AI 900

What is AI 900?

AI 900 certification is a fundamental grade certification for data scientists to have an idea of how to apply **AI** and **Machine Learning** in their profession. Also, it also certifies you for using Azure services related to ML and Ai.

Introduction to AI

AI enables us to build amazing software that can improve health care, enable people to overcome physical disadvantages, empower smart infrastructure, create incredible entertainment experiences, and even save the planet!

What is AI?

AI is the creation of software that imitates human behaviors and capabilities.

Key workloads include:

Machine learning - This is often the foundation for an AI system, and is the way we "teach" a computer model to make prediction and draw conclusions from data.
Anomaly detection - The capability to automatically detect errors or unusual activity in a system.

> Example:
> Imagine you're creating a software system to monitor credit card transactions and detect unusual usage patterns that might indicate fraud
>
> Example:
> an application that tracks activity in an automated production line and identifies failures.
>
> Example:
> a racing car telemetry system that uses sensors to proactively warn engineers about potential mechanical failures before they happen.
>
> These kinds of scenario can be addressed by using ***anomaly detection*** - a machine learning based technique that analyzes data over time and identifies unusual changes.
> ***Note: Small Animation*** ***https://learn.microsoft.com/en-us/training/wwl-data-ai/get-started-ai-fundamentals/media/anomaly-detection.gif***
>
> *In Microsoft Azure, the **Anomaly Detector service** provides an application programming interface (API) that developers can use to create anomaly detection solutions.*

Computer vision - The capability of software to interpret the world visually through cameras, video, and images.

Computer Vision is an area of AI that deals with visual processing.
https://www.microsoft.com/en-us/videoplayer/embed/RE4vC2Q?postJsllMsg=true

Computer vision models and capabilities:
Image classification: Image classification involves training a machine learning model to classify images based on their contents. For example, in a traffic monitoring solution you might use an image classification model to classify images based on the type of vehicle they contain, such as taxis, buses, cyclists, and so on.

Object detection: Object detection machine learning models are trained to classify individual objects within an image, and identify their location with a bounding box. For example, a traffic monitoring solution might use object detection to identify the location of different classes of vehicle.

Semantic segmentation: Semantic segmentation is an advanced machine learning technique in which individual pixels in the image are classified according to the object to which they belong. For example, a traffic monitoring solution might overlay traffic images with "mask" layers to highlight different vehicles using specific colors.

Image analysis: You can create solutions that combine machine learning models with advanced image analysis techniques to extract information from images, including "tags" that could help catalog the image or even descriptive captions that summarize the scene shown in the image.

Face detection, analysis, and recognition: Face detection is a specialized form of object detection that locates human faces in an image. This can be combined with classification and facial geometry analysis techniques to recognize individuals based on their facial features.

Optical character recognition (OCR): Optical character recognition is a technique used to detect and read text in images. You can use OCR to read text in photographs (for example, road signs or store fronts) or to extract information from scanned documents such as letters, invoices, or forms.

Computer vision service in Microsoft Azure:

Computer Vision: You can use this service to analyze images and video, and extract descriptions, tags, objects, and text.
Custom Vision: Use this service to train custom image classification and object detection models using your own images.
Face: The Face service enables you to build face detection and facial recognition solutions.
Form Recognizer: Use this service to extract information from scanned forms and invoices.

Natural language processing - The capability for a computer to interpret written or spoken language, and respond in kind.

NLP enables you to create software that can:

- Analyze and interpret text in documents, email messages, and other sources.
- Interpret spoken language, and synthesize speech responses.
- Automatically translate spoken or written phrases between languages.
- Interpret commands and determine appropriate actions.

Example: Starship Commander, is a virtual reality (VR) game from Human Interact, that takes place in a science fiction world. The game uses natural language processing to enable players to control the narrative and interact with in-game characters and starship systems.

https://www.microsoft.com/en-us/videoplayer/embed/RE4vyDj?postJsllMsg=true

Natural language processing in Microsoft azure

Language: Use this service to access features for understanding and analyzing text, training language models that can understand spoken or text-based commands, and building intelligent applications.

Translator: Use this service to translate text between more than 60 languages.

