

Microsoft Azure AI Fundamentals

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What is Artificial Intelligence (AI)?

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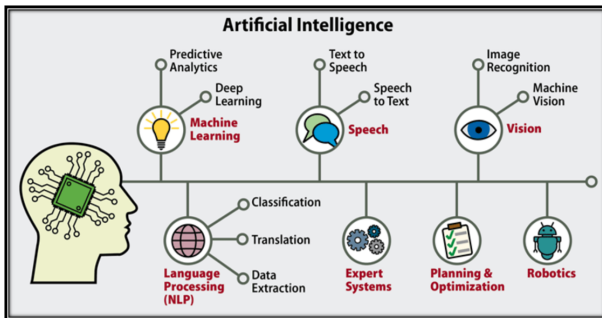


Figure: Components/workloads of AI (Credit)

Key Workloads of AI

- **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.

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

What is Machine Learning (ML)?

- 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. (Microsoft)
- What can we do with ML?
 - Sustainable farming technique to help farmer take informed decisions
 - Healthcare and Medical diagnosis e.g., heart disease prediction and corrective measures
 - Commute prediction : predicting traffic in google map
 - Product recommendation : recommendation of movies in netflix, recommendation of products in Flipkart, Amazon and other online retailers

How does ML work?

- Let's consider you want to teach computer (ML model) to recognize names of different animals from their photos.

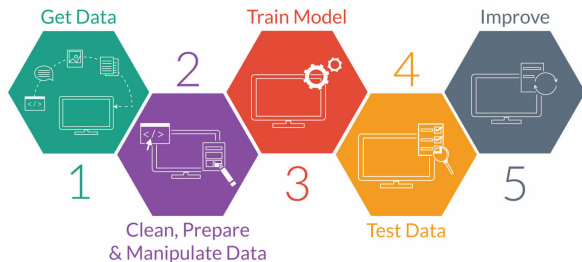


Figure: Workflow of Machine Learning (Credit)

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.
- **Automated machine learning** : 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 Anomaly Detection?

- Anomaly Detection : a machine learning based technique that analyzes data over time and identifies unusual changes. (Microsoft)
- What can we do with it?
 - Software to track credit card transaction and detect fraud by identifying unusual transaction
 - Application to track activities in an automated production line and identify failures
 - A telemetry system to monitor condition of a racing car and predict its failure
- **Anomaly Detection Service** in Microsoft Azure provides an Application Programming Interface (API) that developers can use to create anomaly detection solutions.

How does Anomaly Detection Work?



Figure: Predicting failures in racing car components (Credit)

- Sensors in the car collect telemetry, such as engine revolutions, brake temperature, and so on.
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- If a measurement occurs outside of the normal expected range, the model reports an anomaly that can be used to alert the race engineer to call the driver in for a pit stop to fix the issue before it forces retirement from the race.

What is Computer Vision?

- Computer Vision is an area of AI that deals with visual processing. Let's explore some of the possibilities that computer vision brings.
- The Seeing AI app is a great example of the power of computer vision. Designed for the blind and low vision community, the Seeing AI app harnesses the power of AI to open up the visual world and describe nearby people, text and objects.
- (Animation of Seeing AI App)
- **Computer Vision Models and Capabilities** : Most computer vision solutions are based on machine learning models that can be applied to visual input from cameras, videos, or images. Let's see some common computer vision task.

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.



Figure: Image Classification

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.

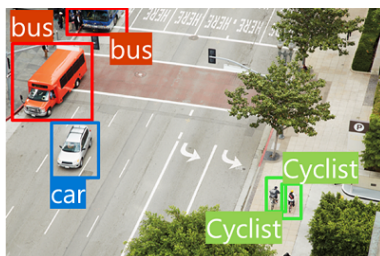


Figure: Object Detection

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.

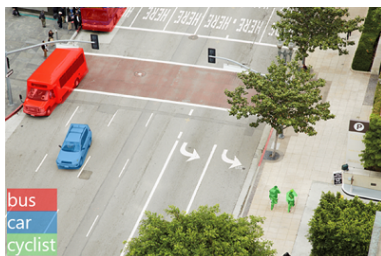


Figure: Semantic Segmentation

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.



Figure: Image Analysis

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.



Figure: Face Detection, Analysis and Recognition

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.



Figure: Optical Character Recognition

Computer Vision Services in Microsoft Azure

- Microsoft Azure provides the following cognitive services to help you create computer vision solutions:
- **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.

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- For 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.

NLP Services in Microsoft Azure

- In Microsoft Azure, you can use the following cognitive services to build natural language processing solutions:
- **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.

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- **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.

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- **Knowledge Mining in Microsoft Azure :**
 - One of these knowledge mining solutions is **Azure Cognitive Search**, a private, enterprise, search solution that has tools for building indexes. The indexes can then be used for internal only use, or to enable searchable content on public facing internet assets.
 - **Azure Cognitive Search** can utilize the built-in AI capabilities of Azure Cognitive Services such as image processing, content extraction, and natural language processing to perform knowledge mining of documents. The product's AI capabilities makes it possible to index previously unsearchable documents and to extract and surface insights from large amounts of data quickly.

Challenges and Risks with AI

- Artificial Intelligence is a powerful tool that can be used to greatly benefit the world. However, like any tool, it must be used responsibly.
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- **Who's liable for AI-driven decision** : An innocent person is convicted of a crime based on evidence from facial recognition – who's responsible?

Understanding Responsible AI

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- **Accountability** : People should be accountable for AI systems. Designers and developers of AI-based solutions should work within a framework of governance and organizational principles that ensure the solution meets ethical and legal standards that are clearly defined.

Knowledge Check

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- A predictive app provides audio output for visually impaired users. Which principle of Responsible AI is reflected here?
 - Transparency
 - Inclusiveness
 - Fairness

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.

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Summary

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.

- All the materials are taken from the Course : Microsoft Azure AI Fundamentals: Get started with Artificial Intelligence with little or no modification.
- This slide has been prepared to demonstrate various concept in the class.
- For detailed material and related course refer to this [Link](#).