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Research Paper

An Algorithmic Study Of Machine Learning

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ABSTRACT

The scientific study of statistical models and techniques used by computer systems to carry out specified tasks without explicit programming is known as machine learning, or ML for short. Understanding algorithms for a variety of everyday applications. One of the reasons an online search engine like Google performs so effectively each time it is used to search the internet is due to a learning algorithm that has figured out how to rank web sites. These algorithms are employed in many different fields, including predictive analytics, image processing, data mining, and more. The primary benefit of machine learning is that algorithms can operate autonomously once they figure out what to do with the data. This document provides a short overview and outlook for the numerous uses for machine learning algorithms have been developed.

Keywords **–** Statistical Models, Explicit Programming, Online Search Engine, Predictive Analytics, Image Processing, Data Mining.

INTRODUCTION

Ever since they first evolved, people have used a wide variety of tools to make a variety of activities easier. Various machines have been invented as a result of human brain inventiveness. Through its ability to service a variety of requirements, such as computing, industry, and transport, these machines made life easier for humans. The first of these is machine learning. Machine learning is the branch of research that allows computers to learn without explicit programming, according to Arthur Samuel. With his checkers playing programme, Arthur Samuel became well-known. Computers can learn how to handle data more effectively by using machine learning (ML). There are situations when we are unable to understand the information we have extracted from the data after examining it. We then use machine learning in that scenario. The need for machine learning is growing due to the number of datasets that are available. Machine learning is used by many sectors to retrieve pertinent data. Learning from the data is the aim of machine learning. Numerous research works have been conducted on the subject of teaching computers to learn on their own without explicit programming. Numerous mathematicians and programmers use a variety of techniques to solve problems involving large amounts of data. The quick advancement of science and technology has given rise to new development opportunities, one of which is artificial intelligence. The incorporation of interdisciplinary theoretical knowledge, such as statistics and algorithm complexity, into machine technology, which is based on computer technology, enhances the functional characteristics of artificial intelligence. It is possible to improve the applicability of machine learning algorithms and provide convenience for the industry's economic development by conducting a realistic analysis of these algorithms and using the results as a guide for future machine learning development.

CLASSIFICATION OF MACHINE LEARNING

(i) Supervised Learning- Supervised learning is one of the more fundamental learning techniques used in machine learning. This approach to learning describes how individuals set appropriate learning objectives prior to learning. When the machine is first trained, it uses information technology to understand what has to be learned. We are expected to progressively finish the necessary learning content in a supervised setting in order to gather fundamental data. When compared to alternative learning techniques, supervised learning is capable of fully utilising the machine's capacity for generalised learning. Following system learning, it can assist users in resolving some highly systematic classification or regression issues. Currently, BN, SVN, KNN,

and other traditional learning techniques are frequently employed. Since the entire process of learning has a goal, the machine learning procedure exhibits some regularity, and the learning material is more structured.

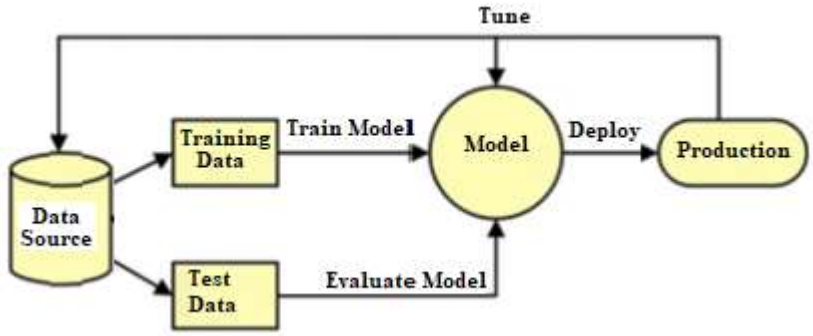


Figure 1- Supervised learning Workflow

(ii) Unsupervised Learning- Unsupervised learning is correlated with supervised learning. In what is known as "unsupervised learning," the machine analyses the data on its own, without the need for human intervention, by marking the material in a certain way during the learning process. In actuality, the technique of operation involves first allowing the machine to learn the fundamental ideas and content, and then providing it with sufficient autonomy to finish a sequence of content learning, incorporating ideas and material resembling the fundamental principles, like tree roots. The scope of machine learning content has generally risen due to the gradual improvement of learning. Currently, algorithms like autoencoders and deep belief networks are used in unsupervised learning.

