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Facial Expression Detection Using Machine learning: A Review

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***Abstract*—In the present era, identifying the objects or expression is one of the most popular techniques automatically. Due to technical advancement, recognition of facial expression in static images and videos are the quite demanding area of the research and innovation. The government of different organization wants to detect humans and their expression for security and surveillance. Machine learning is one of the techniques used by the researchers to identify the facial expression. In this paper, we will find the human facial expression recognition using the OpenCV, Python and through the concepts of Machine Learning. Studies based on machine learning for the detection and identification of facial emotion is highly accurate and capable enough for executing in time for the real-time applications correct.**

***Keywords*—Machine Learning, Facial Expression.**

I. INTRODUCTION

Machine Learning, the discipline and application of algorithms that seem sensible of data, maybe the most fascinating subject of the computer sciences! We are living in an age group where data come in abundance. By using self-learning algorithms from the field of machine learning, this data can be turned into knowledge by us. Library for facial expression is now potent and efficient. This research has been a much better time to break probably into the machine learning field and figure out how to use powerful algorithms to track patterns in data and help to make predictions about upcoming events.

Face detection works as an object detection where it identifies the locations of human features from an input image. We know that object detection is different from the object recognition. In the detection process, it detects the particular object in an input image whereas in the object recognition involves the category and position of the required purpose. Face and facial component detection can be possible with the help of classifiers. As the name suggests, a classifier can classify the detected things into particular categories. In the detection process, a classifier is an algorithm which uses to decide that an input image contains a human face or not. For this perspective, a classifier needs to be programmed on thousands of images with and without human faces. In our work, OpenCV is used for the experiment because two pre-trained face detection classifiers already exist in openCV, which are useful for the output. These two classifiers are Haar Classifier and Local Binary Pattern (LBP) classifier.

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II. CONCEPT AND METHODS

The machine learning approach is instrumental in solving a problem where writing algorithm is too complicated or have no algorithmic solution. Machine learning algorithms are typically uses for a wide range of learning problems such as classification, regression, clustering, similarity detection etc. Many applications used in the today's real-world are powered by machine learning. Applications such as personal assistants on mobile phones use the machine learning algorithms. To understand voice commands in natural languages are used. Also by using a smart reply feature, where the content of an email is scanned and appropriate responses are generated. E-commerce applications provide a recommendation for users based on previous purchases and spending habits. Nearly every industry would be impacted by machine learning, as most processes can be given automated that there is enough training data available. Machine learning algorithms mostly excel in tasks where there is a clear relationship between a set of inputs and outputs which can be modelled by training data.

Although machine learning is a rapidly improving field, there is as of now no notion of general intelligence of the form displayed by humans. This is because models trained on one task cannot generalize the knowledge gleaned to perform another job; that is, machine learning algorithms learn narrow verticals of functions. For example Spam detection, face recognition, natural language processing (NLP), and recommendation system to predict which alternatives a user would prefer.

A. Supervised Learning

Supervised learning algorithms are those machine learning algorithms which are trained with labelled examples. The central intuition to understand when, dealing with supervised learning algorithms is that they learn through the use of models that are clearly annotated to show them what they are supposed to learn. The algorithms, therefore, try to find a mapping representation from inputs to outputs using the labels as a guide. "Supervised" in the name of these types of algorithms, point to the fact that the labels or targets provide supervision throughout the learning process.

B. Classification

Classification comprises training and learning of algorithm to appropriately distinct examples into predefined groups or classes. The classes are usually chosen ahead of time by a human expert with domain knowledge in the field where the learning problem is posed. The examples that are used to train the model are clearly labelled to indicate the category they belong to. During training, the supervised learning algorithm uses the labels to guide its learning, and at test time, it is capable of correctly predicting the categories of new examples. A simplified model of classification is spam detection where an email is correctly identified to belong to one of two classes - spam or not spam. Depending on what is predicted, appropriate action can be taken, such as shifting spam emails to a spam folder while relevant emails are sent to a user's inbox.

C. Regression

Regression is a learning problem where the algorithm is interested in predicting a single real value number. Regression is used where a separate numeric entity is predicted. An example of regression would be predicting the age of a person given a profile picture or predicting the salary of an individual given information about the individual such as level of education, work experience, age, country of residence etc.

III. METHODOLOGY

Researchers use several techniques for facial detection. Two classifiers are used popularly known as Haar feature-based cascade classifiers, Viola-Joness classifiers and 'Cascade of Classifiers'.

A. Haar feature-based cascade classifiers

Image features are used to detect and recognize a particular object in an input image. For specific object detection, need to group or find specific features related to that object so that our system can define and recognize it properly. This entire thing helps when classifier works efficiently.

B. Viola-Joness classifiers

Viola-Joness classifiers normally for the object detection, recognition determination in the computer vision conscientiousness. Haar-cascade classifier engages a machine learning methodology for visual object recognition, which is capable of processing images rapidly, effectively and succeeding high discovery rates. This technique can attribute to three key motives:

In Viola-Jones approach for the 'Haar features' extraction, since for training the system, need to fill a huge amount of training data in the form of images which contains or not reused object for the detection. So the role of the classifier is to extract haar-like features from each input image. Actually, Haar-Like features are just like a convolution kernel. This kernel firstly detects the important or required features are present in an image. If it is not there, discard an input image else placed upon the image for further computation. Haar Like features are just like windows and are set upon images to compute a single feature.

'Adaboost' -This classification approach specifically used to enhance the accuracy of the classifier. When we work on the facial features, then we identify that not all the elements are useful to locate human face or detection of any object. So we need to find which features are important and valuable to get the object—this kind of mechanism where we need to find the best features which come under the Machine Learning Part. In machine learning, Adaboost classifier extracts the best features from the features pool, and this improves accuracy. Here it creates a robust classifier with the help of a linear combination of weak classifiers. This classifier drastically reduces the number of features. So for further process, recognition process will take less time for the same.

'Cascade of Classifiers Viola-Jones Classifier works faster than the other because it uses a cascading of the classifiers. Since cascading contains the number of stages with the particular classifier, so it performs effectively to get the output. Simultaneously it overcomes the issue that all the features need to apply once on the windows. This classifier, groups of features and put them into one window with particular classifier. Same we process applies on different windows. At last, we get the actual classification output of the input image.

For detecting a face, multi-scale functionality for the classification uses for the same. This functionality is used to plot a rectangle with the coordinates (x, y) around the detected object. This functionality works on two important parameters which need to be tuned according to the data.

IV. Conclusion

Machine learning is one of the techniques now used in most of the prediction and recognition techniques. Classification is one of the main approaches for facial expression recognition. The analysis and verification procedure of the facial expression recognition and its classification based on Machine learning. The study found the gap and the solution based on the review of machine learning and traditional recognition system. The research shows that detection and recognition phase plays an important role wherein the machine learning classification is verified automatically. The Classifiers trained machine learning forms the sensor of an exact image. By analyzing the distance function of a facial act unit on diverse feature graphs, the research founds the steady and dependable relationship between the graphs feature and the action units in the system synchronously, which further supports the theory of the classification theory of the machine learning proposed. This assumption has been verified in the expression classification problem, which can be inferred to be equally applicable to other issues.

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