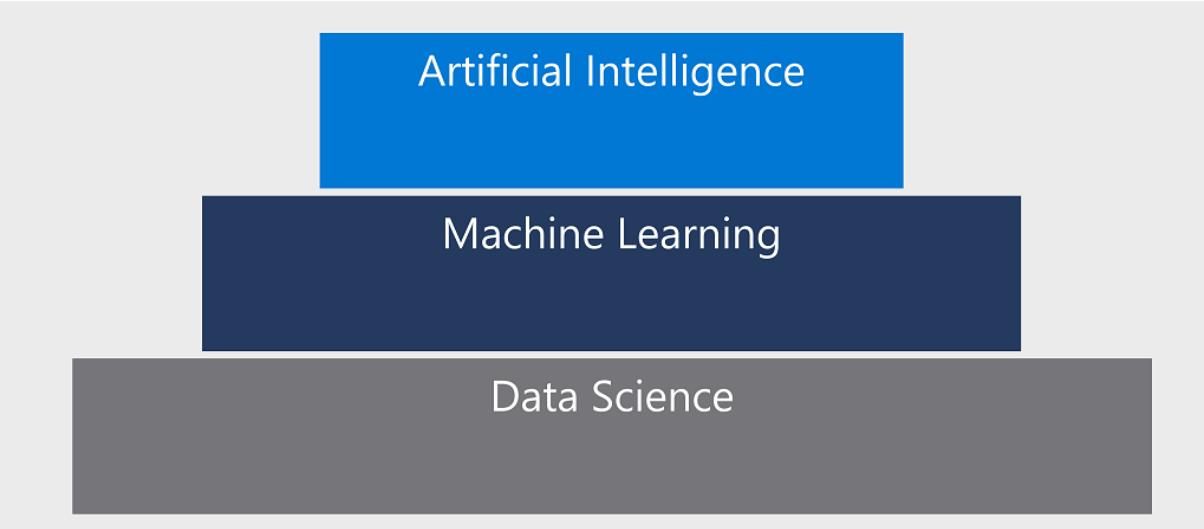
Define Artificial Intelligence

There are many definitions; some technical, some philosophical; but in general terms, we tend to think of AI as software that exhibits one or more human-like capabilities

- Visual perception
  - The ability to use computer vision capabilities to accept, interpret, and process input from images, video streams, and live cameras.
- Text analysis
  - The ability to use natural language processing (NLP) to not only "read", but also extract semantic meaning from text-based data.
- Speech
  - The ability to recognize speech as input and synthesize spoken output. The combination of speech capabilities together with the ability to apply NLP analysis of text enables a form of human-compute interaction that's become known as conversational AI, in which users can interact with AI agents (usually referred to as bots) in much the same way they would with another human.
- Decision making
  - The ability to use past experience and learned correlations to assess situations and take appropriate actions. For example, recognizing anomalies in sensor readings and taking automated action to prevent failure or system damage.

Understand AI-related Terms



- Data Science
  - Data science is a discipline that focuses on the processing and analysis of data; applying statistical techniques to uncover and visualize relationships and patterns in the data, and defining experimental models that help explore those patterns.
  - Example