Speech: Use this service to recognize and synthesize speech, and to translate spoken languages.

Azure Bot: This service provides a platform for conversational AI, the capability of a software "agent" to participate in a conversation. Developers can use the Bot Framework to create a bot and manage it with Azure Bot Service - integrating back-end services like Language, and connecting to channels for web chat, email, Microsoft Teams, and others.

Knowledge mining - The capability to extract information from large volumes of often unstructured data to create a searchable knowledge store.

Conversational AI – be able to hold a conversation with a human.

Machine Learning

Let's start by looking at a real-world example of how machine learning can be used to solve a difficult problem.

Sustainable farming techniques are essential to maximize food production while protecting a fragile environment. The Yield, an agricultural technology company based in Australia, uses sensors, data and machine learning to help farmers make informed decisions related to weather, soil and plant conditions.

How machine learning works?

today's world, we create huge volumes of data as we go about our everyday lives. From the text messages, emails, and social media posts we send to the photographs and videos we take on our phones, we

generate massive amounts of information. More data still is created by millions of sensors in our homes, cars, cities, public transport infrastructure, and factories.

Data scientists can use all of that data to train machine learning models that can make predictions and inferences based on the relationships they find in the data.

Note: Small animation ***https://learn.microsoft.com/en-us/training/wwl-data-ai/get-started-ai-fundamentals/media/machine-learn.gif***

Machine learning in Microsoft Azure

Microsoft Azure provides the Azure Machine Learning service - a cloud-based platform for **creating**, **managing**, and **publishing** machine learning models. Azure Machine Learning provides the following features and capabilities:

Automated machine learning: This feature enables non-experts to quickly create an effective machine learning model from data.

Azure Machine Learning designer: A graphical interface enabling no-code development of machine learning solutions.

Data and compute management: Cloud-based data storage and compute resources that professional data scientists can use to run data experiment code at scale.

Pipelines: Data scientists, software engineers, and IT operations professionals can define pipelines to orchestrate model training, deployment, and management tasks.

What is datasets?

A data set is a logical grouping of units of data that are closely related and share the same data structure.

Example: MNIST database (Images of handwriting digits used to test classification, clustering and image processing algorithm)

What is Labeling?

The processing of identifying raw data (Images, text files, videos, etc.) and adding one or more meaningful and informative label to provide context so that a machine learning model can learn.

Supervised Learning: Data that has been labeled for training

Task driven – make a prediction

When the labels are known and you want a precise outcome.

When you need a specific value returned.

Example: Classification, Regression

Unsupervised Learning**:** Data has been labeled; the ML model needs to do its own labeling.

When the labels are not and the outcomes does not need to be precise.

When you're trying to make sense of data.

Example: Clustering, Dimensionality Reduction, Association.

Reinforcement Learning**:** There is no data, there is an environment and an ML model grnerates data any many attempts to reach a goal decisions-driven.

Neural Network and Deep Learning

What are Neural Networks?

A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.

Neural networks reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning.

What is Deep Learning?

A neural network that has 3 or more hidden layers is considered deep learning.

What is Feed Forward?

Neural Networks where connections between nodes do not form a cycle .

What is Backpropagation?

Moves backwards through the neural network adjusting weights to improve outcomes on next iteration thus is how a neural net learns.

Loss Function?

A function that compares the ground truth to the prediction to determine the error rate (how bad the network performance)

Activation Functions?

An algorithm applied to a hidden layer node that affects connected output.

Dense: When the next layer increases the number of nodes.

Sparse: When the next layer decreases the number of nodes.

What is a GPU?

A General processing unit (GPU) that is specially designed to quickly render high-resolution images and video concurrently.

Challenges and risks with AI

AI is a powerful tool that can be used to greatly benefit the world.

Challenges or Risk

- Bias can affect results
- Errors may cause harm
- Data could be exposed
- Solutions may not work for everyone
- Users must trust a complex system
- Who's liable for AI-driven decisions?

Understanding Responsible AI

Fairness:

Machine learning model to support a loan approval application for a bank. The model should predict whether the loan should be approved or denied without bias. This bias could be based on gender, or ethnicity.

