# ABOUT AI

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

**How does AI work?**

As the hype around AI has accelerated, vendors have been scrambling to promote how their products and services use AI. Often what they refer to as AI is simply one component of AI, such as machine learning. AI requires a foundation of specialized hardware and software for writing and training machine learning algorithms. No one programming language is synonymous with AI, but a few, including Python, R and Java, are popular.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. In this way, a chatbot that is fed examples of text chats can learn to produce lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples.

AI programming focuses on three cognitive skills: learning, reasoning and self-correction.

**Learning processes.** This aspect of AI programming focuses on acquiring data and creating rules for how to turn the data into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task.

Within artificial intelligence (AI) and machine learning, there are two basic approaches: supervised learning and unsupervised learning. The main difference is one uses labeled data to help predict outcomes, while the

other does not. However, there are some nuances between the two approaches, and key areas in which one outperforms the other. This post will clarify the differences so you can choose the best approach for your situation.

**What is supervised learning?**

Supervised learning is a machine learning approach that's defined by its use of labeled datasets. These datasets are designed to train or "supervise" algorithms into classifying data or predicting outcomes accurately. Using labeled inputs and outputs, the model can measure its accuracy and learn over time.

Supervised learning can be separated into two types of problems when data mining: classification and regression:

- **Classification** problems use an algorithm to accurately assign test data into specific categories, such as separating apples from oranges. Or, in the real world, supervised learning algorithms can be used to classify spam in a separate folder from your inbox. Linear classifiers, support vector machines, decision trees and random forest are all common types of classification algorithms.
- **Regression** is another type of supervised learning method that uses an algorithm to understand the relationship between dependent and independent variables. Regression models are helpful for predicting numerical values based on different data points, such as sales revenue projections for a given business. Some popular regression algorithms are linear regression, logistic regression and polynomial regression.

**What is unsupervised learning?**

Unsupervised learning uses machine learning algorithms to analyze and cluster unlabeled data sets. These algorithms discover hidden patterns in data without the need for human intervention (hence, they are "unsupervised").

Unsupervised learning models are used for three main tasks: clustering, association and dimensionality reduction:

- **Clustering** is a data mining technique for grouping unlabeled data based on their similarities or differences. For example, K-means clustering algorithms assign similar data points into groups, where the K value represents the size of the grouping and granularity. This technique is helpful for market segmentation, image compression, etc.
- **Association** is another type of unsupervised learning method that uses different rules to find relationships between variables in a given dataset. These methods are frequently used for market basket analysis and recommendation engines, along the lines of "Customers Who Bought This Item Also Bought" recommendations.
- **Dimensionality reduction** is a learning technique used when the number of features (or dimensions) in a given dataset is too high. It reduces the number of data inputs to a manageable size while also preserving the data integrity. Often, this technique is used in the preprocessing data stage, such as when autoencoders remove noise from visual data to improve picture quality.

**The main difference between supervised and unsupervised learning: Labeled data**

The main distinction between the two approaches is the use of labeled datasets. To put it simply, supervised learning uses labeled input and output data, while an unsupervised learning algorithm does not.

In supervised learning, the algorithm "learns" from the training dataset by iteratively making predictions on the data and adjusting for the correct answer. While supervised learning models tend to be more accurate than unsupervised learning models, they require upfront human intervention to label the data appropriately. For example, a supervised learning model can predict how long your commute will be based on the time of day, weather conditions and so on. But first, you'll have to train it to know that rainy weather extends the driving time.

Unsupervised learning models, in contrast, work on their own to discover the inherent structure of unlabeled data. Note that they still require some human intervention for validating output variables. For example, an unsupervised learning model can identify that online shoppers often purchase groups of products at the same time. However, a data analyst would need to validate that it makes sense for a recommendation engine to group baby clothes with an order of diapers, applesauce and sippy cups.

