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Image Processing: An Application of Machine Learning

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Abstract- In the current scenario of the data world, the data holds significant information if processed correctly. The data can be in the form of images which can prove to be a boon in deriving the useful insights from it in order to get the knowledge of things at an early stage itself. But the matter of concern is deriving the information from the images will be a tedious task for human beings and would incur a heavy cost and time. So, an easy and cheaper technique is to teach a machine efficiently to do the task for us. The concept of using Machines to do human tasks is known as Machine Learning. In this paper, I present various literature reviews regarding image processing in Machine learning and how image processing has helped in identifying the issues at early stages so that they can be resolved easily without causing much harm. Also, image processing has been a helpful tool in computer vision.

Keywords- Machine learning, image processing, classifier,segmentation,clustering.

I. INTRODUCTION

Machine learning is changing the world today by introducing a wide range of applications and revolutionizing every sector like Security, Healthcare, Transportation, etc. It is a trending technology in the 21st century and one famous application is Image Processing. Images play an important role in everyday life because humans respond to images more quickly as compared to the text. Millions of images are captured every minute because of digital technologies.

Image Processing is a method to process the images and extract useful information from them like we use detecting plant disease, human body imperfection, face recognition, etc. Hence machine learning comes into play to predict the outcome of the image by using different types of algorithms.

Image processing is the process in which initially the picture is captured which acts as the input for the process. Then the picture is processed by dividing it into smaller bits usually called image segmentation and morphology tasks for the transformations. Then the feature extraction is done to select the useful insights and then the classification algorithms are applied for the categorization of the outputs. Such a procedure helps us to detect many things at an early stage which can be useful for future issues.

II. LITERATURE REVIEW

Identify the various image processing applications in data to day life and how they are helping in changing the world. Some of the top listed applications are listed below:-

Vijai Singh [1] had presented various methodologies for the detection of diseases in plants at an early stage and how beneficial it is for agricultural productivity. The author has emphasised the need for automatic detection of plant diseases by noticing the symptoms on the leaves of plants as it is more efficient and cheaper than the usual methods. The basic algorithm used for this purpose is the genetic algorithm which is responsible to solve the problem for an optimal solution.

The author presented the image segmentation process for correctly segmenting the images of leaves in order to identify the symptoms based on colour or segments of the image. Also, the paper includes analysis of various algorithms according to the objectives of various authors with their goals and future aspects in detecting the plant diseases. The author also proposed an algorithm for image recognition and the segmentation procedure in which preprocessing of the image is done in order to find the useful segments using the genetic algorithm and the clustering technique is applied for the detection.

The accuracy of classification obtained was 97.6 as a result of using this technique received was different classification algorithms that are used for auto-detection leaf disease. We can also use artificial neural networks, Bayesian classifiers to improve the recognition process. The method used not only detected the disease but also classified the plant disease. Therefore, we can say that instead of using the laborious method of using the experts team to detect the diseases by naked eye we can use the automatic detection method which can be done more easily by using different techniques in a cheaper way.

Paul Viola and Mich ael Jones [2], in their paper, presented machine learning algorithms for object detection at higher conversion rates. The author

completely focused on face detection at 15 frames per second and primarily focused on the information available in the grayscale image but also included another source of information like pixel colour, auxiliary information, to achieve a higher success rate. The author focused on three steps.

Firstly, he introduced the internal image concept for higher feature evaluation in which an internal image is extracted from an image by using very few operations per pixel. Internal image is important for the model because a raw image will not work straight with the detection system. Secondly, feature selection is very important for any model building where he used a classifier which is Adaboost.

To classify the object fastly, the author used Adaboost to exclude the frequent occurrences of features and primarily focus on the small number of critical features. In Adaboost, weak classified points depend only on the single feature, and at each stage of the algorithm process which classifies the new weak learner in order to select the weak classified points. Adaboost is an effective boasting technique that will be used for the dataset which has low bias and high variance.

Lastly, the author has used a more advanced classifier "cascade" which will increase the conversion rate by blurring the background of the image and can focus only on the main part of the image. Cascade came into action to decrease the false-negative rate which is a Type 2 error. Generally, in face detection, we encountered 40 % false positive and 1 % false- negative but the author wants to reduce both the errors.