        - A data scientist might gather samples of data about the population of an endangered species in a geographical area, and combine it with data about levels of industrialization and economic demographics in the same area.
        - The data can then be analyzed, using statistical techniques to extrapolate from the samples to understand trends and relationships between human activities and wildlife, and test hypotheses using models that show the likely impact of human activity on the wildlife population.
        - By doing so, the data scientists may help determine optimal policies that balance the need for economic wellbeing for the human population with the need for conservation of endangered wildlife.
- Deep Learning
    - Machine that have an artificial neural network inspired by human brain to solve complex problems
- Machine Learning
    - Key Foundation for AI
    - Machines that get better at task without explicit programming.
    - Machine learning is a subset of data science that deals with the training and validation of predictive models. Typically, a data scientist prepares the data and then uses it to train a model based on an algorithm that exploits the relationships between the features in the data to predict values for unknown labels.
    - Example
        - A data scientist might use the data they have collected to train a model that predicts the annual growth or decline in population of a species based on factors such as the number of nesting sites observed, the area of land designated as protected, the human population in the local area, the daily volume of traffic on local roads, and so on. T
        - his predictive model can then be used as a tool to evaluate plans for housing, infrastructure, and industrial development in the local area and assess their likely impact on the local wildlife.
    - Data Sets
        - A data set is a logical group units of data that are closely related and/or share the same data structure
            - They are publicly available data sets that are used in the learning of statics,data analytics & ML
            - A dataset which contains many common image using a json file (COCO) format, that identify objects or segments with in the image
    - Data Labeling
        - The Process of identifying the raw data(Images, text files,videos etc) and adding one or more meaningful and adding informative labels to provide context
            - Supervised ML
                - This are classical ML, because they are heavily rely on math's and statistics to produce the outcome
                - Each piece of data will generally be labeled by a human.
                - Task Driven- Make a prediction.
                - When labels are known and you want precise outcome, when you need a specific returned.
                    - Classification

        - Regression
    - UnSupervised ML
        - Lables will be produced by the machine learning and may not be the human readable.
        - Data Driven – recognize a structure or pattern.
        - When the labels are not known and the outcome does not need to be precise
            - Clustering
            - Association
            - Dimensionality Reduction
    - Reinforcement Learning (RI)
        - Decisions Driven
        - There is no data, there is an environment, and an ML Model generates data any many attempt to reach a goal
            - Game AI
            - Robot Navigation
            - Learning Tasks

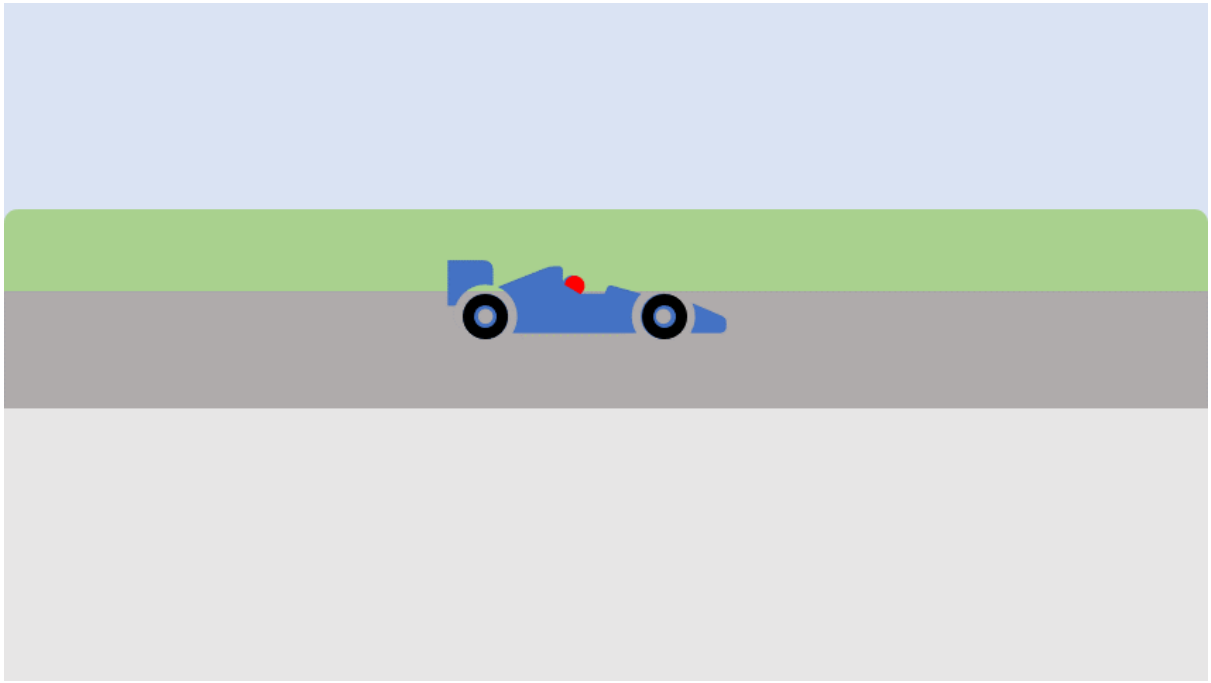
- Artificial Intelligence
    - Artificial intelligence usually (but not always) builds on machine learning to create software that emulates one or more characteristics of human intelligence.
    - Example
        - Balancing the need for wildlife conservation against economic development requires accurate monitoring of the population of the endangered species being protected.
        - It may not be feasible to rely on human experts who can positively identify the animal in question, or to monitor a large area over a sufficient period of time to get an accurate count.
        - Indeed, the presence of human observers may deter animals and prevent their detection. In this case, a predictive model could be trained to analyze image data taken by motion-activated cameras in remote locations and predict whether a photograph contains a sighting of the animal.
        - The model could then be used in a software application that responds to automated identification of animals to track animal sightings across a large geographical area, identifying areas with dense animal populations that may be candidates for protected status.

