



PATTERN RECOGNITION AS AN EMERGING TREND OF ARTIFICIAL INTELLIGENCE

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Abstract—Pattern recognition is one of the well-known trait of artificial intelligence. Pattern recognition has become more and more famous and plays a pivotal role into IT field since 1960's. This research paper introduces basic classification of pattern recognition algorithms as well as models and AMALGAMATION model which combine two or more traditional models to get the best result as output. The final goal of pattern recognition is to build a machine which will act like a human being and can recognize all the pattern by using its algorithm at a faster pace just like a brain of human.

Keywords-Artificial Intelligence, Pattern Matching, Supervised learning, Unsupervised Learning, Pattern Recognition Models, AMALGAMATION Model

I. INTRODUCTION

The assignment of physical object or any event to an already pre specified database of categories is in largely termed as pattern recognition. A pattern is an object, process or event. Pattern majorly concentrates on the arrangement of the objects rather than the basic nature of the elements. What comprises a pattern is a question? A pattern can be said as the arches in a fingerprint or a DNA sample or handwriting cursive or a barcode of an item or a human face or any data that forms a relevant idea. Pattern recognition is usually done from a huge class. A class is a set of pattern that share common attributes mostly collected over a same information resource. When the process of recognition comes the objects are classified to the objects separately. Anything that is opposite to chaos is pattern which is untestable and forms a meaningful sense for data.



Fig 1: Different areas of pattern recognition

A human being can easily classify an object or a trace of element of human or any entity whatever be the orientation or facial changes or some distortions too but if the same task is to be carried out by the machine or the computer in matching it becomes a complex task for it because it has data saved in one format the orientations are not there so recognizing the pattern is a key concept which has gained a lot of importance in the recent times though the technology has prevailed since the 1960s. But in recent trends it is a wide researched field. Pattern recognition is that part of artificial intelligence which helps the machines to think and obtain the answers just alike humans but from the machines.

For e.g., a human being a young adult can easily classify the letters written in any background or even if the parts of the letters are missing or smaller or larger the font. But for the machines that is computers to recognize and give outputs based on the variations it has seen for the same thing and making sounds or matching process for the patterns

.Pattern recognition is the method to observe the environment and distinguish changes and produce the desirable output alike human brain. The best pattern recognition technique implemented successfully and found globally correct is the human brain. Through various researches still the solution is not found that how a human brain forms a correct and inclusive methods for the pattern recognition. The research for artificial implemented pattern recognition is going on since so many decades not been able to find a wholesome solution for the pattern recognition for the entities.

II. RELATED WORK

A) Pattern recognition algorithm

The pattern recognition field has been researched by a large number of researchers and as a result they have developed various algorithms. The basic elements of these algorithms are, i.e. data collection, feature extraction and classification. So it depends upon the algorithm characteristic to be chosen by each element in the design cycle.



Fig 2: Basic pattern recognition model

There are two basic types of pattern recognition algorithms which depend on the type of label output, on whether learning is supervised or unsupervised.

i) Supervised learning

A supervised learning is a type of machine learning algorithm that uses a known dataset which is also known as the training dataset to make predictions. This dataset includes input data and response values. Along with this data, supervised learning algorithms predict the response value for a new dataset. So as a result, a classifier can evaluate an object or entity.



Fig 3: Face detection and stop sign detection

A supervised learning algorithm used in face detection as below.

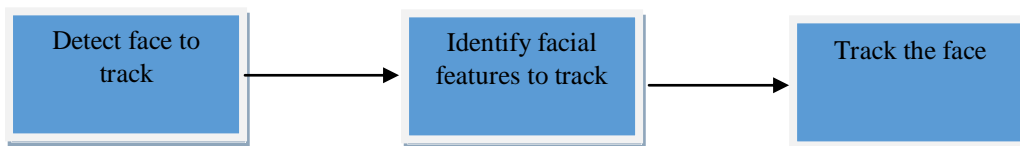


Fig 4: Schematic diagram to detect face

ii) Unsupervised Learning

An unsupervised learning is a type of machine learning algorithm that uses to draw possibilities from the data set consisting of input data without labeled responses. This learning algorithm mostly uses segmentation or clustering

techniques to find out hidden structures in unlabeled data. Among this two method, a cluster analysis is the most common unsupervised learning method. It is used to analyze the data to find hidden patterns or grouping in data.

