

#### **BUS 6121**

Data Wrangling and Exploration

#### **BUS 6131**

Predictive Analytics

#### **BUS 6141**

Analytics Leadership and Strategy

Scan to learn more.



## ACCESS TO THE EXPERTS

Learn directly from full-time MSOE faculty members—no TA intermediaries here. MSOE faculty have years of teaching and industry experience and are experts in machine learning. They've worked for companies like Red Hat, AdRoll and NVIDIA. Get direct feedback through interactive, synchronous courses and flexible office hours.

### **Dr. RJ Nowling**

Machine Learning Graduate Programs Director  
Associate Professor

### **Dr. Jeremy Kedziora**

PieperPower Endowed Chair in Artificial Intelligence  
Associate Professor

### **Dr. Sebastian Berisha**

Associate Professor

### **Dr. John Bukowy**


Associate Professor

### **Dr. Jonathon Flynn**

Assistant Professor

### **Dr. Josiah Yoder**

Associate Professor



Learn more about our Machine Learning graduate programs at [msoe.edu/ai-and-msoe](https://msoe.edu/ai-and-msoe). Contact us at (800) 321-6763 or [grad@msoe.edu](mailto:grad@msoe.edu).



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