The author used a cascade classifier methodology to detect the face from the upright view. The training model consists of 4916 hand-labelled faces with a resolution of 24 by 24 pixels. Faces were extracted from the raw downloaded images. In this, the nonfaces, 9544 images are used to train the model. The first five features in layers are 1, 10, 25, 25 and 50 features respectively and other layers have more features. Cascade was trained with 4916 faces and 10000 non-faces by using the AdaBoost classifier.

Initially, non-face training points were randomly collected from a set of 9544 images, and then these non-face images were used to train the model and the results were fed to the subsequent layers by using the cascade methodology. Then the author collected the false positives and then worked further to reduce the false positives.

Finally, the author has solved the problem of face detection under extreme conditions by using the cascade technique which reduced the time and gave more accurate results as compared to other techniques.
In their paper **"Multi-Classification of Brain Tumor", Nandita Goyal and Dr. Bharti Sharma [3].** The authors have relied on the importance of images in the clinical fields as they help to identify a minute imperfection in the human body such as the CT scan and the MRIs. The authors have presented the study on how image processing has proved to be a boon while dealing with a very brutal imperfection in the cerebrum of human beings known as Brain Tumour. It is the situation when the cells grow unevenly in the human cerebrum.

Therefore, the authors have used an image processing technique to deal with the situation which includes the steps as follows - MRI Image is an input which is then pre-processed to identify the useful insights and then the image is segmented into smaller bits which help to understand the advanced structure. Feature extraction follows the process of image segmentation, in which the non-essential features are discarded, which in turn is followed by applying the classification algorithm to classify the tumour type. The authors have used the K-means algorithm for the classification purpose. Also they have targeted the importance of picture division as a part of the process which actually needs to be handled with proper attention.

The picture division process is the rearrangement and the changing of the actual arrangement of the picture portray, then the morphological tasks are performed for the proper transformation of the picture in order to achieve the goal of dispensing the imperfections. The essential features are extracted for the edge detection and hence the major step of image pre-processing is achieved of edge conservation. The authors have presented the various methods of image segmentation along with their accuracies such as Seed region growing with 92.5%, Threshold segmentation with 91%, etc.

Therefore, using the technique of MRI images, it is possible to detect the Brain Tumor at an early stage and this procedure can be expertized by following the major four steps of image processing without committing any mistake. Hence, the processing of clinical images can prove to be an early indicator for the brutal imperfections which can then be corrected at an early stage and be a saviour of life.

The V.V.D.Shah [4] has emphasized the use of image processing in the defence system of the country. The author has presented a study on remotely sensed images' role in moving the army towards remote sensing technology. One use can be to sensing the enemy in the native field using the satellite another use is verifying the arms from the images. The remote sensing technology works in the following steps. The first step is data acquisition in which information is transferred to earth after the data is received using the photographic data is generated. The pictures are resembled according to the target points in the image then the process of classification can be performed it includes the categorization, partitioning, etc and the fragmentation is

basically the supervised and unsupervised learning. Many algorithms can be used for this process it is basically the image understanding.

One application of image processing can be considered an autonomous vehicle; it considers the modular computer control system and hence the verification depends completely on the image processing in order to achieve the scene interpretation. Therefore, the author has concluded the importance of image processing not only with its military application but also in the field of computer vision.

Olivier Lezoray, Christophe Charrier, Hubert Cardot, and Sebastien Lef evre [5] have presented how machine learning is used in Image Processing. The primary purpose of the author is to increase awareness regarding image processing by using machine learning algorithms. The first step is to identify the issue which you want to detect like image processing used in vehicle detection in which a special issue is vehicle detection. The next step is image processing in which the author has applied the different machine learning algorithms to extract the information from the raw image.

Further Multi-Source analysis comes in the picture in which extract the important features from images that have more weightage in image processing. Like blur the background of the image to identify the image clearly. Lastly, the author introduced morphological processing which is used for segmentation and compression. The author has stated the fourth step on how to process the image and extract useful information from it.

III. CONCLUSION

Machine learning has proved to be a useful methodology to deal with real-world problems and handle them at very ease. Image processing is a vital area of machine learning which could be used for the better cause of well being and in other fields as well like computer vision. If the data is processed with care and proper understanding machine learning can be useful for the best output from the raw data such as images and such insights can be used for further predictions in order to make decisions in a better way for efficient and useful results.

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