Microsoft's implementation of **Responsible AI with Face service,** which retires facial recognition capabilities that can be used to try to infer emotional states and identity attributes. These capabilities, if misused, can subject people to stereotyping, discrimination or unfair denial of services.

Reliability and Safety

consider an AI-based software system for an autonomous vehicle; or a machine learning model that diagnoses patient symptoms and recommends prescriptions. Unreliability in these kinds of systems can result in substantial risk to human life.

AI-based software application development must be subjected to rigorous testing and deployment management processes to ensure that they work as expected before release.

Privacy and security:

AI systems should be secure and respect privacy. The machine learning models on which AI systems are based rely on large volumes of data, which may contain personal details that must be kept private. Even after the models are trained and the system is in production, privacy and security need to be considered. As the system uses new data to make predictions or take action, both the data and decisions made from the data may be subject to privacy or security concerns.

Inclusiveness:

AI systems should empower everyone and engage people. AI should bring benefits to all parts of society, regardless of physical ability, gender, sexual orientation, ethnicity, or other factors.

Transparency:

AI systems should be understandable. Users should be made fully aware of the purpose of the system, how it works, and what limitations may be expected.

Summary:

Artificial Intelligence enables the creation of powerful solutions to many kinds of problems. AI systems can exhibit human characteristics to analyze the world around them, make predictions or inferences, and act on them in ways that we could only imagine a short time ago.

With this power, comes responsibility. As developers of AI solutions, we must apply principles that ensure that everyone benefits from AI without disadvantaging any individual or section of society.

Create a regression model with Azure

What is machine learning?

Machine learning is a technique that uses mathematics and statistics to create a model that can predict unknown values.

Types of machine Learning

There are two general approaches to machine learning, supervised and unsupervised machine learning. In both approaches you train a model to make predictions.

What is Azure Machine Learning studio?

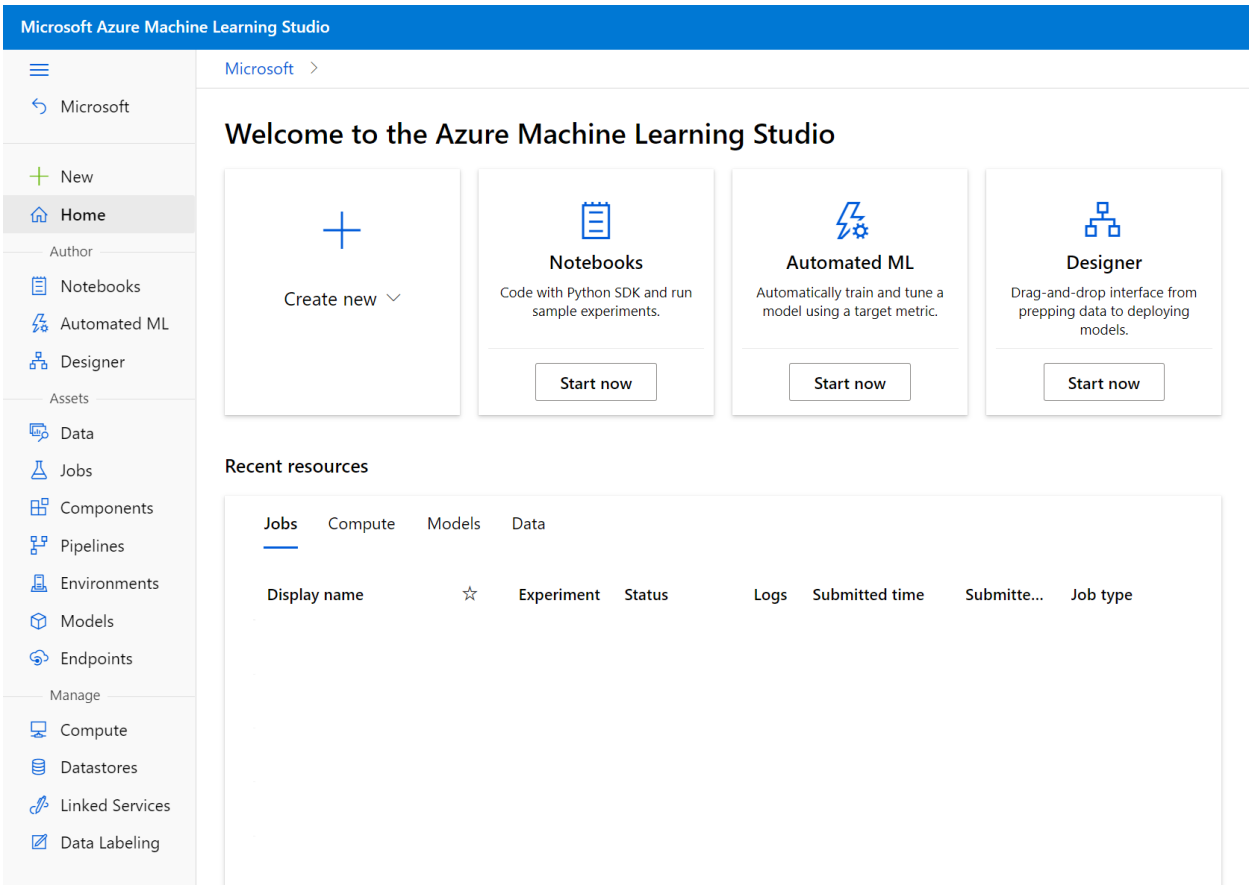
Training and deploying an effective machine learning model involves a lot of work, much of it time-consuming and resource-intensive. Azure Machine Learning is a cloud-based service that helps simplify some of the tasks it takes to prepare data, train a model, and deploy a predictive service.