**Other key differences between supervised and unsupervised learning**

- **Goals:** In supervised learning, the goal is to predict outcomes for new data. You know up front the type of results to expect. With an unsupervised learning algorithm, the goal is to get insights from large volumes of new data. The machine learning itself determines what is different or interesting from the dataset.
- **Applications**: Supervised learning models are ideal for spam detection, sentiment analysis, weather forecasting and pricing predictions, among other things. In contrast, unsupervised learning is a great fit for anomaly detection, recommendation engines, customer personas and medical imaging.
- **Complexity:** Supervised learning is a simple method for machine learning, typically calculated through the use of programs like R or Python. In unsupervised learning, you need powerful tools for working with large amounts of unclassified data. Unsupervised learning models are computationally complex because they need a large training set to produce intended outcomes.
- **Drawbacks**: Supervised learning models can be time-consuming to train, and the labels for input and output variables require expertise. Meanwhile, unsupervised learning methods can have wildly inaccurate results unless you have human intervention to validate the output variables.

Terms

Algorithm A formula or set of rules (or procedure, processes, or instructions) for solving a problem or for performing a task. In Artificial Intelligence, the algorithm tells the machine how to find answers to a question or solutions to a problem. In machine learning, systems use many different types of algorithms. Common examples include decision trees, clustering algorithms, classification algorithms, or regression algorithms.

Artificial Neuron An artificial neuron is a digital construct that seeks to simulate the behavior of a biological neuron in the brain. Artificial neurons are typically used to make up an artificial neural network—these technologies are modeled after human brain activity

Backpropagation Backpropagation, also called “backward propagation of errors,” is an approach that is commonly used in the training process of the deep neural network to reduce errors. It allows the machine learning algorithm to adjust itself according to looking at its past function. It involves the calculation of errors between prediction and the target values, the computation of the gradient of the error function, and then the update of the weigh

Data Data is a collection of qualitative and quantitative variables. It contains the information that is represented numerically and needs to be analyzed.

Data Cleaning Data Cleaning is the process of identifying, correcting, or removing inaccurate or corrupt data records.

Learning Learning is the process of acquiring new or modifying existing knowledge, behaviors, skills, values, or preferences. The ability to learn is possessed by humans, animals, and some machines, and there is also evidence for some kind of learning in some plants. Some learning is

immediate, induced by a single event but much skill and knowledge accumulates from repeated experiences.

Natural Language Processing Natural language processing (NLP) is a method to translate between computer and human languages. Traditionally, feeding statistics and models have been the method of choice for interpreting phrases. Recent advances in this area include voice recognition software, human language translation, information retrieval, and artificial intelligence. There is difficulty in developing human language translation software because language is constantly changing. Natural language processing is also being developed to create human readable text and to translate between one human language and another. Already existing reports associated with radiology images can be used to learn about disease and conditions and the ultimate goal of NLP is to build software that will analyze, understand, and generate human languages naturally, enabling communication with a computer as if it were a human.

Neural networks Also known as artificial neural network, neural net, deep neural net; a computer system inspired by living brains. Neural networks found to perform best in ImageNet data challenges were convolutional neural networks (CNNs). This name comes from the mathematical concept of convolution, which is similar to the CNN convolutional operation wherein filters are applied to an image in fixed spatial regions and are swept across, or integrated, over the entire image. The resulting activations can then be aggregated in pooling operations,

**Frameworks of AI**

Tensor Flow

Hailing from the Google family, Tensor Flow proves to be a robust open-source framework that supports deep learning and which can be accessed even from a mobile device.

Tensor flow is considered an apt tool for statistic program development. As it offers distributed training, machine models can be trained a lot more effectively at any level of abstraction that the user prefers.

**Features**

- A scalable multi programming interface for easy programming
- Strong growth drivers, with a strong open source community
- Provides extensive and well-documented manuals for people

**Pros**

- The language used by tensor flow is Python, which is very popular nowadays.
- This framework is capable of high computational power. Hence, it can be used on any CPU or GPU.
- Uses computational graph abstraction to create machine models

**Cons**

- To make a decision or prediction, the framework passes the input data through multiple nodes. This can be time-consuming.
- It also lacks many of the pre-trained models of AI.

Check out this Udemy course if interested in learning Tensor Flow.

Microsoft CNTK

Microsoft CNTK is a faster and more versatile open-source framework that is based on neural networks that support text, message, and voice remodeling.

