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FACE DETECTION OF LATE COMERS

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ABSTRACT - "Face Detection of Late Comers" project is a face detection system using machine learning which is being developed to detect late comers in an organization. T To implement the proposed system, a data set of a few individual photos is stored onto the database for comparison. A video is captured from a surveillance camera and the human face detected in the video is subjected to a series of steps for feature extraction to form a feature vector. The aim of the project is to deploy a system in college to detect late coming students' image or video captured from a surveillance camera, extract the face features and match it with the data set features. The wide range of the camera, large varied data set and methods to handle blurred images enables to give better results. The concept of machine learning improves the accuracy with experience. The system is being developed in a way such that the accuracy is good. The concept of Deep learning and Neural Network is used to achieve this.

KEYWORDS – Residual Neural Network (ResNet), Support vector machine (SVC), artificial neural network (ANN).

I. INTRODUCTION

"Face detection of late comers" project is a face detection system using machine learning which is being developed to detect late comers in an organization. To implement the proposed system, a data set of a few individual photos is stored onto the database for comparison. A video is captured from a surveillance camera and the human faces are detected in the video is subjected to a series of steps for feature extraction to form a feature vector. Every feature in the feature vector is compared with the ones stored in the database. Once a match is detected for a face, a percentage prediction is made. If the percentage of the prediction is above a threshold value then, that individual is classified under the late comer's category. A database is maintained to keep track of the number of times an individual has been late to that organization. After 3 such detections, a warning message is sent to the person concerned for maintaining discipline. The system proposed can be used for safety purpose and as a disciplinary monitoring system in schools, colleges, universities and offices. The proposed system makes use of the concepts of machine learning and hence its accuracy increases with the increase in experience and time. The concept of Artificial Neural Network and Deep Learning is used to achieve the goal.

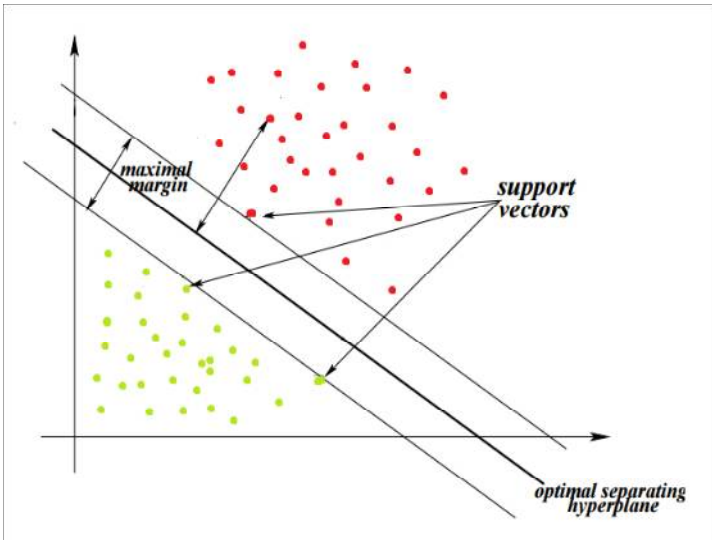
II. METHODOLOGY

ResNe the so-called Residual Neural is a novel architecture with "skip connections" and features heavy batch normalization. Such skip connections are also known as gated units or gated recurrent units and have a strong similarity to recent successful elements applied in RNNs. Thanks to this technique they were able to train a NN with 152 layers while still having lower complexity than VGG Net. It achieves a top-5 error rate of 3.57% which beats human-level performance on this dataset.

SVC

Support vector machine constructs a hyper-plane or set of hyper-planes in a high or infinite dimensional space, which can be used for classification, regression or other tasks. Intuitively, a good separation is achieved by the hyper-plane that has the largest distance to the nearest training data points of any class (so-called functional margin), since in general the larger the margin the lower the generalization error of the classifier.

"Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for either classification or regression challenges. However, it is mostly used in classification problems. In this algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, we perform classification by finding the hyper-plane that differentiate the two classes very well (look at the below snapshot).



