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Machine Learning: Some Insights

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Abstract: *Machine learning is a subfield of AI (artificial Intelligence). Main aim of machine learning is to understand the structure of data and fit that data into some models that can be easily understood and utilized by people. In traditional computing, algorithms are sets of explicitly programmed instructions used by computers to calculate or problem solve. Machine learning algorithms instead allow for computers to train on data inputs and use statistical analysis in order to output values that fall within a specific range. Because of this, machine learning facilitates computers in building models from sample data in order to automate decision-making processes based on data inputs.*

This paper look into the common machine learning methods of supervised and unsupervised learning, and common algorithmic approaches in machine learning, including the k-nearest neighbor algorithm, decision tree learning, and deep learning. The paper explore which programming languages are used most in machine learning, providing some of the positive and negative attributes of each. Additionally, discuss biases that are perpetuated by machine learning algorithms, and consider what can be kept in mind to prevent these biases when building algorithms. Algorithms are major part of any aspect of business.

Keywords: *Big data, supervised learning, unsupervised learning, Clustering AI.*

I. Introduction

Because of new computing technologies, machine learning today is not like machine learning of the past. It was born from pattern recognition and the theory that computers can learn without being programmed to perform specific tasks; researchers interested in artificial intelligence wanted to see if computers could learn from data. The iterative aspect of machine learning is important because as models are exposed to new data, they are able to independently adapt. They learn from previous computations to produce reliable, repeatable decisions and results. It's a science that's not new – but one that has gained fresh momentum.

Machine learning is a method of data analysis that automates analytical model building. Using algorithms that iteratively learn from data, machine learning allows computers to find hidden insights without being explicitly programmed where to look.

Machine learning is currently one of the hottest topics in IT. The reason stems the seemingly unlimited use cases in which machine learning can play a role.

Why is machine learning important?

Resurging interest in machine learning is due to the same factors that have made data mining and Bayesian analysis more popular than ever. Things like growing volumes and varieties of available data, computational processing that is cheaper and more powerful, and affordable data storage.

All of these things mean it's possible to quickly and automatically produce models that can analyze bigger, more complex data and deliver faster, more accurate results – even on a very large scale. And by building precise models, an organization has a better chance of identifying profitable opportunities – or avoiding unknown risks.

Why Machine Learning

With the rise in big data, machine learning has become a key technique for solving problems in areas, such as:

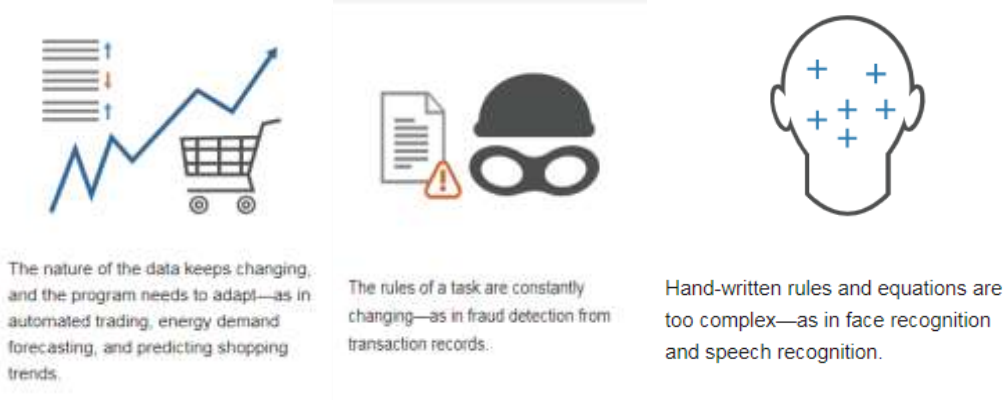
- Computational finance, for credit scoring and algorithmic trading
- Image processing and computer vision, for face recognition, motion detection, and object detection
- Computational biology, for tumor detection, drug discovery, and DNA sequencing
- Energy production, for price and load forecasting
- Automotive, aerospace, and manufacturing, for predictive maintenance
- Natural language processing, for voice recognition applications

What's required to create good machine learning systems?

- Data preparation capabilities.
- Algorithms – basic and advanced.
- Automation and iterative processes.
- Scalability.
- Ensemble modeling

When Should You Use Machine Learning?

Consider using machine learning when you have a complex task or problem involving a large amount of data and lots of variables, but no existing formula or equation. For example, machine learning is a good option if you need to handle situations like these:



The nature of the data keeps changing, and the program needs to adapt—as in automated trading, energy demand forecasting, and predicting shopping trends.

The rules of a task are constantly changing—as in fraud detection from transaction records.