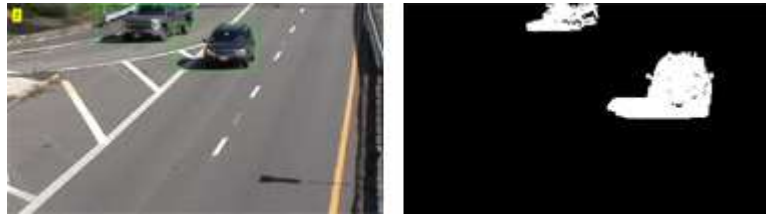


Fig 5: Detecting moving objects

B) Pattern recognition models/techniques

There are several models implemented since the time the pattern recognition has emerged. The models are classified based on their functioning and the working models.

1. Statistical Method

In this basic method what is done is each pattern is fully introduced as features. Here the space occupied by the patterns are non-overlapping that is they don't coexist with each other. It takes a full summary of the images to be compared and depending on that forms a process which is desired. The model works the best when there is a recognizable manner of space between the images and it doesn't form a cluster. In length it means it has a proper interclass distance between the domains of two specific objects. The decision is taken based on the probability distribution and then the output is extracted. There are various intermediate steps which makes it a successful model for the training purpose of pattern recognition. Based on the analysis and the previous database it learns and adapts for the future patterns to be recognized. In case of the distortions and the noisy pattern the model works the best because it takes into consideration the mathematical model of conditional probability into action. Depending upon the model is supervised or unsupervised the model statistical changes the form. The supervised model is solved by the statistical model in terms of discriminant analysis and the unsupervised is solved as the principal component analysis. Discriminant analysis is more efficient in terms to principal component analysis in time accuracy and time underwent.

2. Structural or Syntactical Model

It involves more complex images and patterns that can recognized by the pattern model than the statistical model. The word structural model is named as such because the pattern recognition is done by the means of a hierarchy that is a tree formation which is further divided into sub patterns and then the analysis is done. The model carried out the recognition techniques using two simple procedures. They are:

- a. Syntax analysis
- b. Structure Comparison

The recognition of complex objects requires a hierarchy therefore this pattern is selected. A simpler sub patterns makes up a complex pattern. The model is also called as syntactic model due to the sub patterns how they are formed the grammar behind that and the attempts to recognize the final object from the sub patterns and their associated languages. The structural description is called the primitives and the language description of the rules of the language is called the pattern description language. Increased set of pattern languages increase the complexity of the syntax analysis system. This model is widely used for the shape analysis and the texture formations of contours and the patterns that have structural value. A hierarchical structural model is used where there are more than sub models that are used like 2dimensional math problems, chromosomes and fingerprint has to be detected.

3. Template matching model

One of the easiest and well renowned technique is the template matching method. It generally compares at vast the pixels, curves and the image also. The image prototype is already present the basic comparison is carried between the sample provided and the sample to be matched taking into consideration the image rotations, scaling and the variations that a sample can undergo. The human brain remembers a face even if it turns left or right similarly it takes into all possible changes that a sample can withheld and forms a pattern matching accordingly. This method is not suitable for large images because that will have a lot of implementations and it can't work well with the distorted samples. It matches with the template that has been fed already. The better the database the excellent the recognition and matching.

4. Neural network model

Neural network comes from the term neurons in the human body. There millions of nerves and sub nerves connected to each other and functioning parallel uninterrupted and distinguished. Similarly here the model assumes the

neuron like connectivity found in humans and connects the units and the subunits which are interconnected simultaneously and most importantly parallel. Usually the neural network is called the artificial neural network. The human brain learning is a continuous process similarly the model has a database and it follows an adaptive learning method just like humans. It learns the complex relationships between the samples and the approach to follows. The number of neurons increase the better clarity of the samples at a short interval of time. Similar to the statistical model.

