Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 6.199

IJCSMC, Vol. 9, Issue. 3, March 2020, pg.244 – 247

Automated Attendance Management using OneShot Learning

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Abstract– In the current world, automation is everywhere. Companies and corporations choose automation because it is much more efficient and cheap in the longer duration. It also allows precious man power to be used for something much more productive than mundane tasks. One such task is the attendance system. At the start of every period at least 15 minutes is wasted in just taking attendance. My project aims at automating the attendance process using facial recognition and using minimal hardware. Facial recognition algorithms demand a large amount of processing power which might be impractical for a college to accommodate. Therefore the system will be deployed on the cloud. Another feature that stands out is the fact that my application will not require any camera as the students will be uploading their picture in an intranet portal. A customized portal is also provided for every teacher or staff where he or she can view the attendance of all the students of her class.

Keywords- Face detection, One shot learning, FaceNet, Scalable, Cloud, Convolutional Neural Network

I. INTRODUCTION

Attendance in colleges and universities have become a very important and integral routine. In every University almost all the class hour or session starts with the process of taking attendance. As explained earlier, the most common way of taking attendance is the manual process where the staff manually cross checks the student from using the register. This process is time consuming and is inefficient. This also takes a lot of time if there is a lot of students to be addressed. Further there is also the case of proxy which can happen when the teacher is dealing with a lot of students. Thus traditional process are time consuming, ineffective and unreliable as the time increases. While modern systems like bio-metrics have combated the unreliability factor, they still need hardware and are time consuming as the students need to take time in entering the biometric. This can be rectified by using facial recognition systems. The significant advantage that these systems have over bio-metrics is the fact that they are economically feasible and are not as intrusive as the former[1].While facial recognition is a very good method the significant disadvantage is the fact that they need to be trained frequently for a data-set that changes often as we are considering a

university. My paper aims at providing a system that tackles these problems while providing a scalable, reliable and flexible attendance management system that benefits the staff and the students.

II. LITERATURE REVIEW

Using facial recognition for attendance management is not a new idea. There are a number of systems proposed but they have their own problems and limitations.

A. *Facial recognition using Viola Jones*

This system proposes a facial recognition system that uses viola jones. It also explains that the system needs a very high tier webcam for better accuracy. This system is demands a lot of hardware for implementation and it can be used only for laboratories and exam halls as not all class sessions will happen with the students sitting in-front of a computer. Therefore this system cannot be implemented for an institution which is the main purpose of the paper while also being very expensive and hardware demanding. This system also uses traditional methods like Viola Jones which is old as modern methods like Convolutional Neural Networks are much more faster and accurate than this system[2].Thus the proposed system which uses a CNN to train the dataset will be much more effective, fast and accurate than this system.

B. *Attendance management system using Facenet*

This approach proposes deep learning to train the model and FaceNet for feature extraction and an SVM for classification of the images. This uses 'adam' optimizer and 'triplet loss' as loss function[3]. While Facenet is an excellent way of feature extraction this method also proposes the presence of a camera which might not be economically feasible for all educational institutions. It is similar to the previous model, i.e it is hardware intensive. This model also has a problem in implementing it in an educational institution as the dataset keeps changing and it will not be feasible for the institution to train the new dataset every time there is a new influx of students or when lateral entry happens in the second year of engineering. While this system was indeed an improvement on the viola jones based system it is still not economically feasible for education institutions with limited money and resource to implement this without a massive investment of money and resources upfront. Therefore this system fails when we consider educational institutions which cannot afford a lot of capital.

III. PROPOSED WORK

This paper projects solutions to almost all the problems above while trying to make it economically feasible and scalable as possible. The proposed attendance management system is designed in such a way that the students are required to send an image of themselves at a particular time through the intranet portal of the college. Proxy is prevented in this method as the portal is accessible only through the institution's intranet and time-stamps and IP addresses of the client is also used to prevent the same student uploading two different photos at the same time, while the time-stamp in the photo uploaded will make sure that the same image is not used twice to get attendance. The main reason for this approach is to make the system as economical as possible as it requires very little hardware for installation. Another major problem that we faced in the other models is the inconsistency of the number of students in an institution as the students keep changing every year. There is also the case of lateral entry in the educational institutions of India where there will be a very few students that will enter the engineering college during the second year. To have all the photos of the students used for training the dataset will require a lot of storage space and is again gonna be really expensive for the educational institution. The proposed system combats that by using one shot learning where only a single image of the person is stored in the database for verification. The system uses a pretrained successful implementation of the openface model in keras for training called OpenCv. This is a Keras implementation of FaceNet which is an excellent, proven framework which has been trained on a lot of datasets. This completely negates the need for training the dataset. All that is needed for the application is a single photo of the student. This system will also use OpenCv's Haar feature-based Cascade Classifiers for feature extraction and then the result is passed into the neural network. For calculating the similarity between two images we use or the cosine distance between the vectors.