(iii) Reinforcement Learning- There are reinforcement learning application methods in machine learning in addition to supervised and unsupervised learning. The methodical learning of a given subject is known as reinforcement learning. The information gathered throughout the prior time frame will be utilised in the particular application procedure. It creates a closed loop of data processing by organising and processing the feedback data of a specific part. All things considered, dynamic learning and statistical data collection are expanded upon by reinforcement learning. These techniques are mostly applied to robot control issues. The Temporal Difference Learning Algorithm and the Q-Learning Algorithm are two of its representative learning techniques.

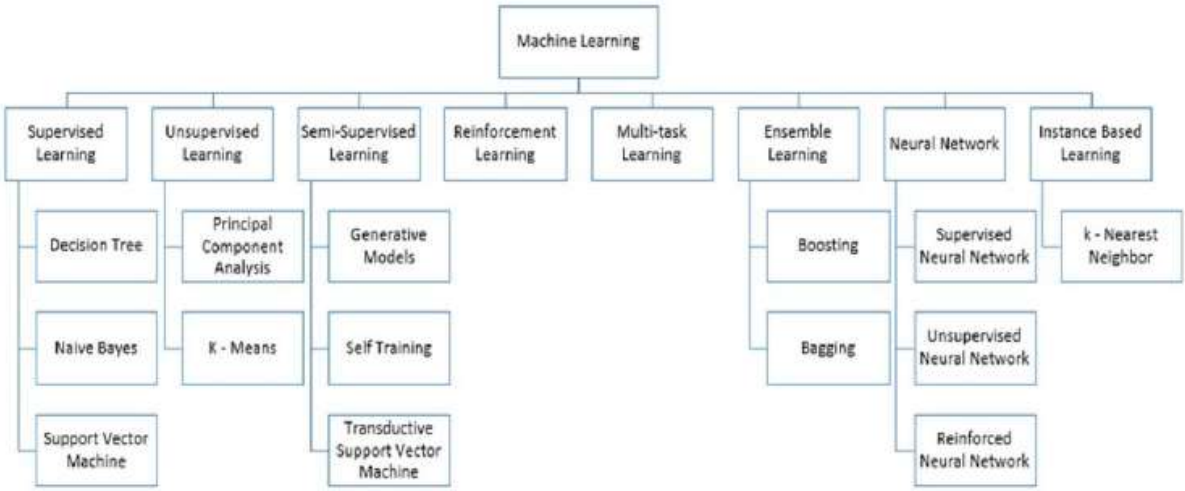


Figure 2- Classification of Machine Learning

ANALYSIS OF ALGORITHMS FOR MACHINE LEARNING

(i) Decision Tree- A graph called a decision tree is used to show decisions and their outcomes as a tree. The graph's edges stand in for the criteria or decision-rules, while the graph's nodes represent an action or option. Nodes and branches make up every tree. Every node represents a characteristic of a group that needs to be categorised, and every branch provides a possible value for the node.

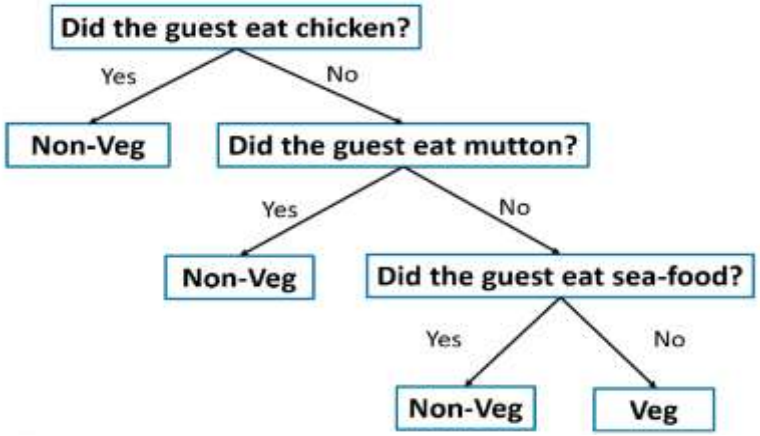
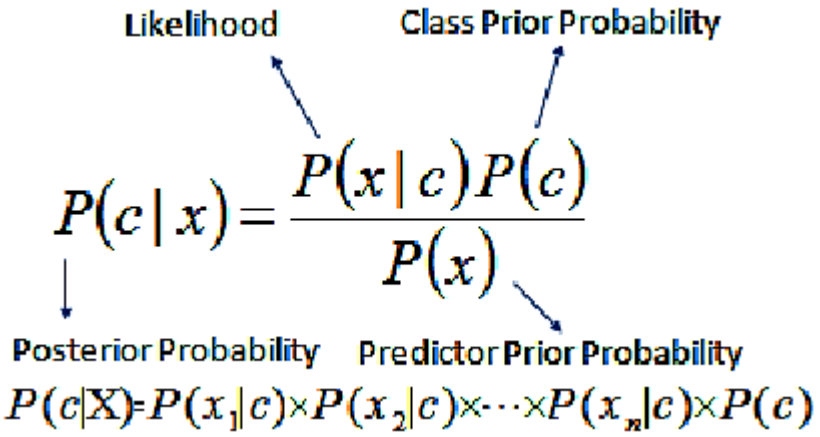