III. SYSTEM ARCHITECTURE

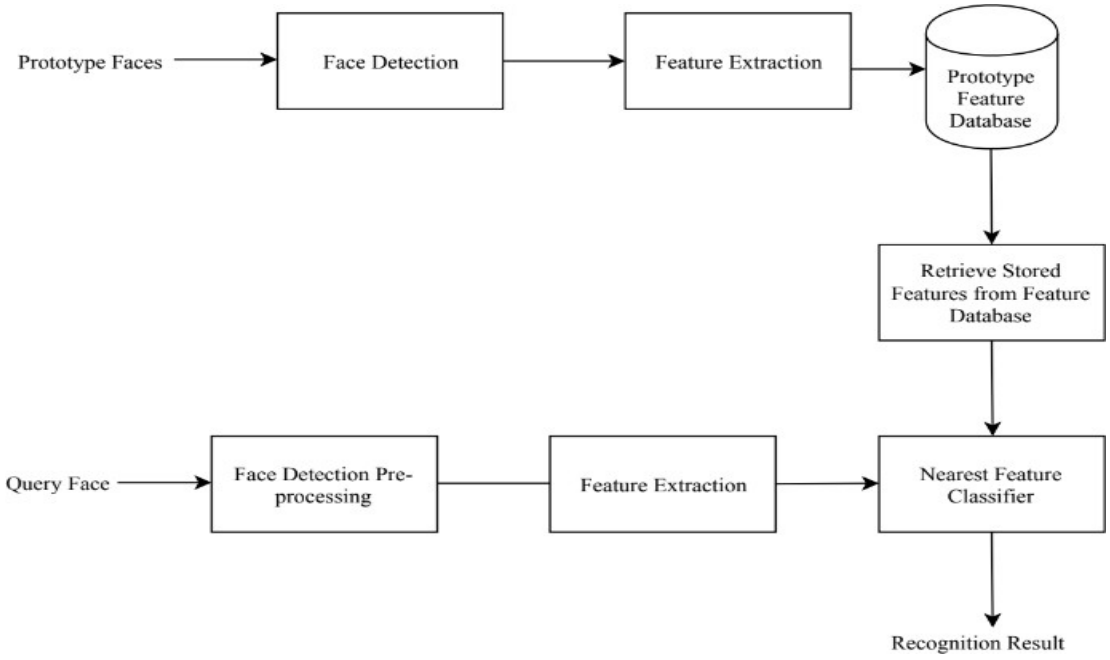


Fig 1: System architecture

Face detection and localization

The captured image can contain both the face of the person to recognize and possibly a background. Hence, first of all one must detect the presence or absence of the face in the captured image. If the image contains a face, its location is localized to extract it. Face detection and localization step is performed in two modules (recruitment and recognition).

Feature extraction

Feature extraction is the key step of the process because the performance of the whole system depends on it. In Feature extraction step also known as indexing or modeling, is extracted from the detected face image a characteristic vector (signature) that is sufficiently representative of a given face and which models the much more precise than the raw image departure. The new representation of the face must have both the uniqueness property for each person and the property of discrimination between different people.

Classification and decision

In classification and decision steps, the system must declare the identity of the person who appears before them without any a priori knowledge about it. To accomplish the task, the developer must affect the extracted feature of his face to a class from those learned. Each class is associated with an identity. Classification and decision steps are executed only in the recognition module.

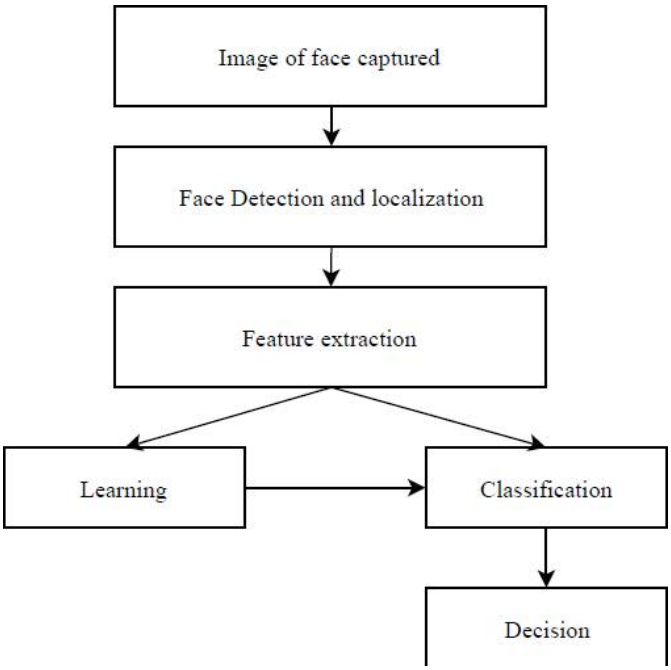


Fig 2: Classification model

1V. IMPLEMENTATION

Involves 5 steps namely,

1. Create embedding (128D) for the input dataset using the pre-trained models.
2. The embedding are used to train the classifier model. (SVM is used)
3. The recognizer model from above step is used to recognize the faces from the surveillance/web camera.
4. If the recognized students are classified as late then they are updated to the database.
5. The concerned person can login into user interface (a web page) to view the details.