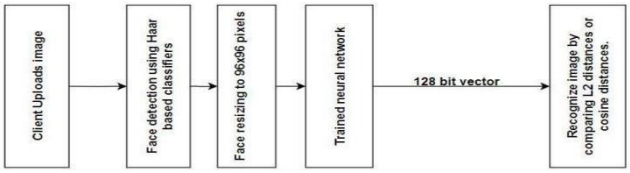

Fig 1 Workflow

The above figure describes the workflow of the system from the beginning till the end. The process starts with the student uploading his/her photos in an intranet portal which will serve as the input. The face detection in the photo uploaded by the student is implemented using Haar based classifiers which is then resized according to the requirements and is sent to the pre trained model. The model gives out a 128bit vector embedding which is then compared with the embedding in the database. To compare the embeddings, we use the L2 functions. The attendance is recorded if the resultant comparison is below a certain threshold.

IV. ARCHITECTURE DIAGRAM

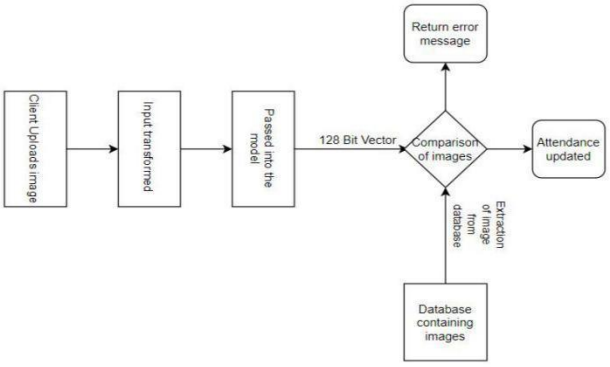

Fig 2 Architecture Diagram

The architecture diagram consists of the client side and the server side. In the client side, the client uploads the image to the server through a portal that can be accessed only through the college's intranet. This functionality will be available only for specific timings. These timings can be set by the staff of the respective college or institution. After the client has uploaded the image, the image is grayscaled and then transformed into the required size of the model. Now this is sent and the face detection is done through haar based classifiers and the vector model extracted from this picture is compared with the existing 128 bit vector model from the database. When they both have a distance less than the threshold limit, the attendance is given to the particular student. The staff can view the attendance of the entire class for a specific period and also the image the student used for the attendance purpose. This image will be deleted after 24 hours for keeping the memory requirements low. The whole system will be deployed on the cloud using Kubernetes as it can be easily scaled up or scaled down. This also combats the high traffic that the servers will face when students uploads their photos into the servers in a specified period. This is one of the major advantages of the system as it is economical, efficient and much more quicker than the rest of proposed models.

V. CONCLUSION

Attendance seems to be one of the most important and consistent activities in a classroom albeit being a task that does not need specialized knowledge to do so. It a simple task that can be automated very easily by a machine. The proposed system aims to achieve that. We have seen a number of systems already in market which can do this pretty easily but they have their own disadvantages. The proposed system covers all of the major issues that were faced by the current set of systems namely efficiency, accuracy, speed and economic feasibility. The main purpose of this system is to automate one of the most important parts of a classroom and benefit the teacher by giving more time to work with and reduce the task that can very easily be done by a machine.

VI. FUTURE SCOPE

In the future, the system's efficiency and accuracy can be greatly improved by using much more efficient algorithms. It can also use other neural networks, which while bringing in the necessity of training the data set, can give back in terms of better execution and reducing the number of data sets that are required to train on.it can also be improved to better recognize the face at low light conditions and also at obscure angles. The application side can be improved by giving the teacher more flexibility in terms of providing attendance for the students who were on duty and also a student side dashboard where it can show the attendance percentage for the respective student. It can also send automated messages to the student's phone number when the attendance percentage in a particular subject goes below the required percentage.

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