Figure 3- Decision Tree

Decision Tree Pseudo Code:

```
def
decisionTreeLearning(examples, attributes,
parent_examples):
if len(examples) == 0:
return pluralityValue(parent_examples)
# return most probable answer as there is no training data
left
elif len(attributes) == 0:
return pluralityValue(examples)
elif (all examples classify the same):
return their classification
A = max(attributes, key(a)=importance(a, examples)
# choose the most promissing attribute to condition on
tree = new Tree(root=A)
for value in A.values():
exs = examples[e.A == value]
subtree = decisionTreeLearning(exs, attributes.remove(A),
examples)
# note implementation should probably wrap the trivial case
returns into trees for consistency
tree.addSubtreeAsBranch(subtree, label=(A, value)
return tree
```

(ii) Navie Bayes- Based on the assumption of predictor independence, this classification method applies the Bayes Theorem. Simply said, a Naive Bayes classifier makes the assumption that a feature's presence in a class is independent of the existence of any other feature. Text categorization is the primary industry that Naïve Bayes addresses. Classification and grouping are its primary uses, and they rely on the conditional probability of occurrence.



Pseudo Code of Navie Bayes

Input:
Training dataset T,
F= (f1, f2, f3,.., fn) // value of the predictor variable in testing dataset.
Output: A class of testing dataset.
Steps:
1) Read the training dataset T;
2) Calculate the mean and standard deviation of the predictor variables in each class;
3) Repeat Calculate the probability of fi using the gauss density equation in each class; Until the probability of all predictor variables (f1, f2, f3,.., fn) has been calculated.
4) Calculate the likelihood for each class;
5) Get the greatest likelihood

MACHINE LEARNING DEVELOPMENT

(i) Theoretical System Continues to Mature- The mechanical theory system will continue to be refined and developed in the future, with new topic branches and coverage added. The original development of machine learning content mostly focused on certain automation businesses, and the theoretical system's content as a whole was not entirely sound. Some fields do not allow the substance of its theoretical framework to be applied in practice. In response to these circumstances, the theory of machine learning will advance steadily, and the level of content refinement will also advance, creating ideal circumstances for the further advancement of machine learning.

(ii) Autonomous Learning Ability is Further Improved- Many Chinese businesses have adopted the automation development model as of late, and the next phase of development will be centred on intelligence. The ability of machines to learn on their own will be significantly enhanced in light of the Internet's rapid expansion. Machine learning will continue to gain more autonomy, whether it is through supervised or unsupervised learning. In the machine's future learning process, it will learn in a targeted or comprehensive way based on its own requirements. This will lower the financial burden on the business to update its equipment structure and provide a strong basis for the enterprise economy's steady growth.

(iii) Integration of Multiple Digital Technologies- Currently, depending on Internet technology has resulted in the development of numerous auxiliary technologies, including digital, cloud computing, Internet of Things, and other technologies. During the data calculating process, these technologies can offer a variety of practical conditions. Even if these digital technologies are still only being integrated, due to the quick advancement of technology, the integration of digital technology is continually getting better. Furthermore, as these technologies are developed further, they will be joined with algorithms to create a new technological application system, which will provide the groundwork for even faster data processing.

(iv) Promotion of Personalized Customization Services- People's needs for tailored applications are ever-increasing along with the socioeconomic level's continual improvement, making this one of machine learning's key future development directions. As the intelligent mechanical learning level continues to advance, various application modules can be configured to meet the real-world requirements of users. In order to satisfy the user's customised needs and raise user satisfaction levels, the data module can match the associated service content and filter out the corresponding information content after receiving the user request message.

CONCLUSION

Both supervised and unsupervised machine learning are possible. Select Supervised Learning if you have fewer data for training that is properly marked. For big data sets, unsupervised learning typically produces superior performance and outcomes. Use deep learning techniques if you have easy access to large data sets. Additionally, you have knowledge of both deep reinforcement learning and reinforcement learning. You now understand the definition, uses, and constraints of neural networks. Various machine learning algorithms are surveyed in this work. Whether they realise it or not, everyone uses machine learning these days. From posting images on social networking sites to receiving product recommendations when buying online. An overview of the majority of widely used machine learning algorithms is provided in this publication.

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