Hand-written rules and equations are too complex—as in face recognition and speech recognition.

II. Methodology

How Machine Learning Works

Machine learning uses two types of techniques: supervised learning, which trains a model on known input and output data so that it can predict future outputs, and unsupervised learning, which finds hidden patterns or intrinsic structures in input data.

Supervised Learning

The majority of practical machine learning uses supervised learning.

Supervised learning is where you have input variables (x) and an output variable (Y) and you use an algorithm to learn the mapping function from the input to the output.

$$Y = f(X)$$

The goal is to approximate the mapping function so well that when you have new input data (x) that you can predict the output variables (Y) for that data.

Supervised machine learning builds a model that makes predictions based on evidence in the presence of uncertainty. A supervised learning algorithm takes a known set of input data and known responses to the data (output) and trains a model to generate reasonable predictions for the response to new data. Usesupervised learning if you have known data for the output you are trying to predict.

Supervised learning problems classified into Regression and Classification problems.

- **Classification**: A classification problem is when the output variable is a category, such as “red” or “blue” or “disease” and “no disease”.
- **Regression**: A regression problem is when the output variable is a real value, such as “dollars” or “weight”.

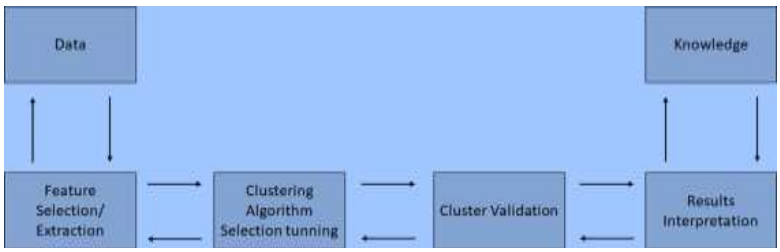
Examples of supervised machine learning algorithms are:

- Linear regression for regression problems.
- Random forest for classification and regression problems.
- Support vector machines for classification problems.

Unsupervised Learning

when dealing with real-world problems, most of the time, data will not come with predefined labels, hence need to develop machine learning models that can classify correctly this data, by finding by themselves some commonality in the features, that will be used to predict the classes on new data.
Unsupervised learning finds hidden patterns or intrinsic structures in data. It is used to draw inferences from datasets consisting of input data without labeled responses.

Unsupervised Learning Analysis Process
The process of developing an unsupervised learning model is as described in below:



Unsupervised learning applications areas are:

- Segmenting datasets by using shared attributes.
- Detecting anomalies that do not fit to any group.
- Simplify datasets by aggregating variables with similar attributes.

Unsupervised learning focus on two main types of problems namely:

- Clustering
- Dimensionality Reduction

Clustering

Clustering is the most common unsupervised learning technique. It is used for exploratory data analysis to find hidden patterns or groupings in data. For this, clustering algorithms are used. Clustering algorithms find the structure in the data so that elements of the same cluster are more similar to each other than to those from different clusters.
For illustration, let us consider a dataset of movies and want to classify them. May have the following reviews of films:

The machine learning model classify that there are two different classes.
Applications for cluster analysis include gene sequence analysis, market research, and object recognition.
Here are some guidelines on choosing between supervised and unsupervised machine learning:

- Choose supervised learning if you need to train a model to make a prediction--for example, the future value of a continuous variable, such as temperature or a stock price, or a classification—for example, identify makes of cars from webcam video footage.
- Choose unsupervised learning if you need to explore your data and want to train a model to find a good internal representation, such as splitting data up into clusters.

III. Conclusion

Machine learning has several very practical applications that drive the kind of real business results – such as time and money savings – that have the potential to dramatically impact the future of your organization. At Interactions in particular, we see tremendous impact occurring within the customer care industry, whereby machine learning is allowing people to get things done more quickly and efficiently. Through Virtual Assistant solutions, machine learning automates tasks that would otherwise need to be performed by a live agent – such as changing a password or checking an account balance. This frees up valuable agent time that can be used to focus on the kind of customer care that humans perform best: high touch, complicated decision-making that is not as easily handled by a machine. At Interactions, we further improve the process by eliminating the decision of whether a request should be sent to a human or a machine: unique Adaptive Understanding technology, the machine learns to be aware of its limitations, and bail out to humans when it has a low confidence in providing the correct solution.

Machine learning has made dramatic improvements in the past few years, but we are still very far from reaching human performance. Many times, the machine needs the assistance of human to complete its task. At Interactions, we have deployed Virtual Assistant solutions that seamlessly blend artificial with true human intelligence to deliver the highest level of accuracy and understanding.

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