Application of Machine Learning and Pattern Recognition- A Vision

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Abstract
When it comes to computer science, machine learning is one of the most talked about subjects. It is modern innovation that has helped human beings, professional processes, and many industries. Artificial intelligence includes machine learning as a subset. [6], and the algorithms used in machine learning are more accurate, and machines as a whole are smarter because of it. It's a neurological procedure that can be used to both humans and robots. Pattern recognition is heavily reliant on the capability of machine learning. It's been employed in a wide range of sectors, with excellent outcomes. Consequently, this topic is in need of more study, which might lead to new real-world applications. Pattern recognition and machine learning have a lot in common, which is why this review article focuses on them both.

Keywords: - Machine Learning (ML), Pattern Recognition (PR), Supervised Learning(SL), Unsupervised Learning(USL), Reinforcement Learning(RL)

Introduction

Machine learning is built on the field of Mathematics and Computer Science. ML methods are described their behavior are best understood using the tool of Probability and Statistics. Automatic data learning, performance improvement, and prediction are all possible with this technology. ML is the complex set of algorithms that allows us automatically identifies patterns in the data. In this digital era, pattern is the distinctive identification of everything. A pattern can be seen physically or quantitatively through the use of algorithms. Identifying and analyzing the patterns to the data is known as Pattern recognition. During the recognition or classification process, items are allocated to one of several classes. In this article, learn more about machine learning and pattern recognition, the kinds of ML and PR, some applications of ML and PR, and the features of ML and PR in operation. Machine learning and pattern recognition will also be examined. However, as seen in Fig. 1, pattern recognition is not an element of machine learning.
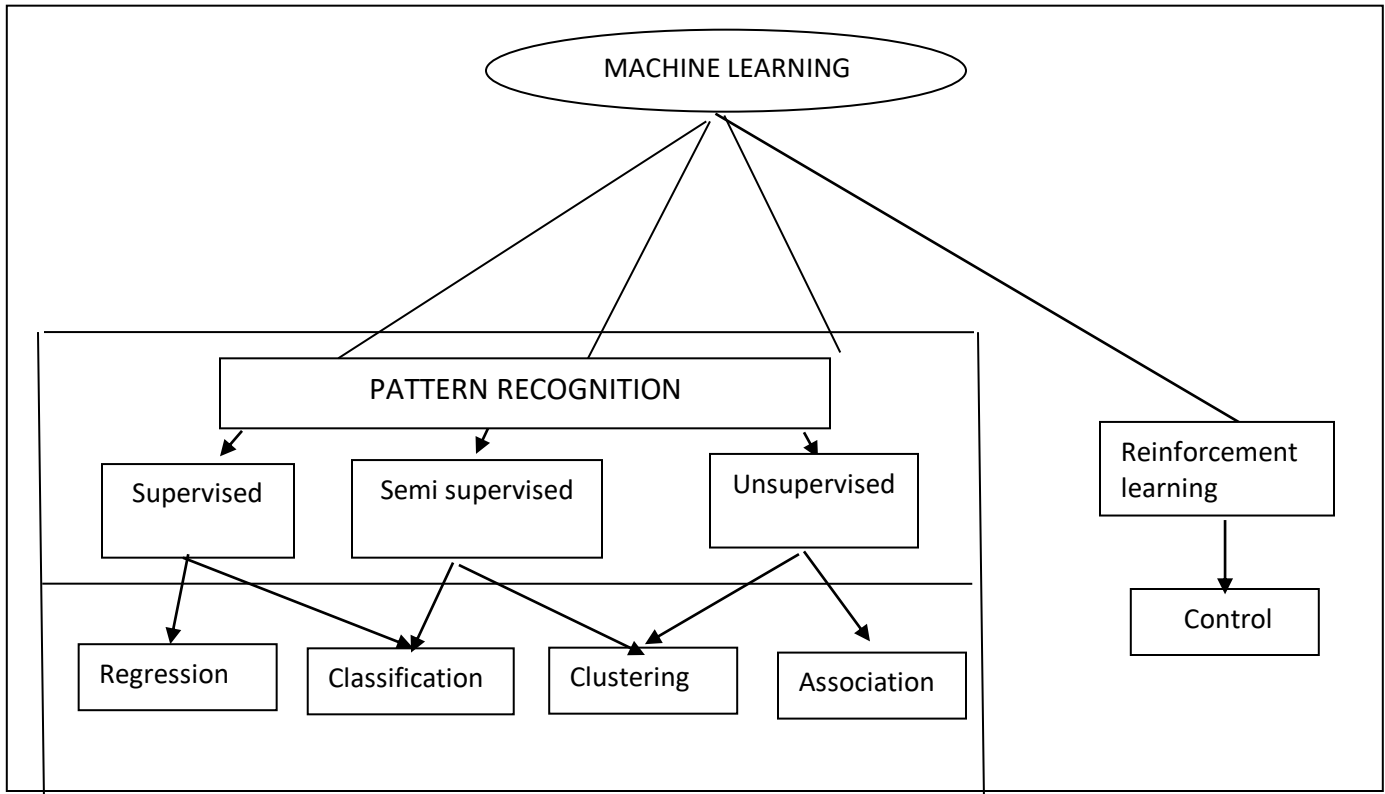
Approaches in Machine learning and Pattern recognition

