

University of Westminster

Trends in Computer Science

4COSC008C

Coursework I - Report

Machine Learning

2a) Overview of Machine Learning. How does it compare with conventional computing?

Student Name : Narthani Lokuge

UoW ID : W2084765

IIT ID : 20222075

Group Members

Name	UOW Number
Hirushi Jayasekara	W2087743
Dharshika Gokularajan	W2082252
Narthani Lokuge	W2084765
Vigneshwaran Vishnumaynan	W2083047
Senuthi Hettige	W2082249

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1. Introduction to Machine Learning

Computer science (also called AI) has a branch called machine learning that allows computers to acquire knowledge and make choices without explicitly programming them. Machine learning algorithms get better over time by examining data and observing trends. It is employed in many different applications, including forecasting, image and recognition of speech, and systems for recommendation. Nowadays, innovation based on data and decision-making in many industries depends strongly on this technology (Colins, 2017).

2. Overview of Machine Learning

2.1. What is Machine Learning

Helping computers learn without direct programming is the responsibility of the “Machine Learning” branch of computer science. Machine learning is the research and deployment of algorithms and techniques that allow machines to learn. They will be asked to help determine which business questions are most crucial to answer and what information is needed to do so.

(1959, Arthur Samuel).

2.2. Evolution of Machine Learning

With the progress made in recent years, the question on everyone had was whether machines will soon be better learners than humans. That is the beginning of figuring out the answer to that - what it means to "learn from a human in context". But then of course, as a consequence, finally people can get understand machine learning is becoming better day by day. Basically, artificial intelligence has already excelled the human learning or whether it will never give up in all corners of the life (Credoreference.com, 2024).



Figure 1 : 2.2 - Evolution of Machine Learning

2.3. Machine Learning Methods

2.3.1. Supervised Machine Learning

The goal of this Machine Learning task is to develop a function that maps inputs to substances using examples of input-substance pairs. To derive the function, training data corresponding to a set of training examples is used. A supervised machine learning algorithm is an algorithm with external support. An input dataset is used to create a training dataset and a test dataset. The variables in the training data set need to be predicted or refined.

(Tsourakis, 2022)

2.3.2. Unsupervised Machine Learning

In contrast to the supervised learning described above, they are completely unsupervised and lack teachers. It is up to the algorithms to survive on their own. to determine and display the fascinating structure of the data. A few characteristics are taught to unsupervised learning algorithms by the data. It uses the features it has previously learned to identify the class of newly introduced data. It is primarily used for grouping and feature reduction.

(library-collections-search.westminster.ac.uk, n.d.)

3. Conventional Computing

3.1. What is meant by Conventional Computing?

In conventional computing, tasks are performed by computers by following fixed, preprogrammed instructions. Because it uses set algorithms, the results are trustworthy and consistent. Operating systems, spreadsheet software, and word processors are a few examples. Conventional computing, compared to machine learning, is incapable of adapting or learning from new information without human intervention (Seife, 2005).

3.2. Overview of Conventional Computing

In traditional programming, computers are given explicit instructions to follow. Because these programs lack the ability to learn or adapt on their own, they are predictable, performing tasks according to established rules and logic and producing predictable and consistent results (Seife, 2005).

The primary function of conventional computers is to execute instructions and perform mathematical and non-mathematical operations to produce desired outcomes. Machine language is a collection of instructions that only include 1 and 0, which is all that computers can understand.

The central processor unit is referred to as the "brain" of a computer. The circuits carry out the calculations. For each of these devices, there are just two conceivable states: on and off. Metal oxide semiconductors are used to make CMOS transistors, the most common type of transistor. The computer memory unit stores data and instructions relevant to processing. It is only possible to finish tasks that have been specifically programmed into traditional computers.

(ITL Education Solutions, 2011)

4. Comparison between Machine Learning and Conventional Computing

Feature	Machine Learning	Conventional computing
Learning Ability	Learns from data and improves over time	Does not learn ; follows fixed instructions
Adaptability	Adapts to new data and situations	Does not adapt without human intervention
Programming Approach	Trains models with data	Based on explicit programming and predefined logic
Result	Makes predictions or decisions based on patterns	Produces consistent and predictable results
Examples	Image recognition, recommendation systems, self-driving cars	Word processors, spreadsheets, operating systems
Dealing with uncertainty	Can handle uncertain and fluctuating data	Works best with well- defined rules and data
Complexity	Handles complex, high – dimensional data effectively	Suitable for well-defined, simple tasks
Execution	May include an iterative training and validation process	Performs tasks directly as programmed

Table 1 : 4 - Comparison of Machine Learning and Conventional Computing

(El Naqa and Murphy, 2015)

(Seife, 2005)

5. Critical Evaluation

Machine learning is used in many different fields. Like all technologies, critical evaluation is important for machine learning too. One of its strengths is detection and prediction on large amounts of data. This is especially useful in areas where you need to filter through large amounts of data, such as medical research and financial analysis. Another advantage of Machine Learning is that it can learn from new data. However, the accuracy of predictions depends on the quality of the data. It is a limitation. The data should not be skewed. Overall, machine learning is a powerful tool, use it only if you understand its strengths and limitations (Scope of this textbook, 2021).

6. Conclusion

In summary, machine learning represents a paradigm shift compared to traditional data processing. While traditional computing relies on fixed, explicit instructions and predetermined logic to perform tasks and produce consistent results, machine learning uses algorithms to recognize patterns, make decisions, and improve over time without explicit programming. The adaptability of machine learning allows it to handle complex and high-dimensional data, making it well-suited for applications such as image recognition, recommendation systems, and self-driving cars. However, the effectiveness of machine learning depends heavily on the quality and type of data used to train it. Despite the powerful capabilities of machine learning, it is important to understand both its strengths and limitations to effectively leverage its potential. Critical evaluation will ensure that the use of machine learning meets its intended purpose, ultimately driving innovation and efficiency across sectors.

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