ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

What Are Artificial Intelligence and Machine Learning?

Artificial Intelligence (AI) is software that allows computers to simulate human reasoning, learning, and problem solving. (source) Machine Learning (ML) is a type of AI that gives a computer the ability to identify patterns to make predictions and decisions without human assistance. (source) ML uses mathematical models of data to help a computer learn without direct instruction. Many consumer products and services, such as autonomous vacuums, navigation apps, and voice-controlled intelligent personal assistants rely on AI. STEM technicians in a variety of fields use AI and ML enabled equipment and processes, from exoskeletons boosting productivity in automotive plants to sensors that detect plant diseases or weeds and decide which chemicals should be applied in precision agriculture.

Vocabulary

- **AI chips**—semiconductors that are designed to handle the computation-heavy algorithms necessary for AI
- **Algorithm**—a series of steps followed in a specific order to perform a task; used to generate a Machine Learning model
- **Chatbot**—provides automated speech recognition and voice synthesis and carries out realistic conversations
- **Deep Learning**—a type of Machine Learning that enables computer systems to learn new knowledge and improve their functionality through experience rather than by being programmed
- **Neural Network**—a series of algorithms that are modeled after the connections in the human brain

How will technicians use AI and ML?

Imagine that every time you got in your car, the car remembered little things like how you took a corner or how you accelerated and braked. It remembered your driving habits and tailored future journeys based on past expeditions. When some machines operate over time, they remember what happened and adjust their next actions. This is how AI and ML enable predictive maintenance.

Manufacturing Scenario

Carlos is a Surface Mount Technician for a manufacturer of small surface-mounted electronic components. Equipped with those components, a pick and place machine that puts electronic components on the motherboard of your new cell phone, for example, might remember position, acceleration and deacceleration speeds, and vacuum nozzle data during the placement. If the vacuum head of the machine is not drawing the exact amount of air to pick up a part, the machine will stop and alert Carlos about the problem through its Human Machine Interface (HMI). Carlos can then stop the process and make adjustments or repairs, but this requires down-time of the machine. In limiting down-time, predictive maintenance is key. Using ML, the pick and place machine can predict there will be a problem even before it happens and alert Carlos to perform preventive maintainence. This saves the company money by minimizing the time the machine is offline.





ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Skills Needed for a High-Paying Career

- Basic programming
- Using probability and statistics
- Modeling and evaluating data
- Coding simple algorithms
- Employing analytical thinking skills
- Computational thinking
- Applying Machine Learning algorithms

Education

Your local community college provides the advanced technology classes you will need to get started. Currently there are very few associate degree programs in AI, but many of the skills needed are taught within Information Technology or Computer Information Systems programs. You will also find the skills applicable in a variety of technical specializations, such as biomedical, energy, environmental, and engineering technologies. Community college course schedules are designed to accommodate the needs of working students and often include online and hybrid delivery formats. Find your nearest community college here.

Future Trends

The future of Artificial Intelligence and Machine Learning include:

- AI and ML models using expanded datasets
- Increased use of no-code ML
- ML technology offered through the cloud
- AI- and MI-enhanced cybersecurity
- Advanced applications using Natural Language Processing
- Emphasis on ethical and responsible AI
- Connected AI systems enabling ML algorithms to learn continuously
- AI-fueled technology advancements in transportation, healthcare, education, and customer service

Learn More

- Artificial intelligence (AI) vs. machine learning
- Can a neural network learn to recognize doodling?

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What Are Artificial Intelligence and Machine Learning?

Artificial Intelligence (AI) is the simulation of human cognitive processes: learning, reasoning and self-correction. (source) Its foundations include mathematics, logic, philosophy, probability, linguistics, neuroscience, and decision theory. Many technologies use AI, including computer vision, robotics, machine learning, and natural language processing.

Machine Learning (ML) is a subfield of artificial intelligence. Its goal is to enable computers to learn on their own. A machine's learning algorithm enables it to identify patterns in observed data, build models that explain the world, and predict things without having explicit pre-programmed rules and models. (source)

AI and ML Competencies

- Using probability and statistics
- Modeling and evaluating data
- Coding simple algorithms
- Employing analytical thinking skills
- Computational thinking
- Applying Machine Learning algorithms

Cross-disciplinary Skills

- Basic programming
- Using statistical methods
- Data analysis
- Communicating effectively with diverse audiences
- Upholding ethical computing principles

Security Technology Scenario

Tiffany, a Network Technician working with the IT security department at a small company, was assigned to automate the manual tasks involved in monitoring the hundreds of networking devices. Each of the networking devices keeps a log or text file of the status of the network devices. When a security incident occurs the network device logs the attack. Without automation, several employees have to view each network device's log to react to the attack and protect the network. Tiffany installed a Machine Learning application that not only checked each log but also automated the steps necessary to defend the network. ML can also provide predictive analytics to enable early detection and remediation of threats.

Agriculture Technology Scenario

Maelynn is an Agricultural Technician for a major soybean producer. The company is instituting a Precision Agriculture Strategic Plan to use technology to conserve resources, such as fertilizer and water, while increasing crop yields and profitability. As part of this plan, Maelynn was tasked with finding new ways to identify unhealthy plants. She partnered with a data science technician to accomplish this by using a combination of drones and AI software tools. Drones were used to take photos of the soybean fields. The photos were assembled by GPS location and evaluated for dark or unhealthy leaves. The AI tools allowed the software to pinpoint the unhealthy plants in the pictures and send that GPS information to an autonomous tractor in the field. Instead of the autonomous tractor spraying the entire field, the AI software directed the sprayer to only cover the areas where the plants were not healthy. This AI process not only saves the company money on chemicals and water but is also better for the environment.

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Activity

Students will investigate how Artificial Intelligence (AI) and Machine Learning (ML) could be used to solve problems in their field of study. To begin, they will develop a specific recommendation for how machine learning could contribute to solving one of these problems. Then, they will consider the training data an AI system would need to make this possible.

Warm-Up

Review the definitions of AI and ML. Watch the video Artificial Intelligence Explained in 2 Minutes, followed by Deep Learning to help students think about ways that AI and ML help society solve problems. Explain that today's activity will give them the opportunity to discuss this in the context of industries where technicians work.

Activity Steps

1. Tell students that they will investigate the potential of AI and ML in their field of study. Explain that the goal is to explore one problem where AI or ML technology has potential to innovate.
2. Have students work in pairs to identify a problem in their career field that might be solved using AI or ML.
3. Give students 20 minutes to conduct research on their problem.
4. When there are about 10–15 minutes left in the class period, allow each pair to share their findings.

Tools Available

- Try AutoML Google Cloud
- Scikit-Learn Machine Learning in Python
- Teachable Machine with Google

Read More

- What is Artificial Intelligence?
- An Introduction on Artificial Intelligence and Machine Learning
- Bytes of AI: Short Curriculum

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ABOUT THE PROJECT

Preparing Technicians for the Future of Work, funded by the National Science Foundation Advanced Technological Education program, recognizes that technicians need an expanded skill set to remain competitive. The project's Framework for a Cross-Disciplinary STEM Core outlines recommendations for incorporating knowledge and skills in Advanced Digital Literacy, Data Knowledge and Analysis, and Business Knowledge and Processes. Learn more about implementing the Framework at preparingtechnicians.org.