MACHINE LEARNING and AI WITH PYTHON

Lesson 1   Introduction to Machine Learning and AI

These machine learning programming lessons will teach you most of the codes to solve most machine learning applications to solve Artificial Intelligence applications . Machine learning is all about applying mathematical equations to solve human thinking problems. Machine learning has not replaced the human brain yet, but new techniques in Artificial Intelligence one day, it will be possible. Machine Learning is very mathematical oriented applying statistics and advanced mathematics to solve human thinking problems. Machine learning is also very programming oriented as well. Machine Learning combines mathematics and programming together. We use the Python programming language since it is easy to use and has many readily available libraries to enable machine learning. If you do not know Python we suggest you take our Python lessons first, available on our web site or take individual lessons with one our personnel tutors on Skype. We will use the python Spyder IDE, that is bundled with Jupiter notebook. Although Jupiter note book is quite popular, but it is very difficult to use as a standalone application. Spyder allows you to have separate program files that you can store and run anywhere on your computer where as Jupiter forces to put all your files in a note book. You can download Spyder from the following link. Spyder is bundled with Jupiter notebook.

https://www.anaconda.com/distribution/

Spyder is good to use because it has all the python libraries built in to it. You do not need to waste countless hours downloading Python libraries and finding out you have so many version mismatches.
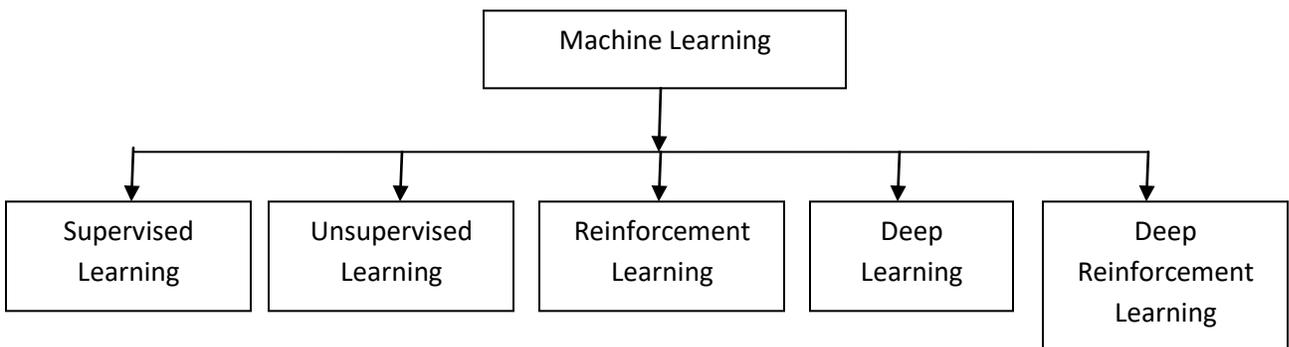
Machine learning has first started with statically analysis such as

- Regression
- Classification
- Clustering
- Probability Theories
- Decision Trees

But now has evolved to more sophisticated algorithms like neural networks that use algebraic and calculus mathematical operations. New advances in programming algorithms will depends less on mathematics and more on programming algorithms, to provide more of a natural decision making process.

TYPES OF MACHINE LEARNING

Machine Learning can be categorized into the following types:

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                          │ Machine Learning │
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   ▼           ▼                   ▼               ▼                ▼
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│Supervised│ │Unsupervised │ │Reinforcement│ │ Deep    │ │ Deep          │
│Learning  │ │Learning     │ │Learning     │ │ Learning│ │ Reinforcement │
└─────────┘ └─────────────┘ └─────────────┘ └─────────┘ │ Learning      │
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Supervised Learning

Supervised learning is used to train a machine to learn using test data. The program is "trained" on a pre-defined set of "training examples", which then facilitate its ability to reach an accurate conclusion when given new data. The test data is used to develop a relationship between x y data points. A mathematical relationship is determine from these data point. It may be a linear or non linear relation. Once a mathematical relationship is developed then the output can be predicted with real data. Techniques in supervised learning are Linear Regression, and Classification. Linear regression is used in predicting, forecasting, and finding relationships between quantitative data. A good example is finding the relationship between company's advertising budget and its sales. Classification focuses on predicting a qualitative response by analyzing data and recognizing patterns. A good example is to classify whether or not a credit card transaction is fraudulent. There are many classification techniques we will study. Classification algorithms are also known as classifiers. We will study the following classifiers:

k-Nearest Neighbors
Decision Trees
Naive Bayes
Logistic Regression
Support Vector Machines

Unsupervised Learning

In unsupervised learning, the machine is made to learn on its own without any supervision. In unsupervised learning patterns and relationships are automatically found in the test data. Unsupervised learning problems can be divided into the following kinds:

Clustering

Clustering discovers similar data items and groups them together. For example, grouping customers by their purchasing behavior.

Association

Association discovers the rules that describe large portions of data. For example, finding the customers who buy both **x** and **y**.

Clustering algorithms are:

K-means clustering
Mean-Shift Algorithm
Hierarchical Clustering
Cluster Identification

Association algorithms are:

Apriori algorithm

Reinforcement Learning

Reinforcement learning rewards the machine when it does the job the expected way .Reinforcement learning's <mark>algorithms</mark> train the systems to make specific decisions. The machine is exposed to an environment where it trains itself continually using a trial and error method. These algorithms learn from past experience and tries to capture the best possible knowledge to make accurate decisions. Markov Decision Process is an example of reinforcement machine learning algorithms

Deep Learning

Deep learning simulate the human brain with Artificial Neural Networks (ANN), Convolutional Neural Networks for Computer Vision and Recurrent Neural Networks (RNN)s for Natural Language Processing. Deep Learning allows us to train an ANN to predict outputs, given a set of inputs. Learning can be supervised, semi-supervised or unsupervised.

Deep Reinforcement Learning

Artificial Neural Networks (ANN), combine with reinforcement learning algorithms to create something more powerful. Reinforcement learning refers to goal-oriented algorithms, which learn how to attain a complex objective (goal) or maximize along a particular dimension over many steps; for example, maximize the points won in a game of chess over many moves. these algorithms are penalized when they make the wrong decisions and rewarded when they make the right ones – this is reinforcement.