Example-1

suppose an environmental conservation organization wants volunteers to identify and catalog different species of wildflower using a phone app. The following animation shows how machine learning can be used to enable this scenario.

Example-2

Let's explore how anomaly detection might help in the racing car scenario.

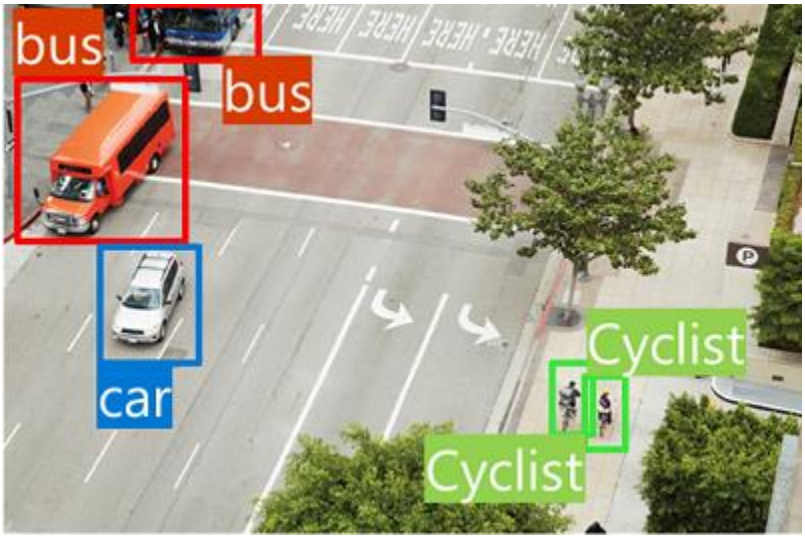


Example-3

Image Classification

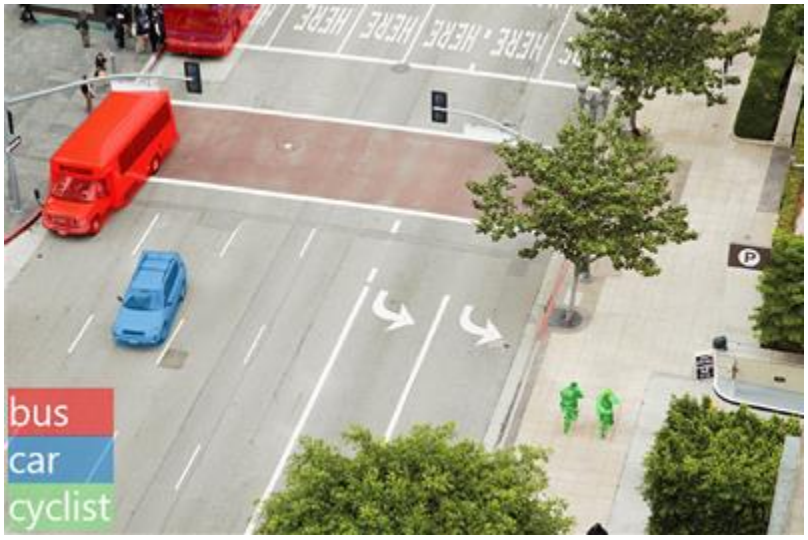
Example-4

Object detection



Example-5

Semantic segmentation

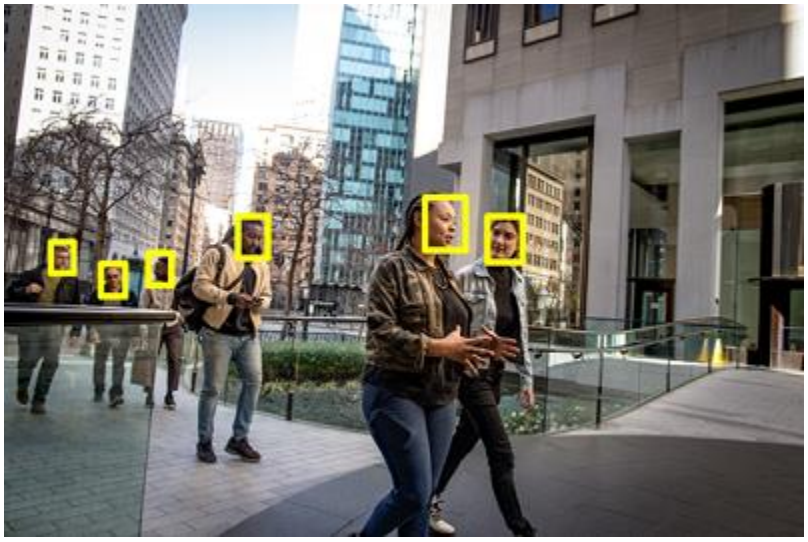


Example-6

