

# Machine Learning Pattern Matching

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## ABSTRACT

Machine Learning: The ability to learn is a significant issue for the process of intelligence, determining a concern for cognitive psychology as well as artificial intelligence. The industry of machine learning defines the computational issues and processes that highlight learning activities in humans and machines. Despite the fact that most of the researcher ignored the issues of machine, learning only a century ago, the role of knowledge has increased during this era. After the computers became less expensive and all types of organizations could purchase them, most of the processes in the companies were transferred to the digital form and the problem of data storage has increased, so that data storage and learning become a significant issue in the world of digital technologies. Most of the significant transformations in the science and in the digital technologies are happened due to computing, especially after the amount of data increased significantly. Pattern recognition is described in the paper as an efficient automated method that is closely related to machine learning and can be useful in data mining and in different types of data searching. The paper performs all necessary information concerning the science of machine learning and the corresponding progress of its processes. The types of learning algorithms, processes, techniques, and models will be observed in order to demonstrate how it can be integrated in the digital processes.

**Keywords:-** Machine Learning

## I. UNDERSTANDING MACHINE LEARNING

Machine learning is one of the leading and fastest developing areas of the computer science. A thousand year ago, people compare painters, philosophers and other professionals with the gods, but at the present days each person can get as much information as it is necessary. The same democratization as with the professionals had happened in computing and dating. Only a hundred years ago, large corporation, governmental institutions, and big hospitals can purchase a computer for work, but at the present days most of the population has a personal computer or another gadget that can be used for getting necessary information. With the integration of social media, most of the people replace discussions in the parks or pubs for chatting in the Internet. Social media and the Internet made the data available and cheap. Thus, all the data generated with the help of machines and other corresponding services is a by-product of digital technology. The professionals allocate significant resources in order to store the data efficiently and to control as well as to manipulate the information. Almost all the services and stores are connected online, where they store

information about the products, the goods bought, prices, total costs, and other.

The term of machine learning was performed by Arthur Samuel, where the professional determines a computer program and the performance as well as offers an operational definition (Russell & Norvig, 2009). Shai and Shai (2014) define the term of machine learning as the automated detection process to perform the meaningful patterns with data. The researchers highlight that a machine learning and a pattern recognition algorithms based technology surround people every day, they are search engines, anti-spam software, credit card transactions, digital cameras for detection, intelligent personal assistant applications in order to detect voice commands, to drive an autonomous vehicle and to classify new astronomical structures. Also, pattern recognition is actively used in the scientific application and in the corresponding industries of medicine, astronomy, and bioinformatics.

Gori (2017) defines machine learning as a scientific study of algorithms as well as statistical models that have to be integrated into computer

processes in order to make predictions or decision concerning a certain task. In fact, the algorithms of machine learning are used not only in the computational statistics to make the decision or predictions, but also in the field of mathematical optimization. The main task of optimization is to define and deliver the methods, theories and a certain type of applications in the field of machine learning. Moreover, data mining deals with machine learning, focusing mainly on the identification of data analysis with the help of unsupervised learning. As a result, machine learning can be observed as an efficient process for predictive analytics. In fact, both machine learning and data mining use the same technologies and methods, but with different focuses. For example, data mining concentrates on the identification of unknown properties, whereas machine learning focuses on the prediction on the basis of the received data.

It is necessary to highlight that data mining requires using a variety of machine learning methods with different purposes. Generally, machine learning performance is identified within the corresponding ability to demonstrate and reproduce the knowledge, whereas data mining process deals with unknown data. Furthermore, machine learning deals with the optimization with the main aim to minimize loss function, where the loss function is determined with the difference among the predictions and the present problem. The main differences between machine learning and generalization involve the followings: optimization algorithms deal with minimization of the losses concerning a training set, but during the machine learning, the process is aiming at the minimization of the loss concerning unseen examples.

## **II. MACHINE LEARNING TASKS AND PATTERN RECOGNITION**

Machine learning tasks are divided into supervised learning and semi-supervised learning. In case of supervised learning, an algorithm determines a mathematical model of data with inputs and outputs. Within semi-supervised learning, an algorithm deals with the corresponding mathematical models of training data, where some of the information is not presented. Furthermore, the machine learning tasks can be used when there are a variety of routine issues that can be done with a program such as speech recognition and data sorting. The tasks beyond human capabilities are

also can be done with the help of machine learning techniques such as analytical data, astronomical data, weather prediction, web search analytics, electronic commerce and other similar processes. Despite the fact that the main disadvantage of machine learning processes is their rigidity, many tasks can be changed over time or some of the programs can be adaptable to the input information and as a result provide further changes to such programs.