It is considered to have learnt from experience E when a computer program's performance on tasks T, as evaluated by P, rises with experience E. Identifying and classifying patterns in the environment, such as animals, and making smart judgments based on those patterns or pattern classes (such as a dog, a mammal, or an animal) is all part of the study of pattern recognition [2]. a wide range of fields rely on the ability of machines to recognise, describe, classify, and organise patterns Computer vision, artificial intelligence, and remote sensing[12] are examples of engineering and scientific fields. The ability to recognise and categorise unfamiliar entities quickly and effectively is a characteristic of machine learning and pattern recognition. It recognizes forms and objects from various perspectives and identifies patterns and objects even when partially hidden. It also recognizes patterns quickly, easily, and automatically.

When it comes to machine learning, supervision is key. This kind of machine learning algorithm is trained using labelled data. When a new input is provided, the system uses the training dataset to generate the right output. In the right conditions, supervised learning may be quite effective. However, this approach requires proper labelling of the data in order to work. It is mostly employed in the classification and regression processes. Random Forest, Decision Trees, Logistic Regression, Support Vector Machines, and Convolution Neural Networks are examples of classification techniques. Linear Regression, Multiple Linear Regression and Decision Trees are all examples of regression algorithms. Ridge or Lasso Linear Regression, Bayesian Linear Regression, and Polynomial Regression are further examples.

Unsupervised learning is Machine learning that is unsupervised does not require any supervision. Unsupervised learning is frequently employed in situations when there is simply an input file and no specified output data. Any link between two data points may be determined precisely by using labels in supervised learning. In contrast, there are no labels to cope with in unsupervised learning, which leads to the construction of hidden structures. There is no need for human input for the software, which abstractly sees the links between data points. Clustering and Association are two sorts of categories for which unsupervised learning can be employed. K-Means Clustering, Mean-Shift Clustering, Hierarchical Clustering, Gaussian Mixture Models, and Deep Neural Networks are all examples of clustering methods. An association algorithm is a Learning Classifier System, Apriori Algorithm, Singular-Value Decomposition and Singular Value Decomposition [7].

There is a third option, semi-supervised learning, which lies somewhere in the middle of the two. Small amounts of labelled and unlabeled data are blended during training. This is useful for applications that have a limited amount of data to train with. It is divided into two categories are classification and clustering [10].

Reinforcement Learning is a branch of Artificial Intelligence and belongs to Machine learning that enables robots to interact with their dynamic surroundings to achieve their objectives. Machines and software agents can use this to assess the best conduct in a given situation. Agents can learn and improve their behavior over time with the help of this incentive feedback. A reinforcement signal is a simple form of feedback reward. The agent in the environment is expected to function in the existing state. This sort of learning differs from supervised learning in that the training data is the former includes output mapping, which allows the model to learn the correct answer. Game AI, Skill acquisition, Learning task, and Robot Navigation are some applications of RL [4]. Its categorization is Control.

APPLICATIONS OF ML AND PR

Extremists in crowded places, such as convention centres, airports, and other major events, may be identified using face recognition technology. Contactless communication and security are becoming more important in the wake of the COVID-19 outbreak. As a result, numerous firms are now using it. Face recognition for security purposes also uses computer vision. After an algorithm recognizes the person's face, permission for continued accessibility is granted Neha sharma et al [5].

This paper provides indoor positioning system that use decision trees, nave bayes, Bayesian Network (BK), k-Nearest Neighbour, Sequential Minimal Optimization (SMO), Ada Boost, and bagging with comparative metrics such as computing time and accuracy are examples of object detection machine learning applications Pramila Pet al [6].