Image analysis

Example-7

Face detection, analysis, and recognition



Example-8

Optical character recognition (OCR)

Example 9

Automate ML- Bike Rental

https://microsoftlearning.github.io/mslearn-ai-fundamentals/Instructions/Labs/01-machine-learning.html

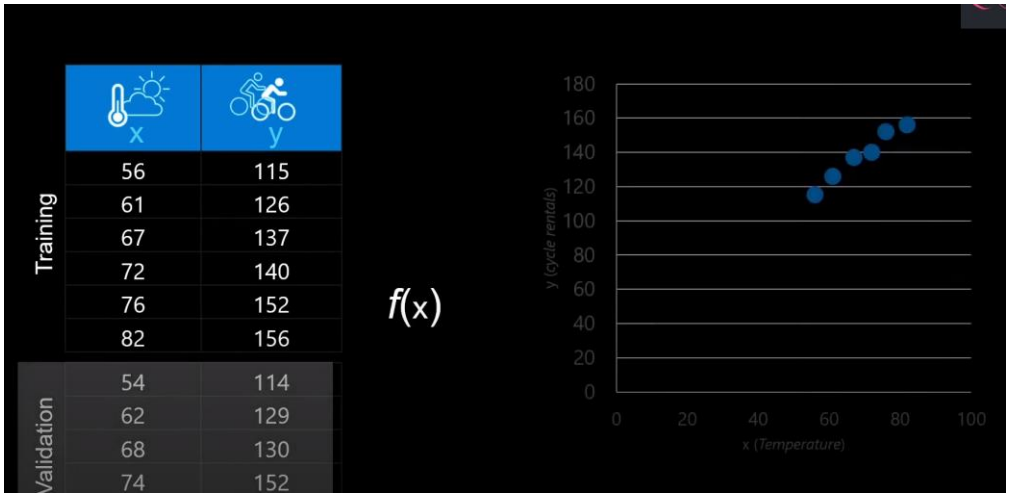
Here

X = Temperature

Y= Number of Rentals

f(x)=Y

Now Apply the Regression, to find out the prediction



here is the general formula for a linear regression line:

f(x) = mx+b;

here m is slope

b is the y-intercept of the line

m = (y2 - y1) / (x2 - x1)