It provides an efficient scaling environment due to a faster overall evaluation of the machine models while taking care of accuracy.

Microsoft CNTK has integrations with major massive datasets, making it the leading choice to be adopted by big players like Skype, Cortana, etc., with a very expressive easy-to-use architecture as well.

**Features**

- Highly optimized to provide efficiency, scalability, speed, and high-level integrations
- Has built-in components such as hyperparameter tuning, supervised learning models, reinforcement, CNN, RNN, etc.
- Resources are utilized to provide the best efficiency.
- Own networks that can be expressed efficiently such as full APIs, both high level and low level

**Pros**

- As it supports Python and C++, this framework can work with multiple servers at once and hence makes the learning process quicker.
- It has been developed keeping in mind the recent developments in the world of AI. Microsft CNTK's architecture supports GAN, RNN, and CNN.
- It permits distributed training to train machine models effectively.

**Cons**

- It lacks a visualization board and mobile ARM support.

Caffe

Caffe is a deep learning network that comes along with the preloaded set of trained neural networks. This should be your first pick if your deadline is close.

Known for its image processing capabilities, this framework also has extended support of MATLAB.

**Features**

- All of its models are written in plaintext schemas
- It offers massive speed and highly efficient work since it is already preloaded.
- An active open source community for discussion and collaborative code.

**Pros**

- Interlinking C, C++, and Python, it also supports the modeling of CNN(convolutional neural networks)
- Efficient when computing numerical tasks due to its speed.

**Cons**

- Caffe is not capable of handling complex data but is comparatively fast while handling the visual processing of images.

Theano

Using GPUs in place of CPU, this framework supports deep learning research and is capable of delivering accuracy for networks that need high computational power. For instance, the computation of multi-dimensional arrays requires high power, and Theano is capable of that.

Theano is based on python, which is a proven programming language when it comes to faster processing and response.

**Features**

- Evaluation of expressions is faster due to dynamic code generation
- It provides an excellent accuracy ratio, even when values are minimal.
- Unit testing is a significant feature of Theano, as it allows the user to self-verify their code as well as to detect and diagnose errors easily.

**Pros**

- Theano offers efficient support for all the data-intensive applications but requires combining with other libraries.
- It is efficiently optimized for the CPU as well as the GPU.

**Cons**

- There will be no more updates or addition of features to the current version of Theano.

Amazon machine learning

Being a trending entrant to the AI community, Amazon machine learning offers high-end support in the development of self-learning tools.

This framework already has existing user base in its multiple services like AWS, S3, and Amazon Redshift. This is a managed service by Amazon, with three operations performed on the model, which are data analysis, training of the model, and evaluation.

**Features**

- There are tailored Tools for every level of experience in the AWS even if you are a beginner, data scientist, or developer
- Security is of utmost importance, so all data is encrypted

- Provides extensive tools for data analysis and comprehension
- Integrations with all major datasets

**Pros**

- You don’t need to write a lot of code with this framework. Instead, it lets you interact with the AI-powered framework via APIs.
- Commonly used by data scientists, developers, and ML researchers.

**Cons**

- It lacks flexibility as the entire framework is abstracted, so if you’d like to choose a particular normalization or machine learning algorithm, you can’t.
- It also lacks data visualization.

Torch

The Torch is an open-source framework that could support numerical operations. It offers numerous algorithms for the faster development of deep learning networks.

It is used extensively in the AI labs of Facebook and Twitter. There is a python based framework known as PyTorch, which has proven to be simpler and more reliable.

**Features**

- Features a lot of routines to index, slice, transpose with an N-dimensional array model
- Optimization routines are present, primarily numeric based with neural network models
- GPU support is highly efficient
- Integrates easily with the iOS and Andriod

**Pros**

- Very high flexibility regarding languages and integrations
- High level of speed and GPU utilization efficiency
- Pre-existing models are available to train the data on.

**Cons**

- Documentation is not very clear to the users, so it presents a steeper learning curve
- Lack of code for immediate use, so it takes time.
- It is initially based on a programming language called Lua, and not many are aware of it.