Most importantly, Azure Machine Learning helps data scientists increase their efficiency by automating many of the time-consuming tasks associated with training models; and it enables them to use cloud-based compute resources that scale effectively to handle large volumes of data while incurring costs only when actually used.

Azure Machine Learning studio

Azure Machine Learning studio is a web portal for machine learning solutions in Azure. It includes a wide range of features and capabilities that help data scientists prepare data, train models, publish predictive services, and monitor their usage.

To begin using the web portal, you need to assign the workspace you created in the Azure portal to Azure Machine Learning studio.



Azure Machine Learning compute

At its core, Azure Machine Learning is a service for training and managing machine learning models, for which you need compute on which to run the training process.

Compute targets are cloud-based resources on which you can run model training and data exploration processes.

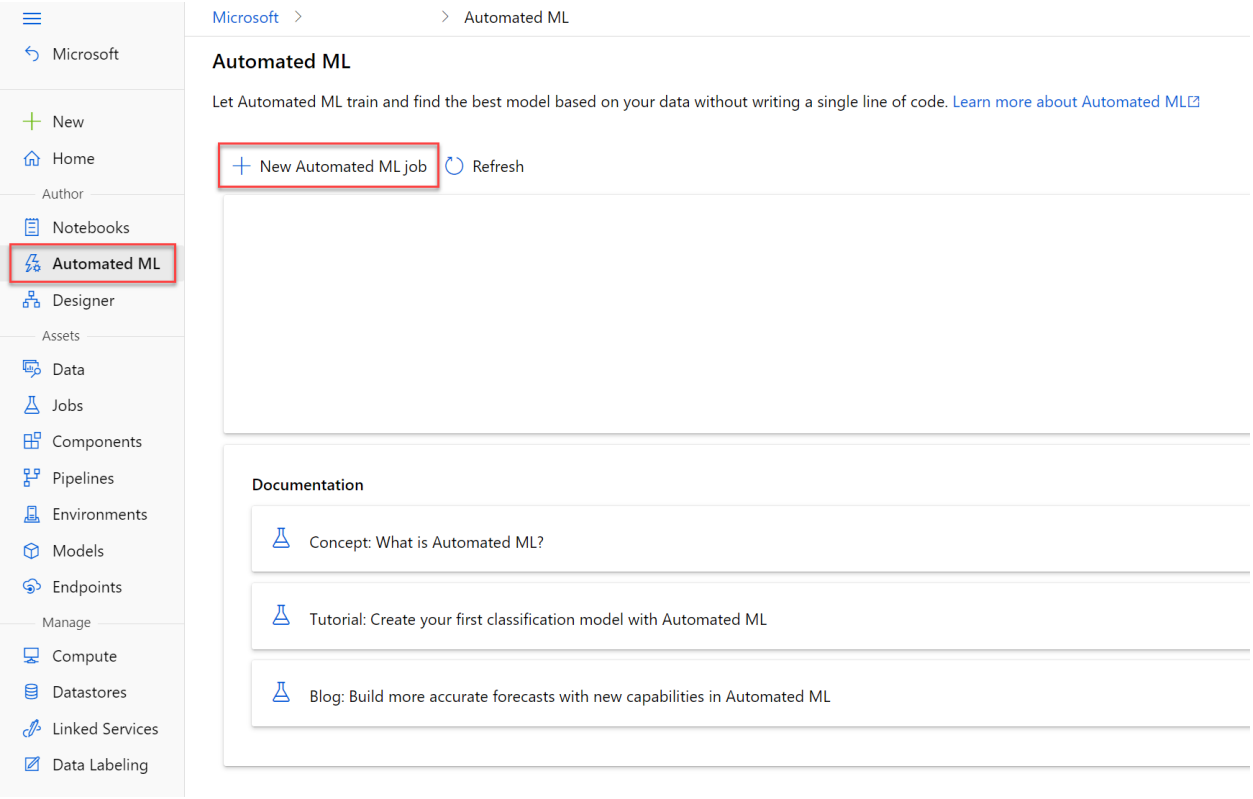
There are four kinds of compute resource you can create:

- Compute Instances: Development workstations that data scientists can use to work with data and models.
- **Compute Clusters**: Scalable clusters of virtual machines for on-demand processing of experiment code.
- **Inference Clusters**: Deployment targets for predictive services that use your trained models.
- **Attached Compute**: Links to existing Azure compute resources, such as Virtual Machines or Azure Databricks clusters.

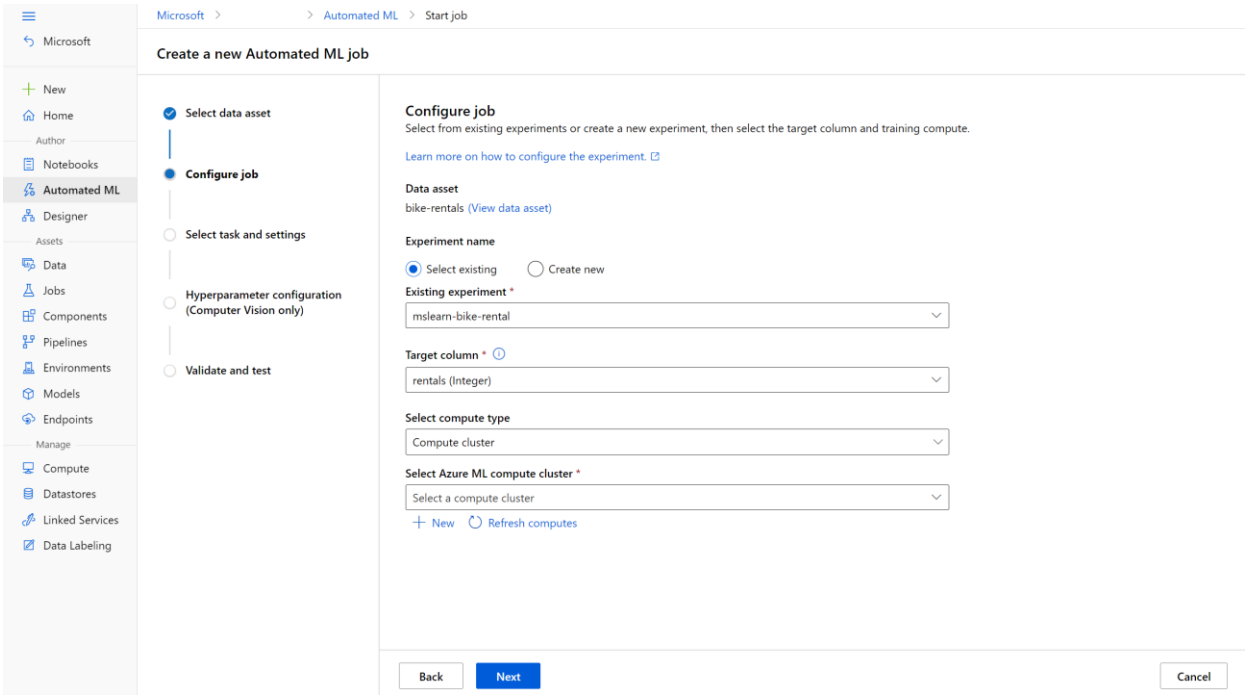
What is Azure Automated Machine Learning?