5. Fuzzy Set Model

The thinking of a human being was studied for various years before developing this model. The human brain how it forms a pattern is yet unknown but the likelihood how it forms a pattern and answers to some mystical questions is fuzzy that is it is not fixed. It varies sometimes it is a thing and at different it is different so it quite unpredictable based on the human nature this model is developed which also occupies a place for the unpredictable intentions and variations that are formed. So the fuzzy sets are developed. It majorly categories two concepts generalization and the abstraction.

III. IMPLEMENTATION

We the authors carried out various works and research based on the pattern recognition algorithms that are already used and the techniques that are used recently and the models that have been there since a long time. Out of our observations we came to a point where we have obtained certain results such as no model or a technique is self-sufficient for all the universal problems and their solutions. We have created a probability of using two or more models together and then trying to find out the result and then it showed perfect result as compared to be dependent on one and only model fully. Any model as a stand-alone model is sufficient until its own domain only but when it comes to a wholesome explanation of the probable answers and the desired output we need to find out a model which is applicable to all. Our model which is AMALGAMATION MODEL. The model carries out the advantages of each and every model in particular and avoids the disadvantages by differentiation and mathematical equations. A well-organized algorithm is implemented that does the functioning accordingly. Statistical model is used for the distortions of noise and pattern matching which is simpler. Structural model is best suitable for the contour matching of images. Template model is best suitable for the already present templates and sample. Fuzzy set model is based on the artificial neuron model .In the amalgamation model the algorithm steps are as follows:

1. Create a probable database for which the pattern matching may occur in future.
2. Limit the area of matching to specific area from a wide selection.
3. Feed the variations which finds the result even if there are differences.
4. Eliminate the noise and decode the pattern
5. Check the grammar and the language
6. Add the grammar to the dictionary
7. Give the desired pattern matching.

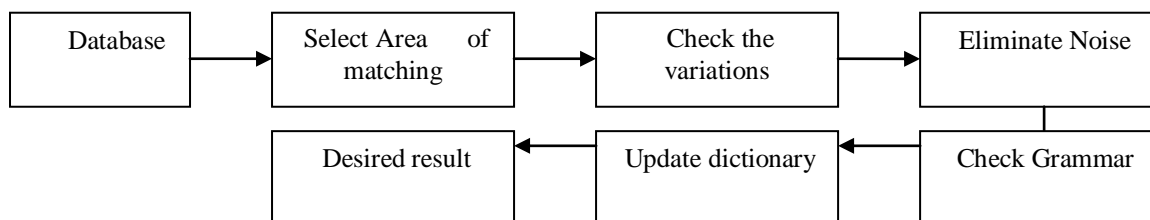


Fig 6: Schematic approach of the algorithm: AMALGAMATION MODEL

A) Goal of Pattern Recognition

Separate the sample from the mixture of samples.

Eliminate the noise and the distortion from the sample.

Out of all the outputs received sense the one which is more applicable.

IV. APPLICATION OF PATTERN RECOGNITION

Pattern recognition has gained importance in the recent past widely. We have seen its effects and impact and usefulness almost in each and every field of technology. Some of the applications of the pattern recognition are as listed below:

Machine learning, mathematics, computer science, biology, searching algorithms, biometrics and many complex unsolved problems can be easily solved by the pattern recognition. It has also gained a remarkable name in the field of medicines in cancer detection for an example the cells can be found out by the grading tissue pattern method and from medical to the land cover classification using satellite data. It is also used in the grouping and the ungrouping method used in the satellite data.

V. CONCLUSION

Pattern recognition plays an important role in our lives. With the increasing things in each facet of life it has become very difficult to remember all of them and find the pattern out of them we require some or other thing as intelligent as human and reliably quick. For that we have is artificial intelligence a wider field which is shortened and made into terms of pattern recognition. Pattern recognition has various techniques which makes it easier to detect and match patterns from the biometrics to space related queries. Giving a perfect accurate answer which was just so unimaginable. The authors have a keen interest in the same and have tried to represent the work which is already present by comparison of wide number of research and also presented a piece of work which we have analyzed and correlated facts for the complex decision making problems into the small desired output result.

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