The first step involves creating the Binary Large Object (BLOB) of the input data. Images are read from the local memory and are pre-processed by resizing. They are then converted into blobs. The BLOB for an image is shown in the below figure. All the input images are made to contain single faces in them thus allowing the face detector to localize the faces in the image easily.

An assumption that each image has only one face is made, so while bounding the face the largest probability is considered. To do the same argmax is used. Face features are detected using ResNet -a CNN network. From the BLOB of the image, face bounding are extracted and this is given as input to the pre-trained model (A embedding model called openface_nn4 with small2.v1 model) which generates 128D vector. These vectors are serialized and stored into the pickle file.

The embedding from the previous step are used as input to the Support Vector Classifier (SVC). And two serialized files are generated. One of which is a label encoder that contains the University Serial Number (USN) of the students that model can recognize. Another file contains the trained Linear Support Vector Machine (SVM) model. SVM is a machine learning model rather than a deep learning model and it is responsible for actual recognition of faces.

Once the label encoder and recognizer SVM models are created, frames are fetched from the surveillance/web camera and 128D vector for this frame is calculated and matched with the previously computed embedding. If the match is above certain confidence level only then the images are labeled.

If students are classified as late comers then, count is incremented in the database for each of those students. The concerned person can view the details of these students through the web interface and can take action accordingly

V. RESULTS

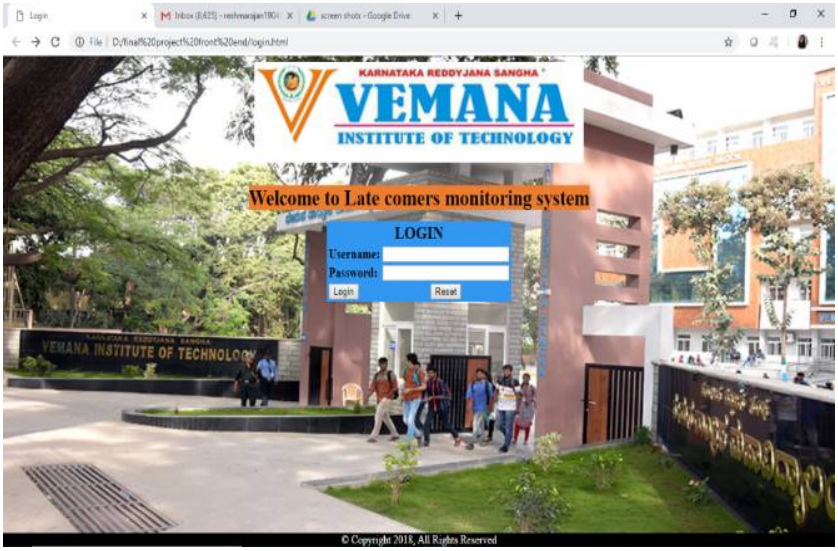


Fig 3: Initial login page

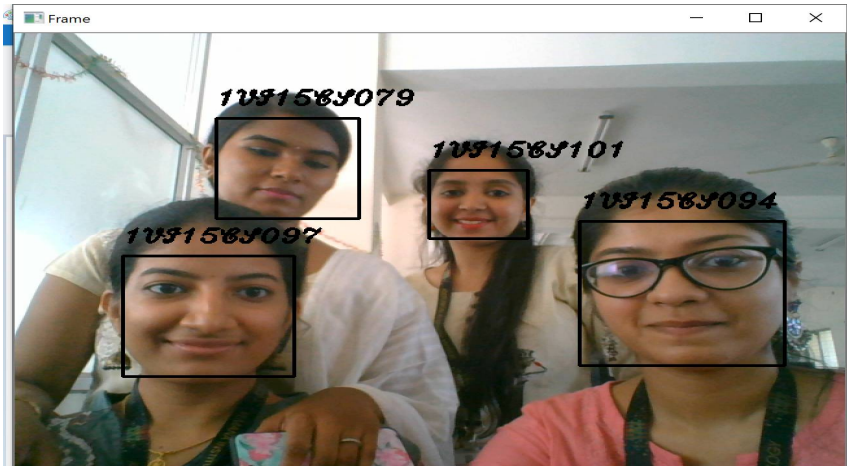


Fig 4: Face detection and recognition

VI. CONCLUSION

The "Face detection of late comers" project is being deployed in college to detect late comers captured from a surveillance camera, extract the face features and match it with the data set features. The wide range of the camera, large varied data set and methods to handle blurred images enables to give better results. Once a person's face has been detected with accuracy above the threshold value, a notification is sent to the concerned authority. The system can be used at educational institutions and offices to keep track of the late comers. The concept of machine learning improves the accuracy with experience.

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