As expected and shown, 3D bioprinting can make use of machine learning. Machine learning may be used to enhance or analyse dimensional accuracy, defect identification, and the design of material properties. Chongyue Yu[7]

They proposed a machine learning methodology for georeferencing satellite photos in this study. The methodology is put to the test on several data sets, One such data set with confined terrain undulations is given herein. The proposed solution solves the shortfalls of Rational Functional Models (RFM) for georeferencing large strips, according to their analysis   D Sudheer Reddy et al [8].

Because of the market's volatility and nonlinearity, it is difficult to accurately estimate future stock market returns. Programmable solutions for stock value prediction have proven to be more accurate with the emergence of artificial intelligence and improved processing capability. The next day's end cost of five organizations from assorted areas was guage involving Artificial Neural Network and Random Forest methods in this examination. There are a number of variables that may be generated from the stock's open (high), high (low), and close (close) values. The models are analysed using standard strategic metrics such as the Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). The models' poor performance on these two measures suggests that they are effective. A study by Vijh et al. [11].

Machine learning-based image recognition technology is widely utilised in feature picture categorization, segmentation, and recognition. In this paper, image recognition technology is used to extract licence plates from complex backgrounds, segment licence plate characters and recognise characters, and create a machine learning non licence plate automatic generation algorithm, which could improve the efficiency of non licence plate recognition Lijuan Liu et al [13].

The accuracy of current weather forecasts is critical to a wide range of applications, including aviation safety, defence planning, and energy consumption. That is the reason mathematical climate forecast models with high goal run huge number of lattice cells and material science bundles that settle their own conditions consistently. Everything is covered, from radiation physics to cloud physics to boundary layer turbulent flow and land surface interactions with the fluid atmosphere. Author Sue Ellen Haupt and others [14].

A design pattern may be incorporated in any part of a software project and will be very helpful and essential for software maintenance and development. The development of a pattern recognition system makes use of ANNs and feature selection methodologies. Using an open source application, Sultan Alhusain and Simon Coupland and others [15] established six Design Patterns to verify their hypothesis.

Image segmentation, image registration, multimodal image fusion (combining pictures from several sources), computer-aided diagnostics, image-guided treatment, image annotation, and database retrieval are all examples of this. Ashish Khare et al [16].

In today's world, fraud is a huge issue. Payment fraud losses are becoming more common as e-commerce evolves. Payment failures have cost businesses, governments, and individuals a lot of money. They want to employ machine learning to combat credit card fraud, which they think can be used to combat other sorts of fraud as well. Based on the AUC, the Random forest classifier outperformed all other models, followed by logistic regression, decision trees, oneclass support vector machine, isolation forest, and local Outlier factor. The performance of the random forest

classifier on unseen data was enhanced by oversampling the data, Sikiru Ademola Adewale et al [17].

To mention a few of the 23 new technical and technological sectors in which optical networks have grown more "smart," software defined networking has emerged. A SDN stage with elite execution equipment and insightful programming gives a strong groundwork to significant optical systems administration forward leaps. As indicated by Francesco Using the huge amount of information accessible from network observing parts, Musumeci et al. recommend areas of strength for that gaining calculations might gain for a fact and make networks more adaptable and versatile[18].

Based on expected weather and soil conditions, the new weather-based crop selection strategy is proposed. RNN is used for seasonal weather forecasting. A classic ANN is also used to compare the predictions, and the findings show that the new ANN is more accurate in its forecasting. An irregular woodland classifier with an additional an edge boundary is utilized to get more than one harvest that is proper for an area. Furthermore, depending on expected meteorological conditions, the suggested technique indicates the best seeding timing for each crop, Sonal Jain et al [19].

This study shows how significant techniques like Data Mining, Machine Learning, and Statistical Techniques are being used in the educational and academic fields. Its goals are to define improved procedures for doing research on overall performance using complex forecasting strategies. The main aim here is to seize and organise the records, as well as to figure out the best way to proceed with the study. This paper introduces high-quality, appropriate ways for gathering data by selecting the appropriate metrics and performance indicators. The proper metric in EDM is one that is impartial and takes into account all elements, whether educational or non-academic. They hope to provide an understanding of the approach and algorithm employed while working with educational data through this study, H. Kishan Das Menon [a,*] et al [20].

Conclusion

In a word, machine learning is a major advancement in artificial intelligence. Many academics are focusing their study on ways to use machine learning in their different professions, which is a promising new technology. It is the primary objective of this article to offer an overview of the many kinds and methods of Machine Learning and Pattern Recognition, as well as a quick discussion of these issues. This suggests that machine learning will have a wider range of applications in the future, with which it will be able to produce outstanding results. A new architecture may emerge as a result of continuing study.

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