Azure Machine Learning includes an automated machine learning capability that automatically tries multiple pre-processing techniques and model-training algorithms in parallel. These automated capabilities use the power of cloud compute to find the best performing supervised machine learning model for your data.

Automated machine learning allows you to train models without extensive data science or programming knowledge. For people with a data science and programming background, it provides a way to save time and resources by automating algorithm selection and hyperparameter tuning.



In Azure Machine Learning, operations that you run are called jobs. You can configure multiple settings for your job before starting an automated machine learning run. The run configuration provides the information needed to specify your training script, compute target, and Azure ML environment in your run configuration and run a training job.



Understand the AutoML process

You can think of the steps in a machine learning process as:

1. Prepare data
2. Train model
3. Evaluate performance
4. Deploy a predictive service

Create a regression model with Azure Machine Learning designer

Identify regression machine learning scenarios

Regression is a form of machine learning used to understand the relationships between variables to predict a desired outcome. Regression predicts a numeric label or outcome based on variables, or features.

Regression is an example of a supervised machine learning technique in which you train a model using data that includes both the features and known values for the label, so that the model learns to fit the feature combinations to the label. Then, after training has been completed, you can use the trained model to predict labels for new items for which the label is unknown.

What is Azure Machine Learning?

Training and deploying an effective machine learning model involves a lot of work, much of it time-consuming and resource-intensive. Azure Machine Learning is a cloud-based service that helps simplify some of the tasks it takes to prepare data, train a model, and deploy a predictive service. Regression machine learning models can be built using Azure Machine Learning.

What is Azure Machine Learning designer?

In Azure Machine Learning studio, there are several ways to author regression machine learning models. One way is to use a visual interface called designer that you can use to train, test, and deploy machine learning models. The drag-and-drop interface makes use of clearly defined inputs and outputs that can be shared, reused, and version controlled.

Pipelines:

Pipelines let you organize, manage, and reuse complex machine learning workflows across projects and users.

Components:

An Azure Machine Learning component encapsulates one step in a machine learning pipeline.

Datasets:

You can create data assets on the Data page from local files, a datastore, web files, and Open Datasets. These data assets will appear along with standard sample datasets in designer's Asset Library.

Azure Machine Learning Jobs

An Azure Machine Learning (ML) job executes a task against a specified compute target. Jobs enable systematic tracking for your machine learning experimentation and workflows. Once a job is created, Azure ML maintains a run record for the job. All of your jobs' run records can be viewed in Azure ML studio.

- Mean Absolute Error (MAE): The average difference between predicted values and true values. This value is based on the same units as the label, in this case dollars. The lower this value is, the better the model is predicting.
- Root Mean Squared Error (RMSE): The square root of the mean squared difference between predicted and true values. The result is a metric based on the same unit as the label (dollars). When compared to the MAE (above), a larger difference indicates greater variance in the individual errors (for example, with some errors being very small, while others are large).
- Relative Squared Error (RSE): A relative metric between 0 and 1 based on the square of the differences between predicted and true values. The closer to 0 this metric is, the better the model is performing. Because this metric is relative, it can be used to compare models where the labels are in different units.
- Relative Absolute Error (RAE): A relative metric between 0 and 1 based on the absolute differences between predicted and true values. The closer to 0 this metric is, the better the model is performing. Like RSE, this metric can be used to compare models where the labels are in different units.
- Coefficient of Determination (R2): This metric is more commonly referred to as R-Squared, and summarizes how much of the variance between predicted and true values is explained by the model. The closer to 1 this value is, the better the model is performing.

Create a clustering model with Azure Machine Learning designer

Clustering is an unsupervised machine learning technique used to group similar entities based on their features. Learn how to create clustering models using Azure Machine Learning designer.