Pattern recognitions and data mining are observed as the most significant processes of machine learning. With the help of computer algorithms, it is possible to implement pattern recognition in engineering and related processes. Pattern recognition processes can be divided into supervised learning, unsupervised learning and semi-supervised learning processes (James, Witten, Hastie & Tibshirani, 2013). It is actively used in the computer-aided diagnosis, speech recognition, identification of healthcare interpretations as well as automatic recognition of photos, images, faces, handwriting images and other analysis. The professionals highlight four parameters of learning paradigm that have to be observed and classified (Poddar, Sahidullah & Saha, 2018). The types of learning involve the following: supervised versus unsupervised, active versus passive learners, helpfulness of the teacher and online versus batch learning protocol. Firstly, during the supervised versus unsupervised model, it is necessary to define an interaction between the learner and the environment. For instance, the process of spam detection involves the function of machine learning when a receiver gets training e-mails and label them correspondingly. As a result, the program can determine a rule for detection new e-mails and further labeling them to the spam or not-spam boxes. During the unsupervised learning processes, the professionals do not differ the test data and training data as well. Secondly, during active versus passive learners models, the paradigms vary by the role that of a participant. Thus, it is necessary to differ “active” learners and “passive” learners.

The automatic pattern recognition provides opportunities to minimize processes of image analysis. It is also actively used in the artificial neural networks in order to identify the fingerprints, to detect face, to verify signature or to complete the authentication of a voiced-based procedure. Moreover, the researchers integrate he

artificial neural networks to the different types of navigation and guidance systems. Pattern recognition model can be used in psychology in order to define the objects, perception from them as well as to get sensory inputs. In fact, in order to integrate pattern recognition to the processes in different area of study it is necessary to define if it is supervised or unsupervised as well as to define the nature of algorithms, because it can be statistical and non-statistical. Also, the statistical algorithms are usually divided into parametric (linear or quadratic analyses, maximum entropy classifier), nonparametric (decision trees, Kernel estimation, Perceptions and other similar algorithms) clustering (Correlation, Mixture models, Hierarchical clustering) as well as ensemble learning algorithms, multilinear subspace learning, regression algorithms and sequence labeling.

### **III. PROCESSES AND TECHNIQUES**

In order to increase the performance of machine learning algorithms, it is necessary to apply a variety of processes, techniques, and special methods. For example, feature learning is represented as a set of efficient techniques that can help to find all necessary data automatically which is necessary for further classification. Also, feature engineering provides opportunities to study the features and integrate them for tasks. Feature learning can be described as supervised or unsupervised, where supervised learning is observed with the help of input data, as an example it can be artificial neural networks, dictionary learning and other. Unsupervised feature is described with the help of unlabeled input data, as an example it can be independent component analysis, different forms of clustering and autoencoders. In other words, feature learning algorithm is aiming to collect information in their input as well as to transport it in order to make it efficient.

The following process that can be applied to the machine learning algorithms is sparse dictionary learning. Tillmann (2015) considers that such method is strongly NP-hard and also it is a complicated process to solve approximately. It is a method of feature learning where the main or basis functions of a linear combination are performed with a training example, so that it is represented as a sparse matrix. Another process is anomaly detection or outlier detection, which is aiming at

the identification of suspicious or rare items from the data. The anomalous data is performed as bank fraud, errors in the data or structural defect. Chandola, Banerjee and Kumar (2009) highlight three broad categories of possible anomaly detection such as unsupervised anomaly detection, supervised anomaly detection and semi-supervised anomaly detection. During the process of unsupervised anomaly detection, the system identifies rare items and other types of errors in an unlabeled test data set. Supervised anomaly detection performs special techniques to define “normal” and “abnormal” set of data. Semi-supervised anomaly detection is used to build a special model that can determine normal behavior from a current or received training data set and then to conduct all necessary tests.

Furthermore, a decision tree model is widely used in statistics, data mining, and machine learning as well to observe an item and to make a conclusion concerning a target value. The decision tree is used as a predictive approach which can be applied in statistics, machine learning, and data mining. If it deals with data mining, the decision tree process is actively used to describe all necessary data, to determine and further create a model that can predict the corresponding value of a target. It can be based on the different inputs, being a simple demonstration for classification. Thus, a classification tree is necessary to integrate when the predicted results is the class to which the received data correspond. Decision trees can be performed not only with an analysis of classification tree, but also with the help of regression tree. A regression tree analysis performs the possible predicted outcome that is expressed by a real number such as the price for a product, the length of vacation, or any other similar issues.

### **IV. CONCLUSION**

Learning is a complicated process that has to be developed continuously. The process of learning provides opportunities for the participants to get all necessary skills, knowledge, and experience for further implementation to the practice. Machine learning algorithms are widely used at the present days. With the help of inputs or external information, pattern recognition process can change the structure, program, as well as necessary data in order to correspond with the program for a participant. The main aim of the machine learning is to improve the performance of

the tasks in order to make predictions or to make an efficient decision. It closely operates with computational statistics with the same purpose to make specific predictions with the help of computers. The paper have determined different approaches, types of learning algorithms, models and techniques which can be integrated to the data mining or data analysis. To conclude with, it is necessary to highlight that artificial intelligence play a vital role in the machine learning, because it provides opportunities to perform tasks concerning the predictions, recognition functions, diagnostics, the control of robots, planning and other similar processes.

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