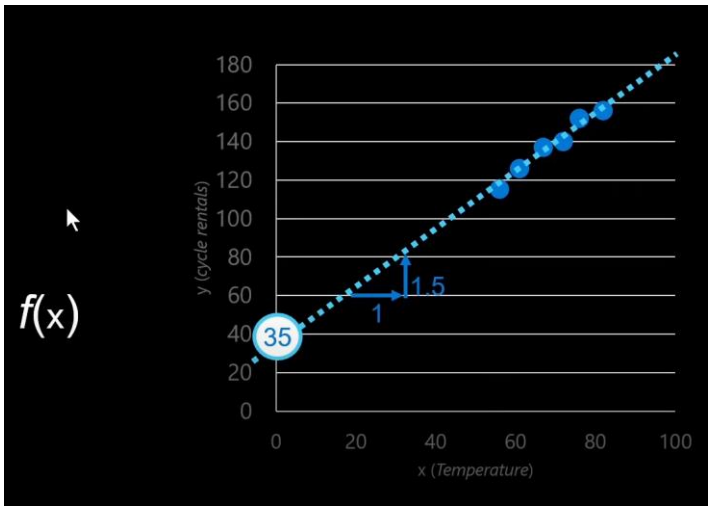
(0,20) (35,60)

64-35/20-0 = 1.45

35+ 1.45(x)

35+ 1.45(54

102.5



https://raw.githubusercontent.com/MicrosoftLearning/mslearn-ai-fundamentals/main/data/ml/daily-bike-share.csv

Deep Learning

1. Neural Networks (NN)
    a. Often described as mimicking the human brain, a neuron/node represents an algorithm. Data is inputted into a neuron and based on the output the data will be passed to one of many other connected neurals
    b. The connection between neurons is weighted.
    c. The networks is organized in layers
    d. Deep Learning
        i. There will be a input layer, 1 to many hidden layers and an output layer
    e. Feed Forward (FNN)
        i. NN where connections between nodes do not form a cycle (always move forward)
    f. Backpropagation (BP)
        i. Moves backwards through the NN adjusting weights to improve outcome on next iteration, this how a neural networks learn
    g. Loss function
        i. A function that compares the ground truth to the prediction to determine the error rate (how bad the networks performed)
    h. Activated Functions
        i. An algorithm applied to a hidden layer node that affects connected output

Understand AI considerations for AI Engineers

Software engineers can take advantage of these services to create applications and agents that use the underlying AI functionality, using them as building blocks to create intelligent solutions.

This means that software engineers can apply their existing skills in programming, testing, working with source control systems, and packaging applications for deployment, without having to become data scientists or machine learning experts.

The fully capitalize on the opportunities of AI, software engineers do require at least a conceptual understanding of core AI and machine learning principles.

- Model training and inferencing
- Probability and confidence scores
- Responsible AI and ethics
    - Fairness
    - Reliability and safety

- Privacy and security
- Inclusiveness
- 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.
        - For example, when an AI system is based on a machine learning model, you should generally make users aware of factors that may affect the accuracy of its predictions, such as the number of cases used to train the model, or the specific features that have the most influence over its predictions. You should also share information about the confidence score for predictions.
        - When an AI application relies on personal data, such as a facial recognition system that takes images of people to recognize them; you should make it clear to the user how their data is used and retained, and who has access to it.
- Accountability

Challenge or Risk	**Example**
Bias can affect results	A loan-approval model discriminates by gender due to bias in the data with which it was trained
Errors may cause harm	An autonomous vehicle experiences a system failure and causes a collision
Data could be exposed	A medical diagnostic bot is trained using sensitive patient data, which is stored insecurely
Solutions may not work for everyone	A home automation assistant provides no audio output for visually impaired users
Users must trust a complex system	An AI-based financial tool makes investment recommendations - what are they based on?
Who's liable for AI-driven decisions?	An innocent person is convicted of a crime based on evidence from facial recognition – who's responsible?

Natural Language Processing (NLP)

Natural language processing (NLP) is the area of AI that deals with creating software that understands written and spoken language.

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.

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.