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Survey on Various Techniques of Attendance Marking and Attention Detection

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Abstract - In recent years, the educational system has seen a lot of improvement in the quality of education provided to the student, many new technology are introduced which make the learning simple and efficient. But still there are many teachers who are facing problems in their lectures because of attention deficiency of the students and also there is lot of wastage of time in marking the attendance using traditional methods. This paper describes different methods used for attendance marking and detection of level of attention paid in class by students using the computer system. Marking of attendance is still done by the traditional methods of education system such as teacher personally marking the attendance physically or students signing the attendance papers provided by the professors. This may lead to the mistakes which are done intentionally or unintentionally and also wastage of time allotted for lectures to the teachers. Also attention deficiency that is low level of attention and lack of focus is main problem faced by numerous amount of student which creates various kinds of problems for both students and teachers. This paper describes and compare various techniques used to marked the attendance and also check the attention level of students automatically

Key Words: Attendance, Attentiveness, Face Detection, Face recognition.

1. INTRODUCTION

Education system nowadays are facing many issues because of irregularity of the students in classrooms, and even if students are physically present in the classroom many times they are mentally elsewhere and not paying attention to the classes which are going on in front of them. This directly affects students in their performance. Human brains are constantly analyzing the situation around us and processing the information and responding to it accordingly. Each person reacts differently than other under same circumstances. Same stands for the students and teachers in the classrooms. Many times teachers cannot pay attention to each and every students while they are teaching. Many students remain unnoticed even if they are not paying attention in the classes. This also affects the quality of the lectures which are delivered by the teachers. There is also lot of time spend in marking of the attendance which is not relevant to the teaching and leads to wastage of teaching time. This results in poor quality of lectures, which ultimately affects the results in performance of both teachers and also of students.

In recent years, with the advancements of the technologies it is possible to solve the above problems. There are many methods such as using the biometric system or using the face detection system for marking the attendance of the students and also to check attention level of the students in the classroom. Research states that using such methods are much more efficient and much more reliable than the traditional system. Using such methods a lot of time is saved as compare to marking of attendance by traditional methods. Also because the systems are automated, the human interference in the process is none or very minimum therefore the quality and efficiency of the system is great and there is no chance of human error.

The systems which uses face detection technique to mark the attendance, data of facial features of student is stored in the database of the system. So after the student occupy their seats in the class then the system will capture the photos of the classroom and then using the programmed algorithms it will recognize the facial features present in that image. After recognizing the facial features, system will check the database and it will compare the both features. After the comparison, the students whose features are matched will be marked present and others are marked absent. Similarly in biometric system the biometric information of the person is stored in machine database such as photo, fingerprints and iris scan. Person just have to give their biometric and their attendance wil be marked automatically by the system. This will save the time spent in the marking of attendance and can be utilize for the study related activities. There are also system present which measures the attention level of the students. In such system some algorithm uses only the 2-D images while some algorithm also uses the sensors such as Kinect One sensors, sensors used for eyeball tracking and sensors used for mapping the brainwaves to determine the attention level of the students present in the classroom.

2. LITERATURE SURVEY

Author presents the system which uses different kind of techniques and algorithm to detect the facial features and mark the attendance[1]. The system SAMS(Smart Attendance Monitoring System) uses the video feed as a input. After receiving the input system various operations such as face detection, facial features extraction, normalization of facial features and quality score assignment are performed. In face detection process author uses the ideas presented in and then uses the correlation tracker from dlib library to keep track of face from frame to frame[2]. After that using different formulas Normalized Head Pose Parameter (NHP), Normalized Sharpness (NS), Normalized Resolution (NR) and Normalized Brightness (NB) is calculated. After that the Face Quality Assessment (FQA) is calculated using the formula given below:

FQA= NHP×17+ NS×9+NB×6+NR×8

Higher the value of FQA better quality of the face will be to store in face log. After capturing the image it further needed to represent in the form of facial features representation. Hence to obtain distinct features from the face image, Convolution Neural Network (CNN) also know as deep learning is used. SAMS is designed to register the face of the individual and then network train it for the automatic future use of the system in marking the attendance. And the whole process will be done in ongoing class without disturbing it.

Author gives the approach for marking the attendance using face detection system which uses Discrete Wavelet Transforms (DWT) and Discrete Cosine Transformation (DCT) to extract the facial features[3]. DWT uses different types of filter and used to eliminate blockiness which is present in the input image. DCT is generated from Discrete Fourier Transform (DFT). There is no correlation between the DCT coefficient. So as a result of that each DCT coefficient can be calculate independently. It also has a properties such as energy compaction, Domain scaling, separability and scaling. After extracting the facial features using DWT and DCT Radial Basis Function Network (RBFN) is used to classification of the facial objects. RBFN is created from Multi-Layer Perceptron Network (MLPN) and calculates the results using the weight of the input. Weights from the hidden to output layer is calculated from the weights of the input to hidden layer. The efficiency of the system is determined by the result which are correctly calculated or the faces which are correctly recognize. In the proposed system of [3] the success rate is 82%. Out of 148 images of the 16 different students system can recognize 121 students correctly. So the system is quite accurate in recognition and marking the attendance of the students.

Author presents the approach of marking the attendance using the smartphone cameras. It presents the simple method to use with the simple algorithm and with the minimum use of hardware as only smartphone camera is used[4]. This system is divided into the number of different methods as described ahead. First step is to enroll the data of the students in the database. There are two different database created, first is enrolment database and second is query database. In first step the information of the students is stored in the enrolment database such as biometrics of the students, images with different angles and the facial features of the student. In second step the image of the classroom is captured. Sometimes only one image is sufficient but sometimes because of low quality of the image due to smartphone camera resolution or sometimes camera don't cover the entire class if it is big then in that case multiple images needed to capture. In next step the faces which are present in the image are detected and the facial features are extracted. After detecting the faces and the facial features the query database is formed in the fourth step. And in the last step the images are matched in both database to check the number of students present in the classroom. In this method simple matching algorithm based on cosine similarity is used to match the faces. But in this method instead of regular way of matching of query database to enrolment database the reverse approach is used. And enrolment database is checked with the query database to checked if the faces are present. If the facial features are matched in both database then the student is marked present else marked absent. And also to implement the whole system one of the deep learning method FaceNet is used. This algorithm produces the result with the high quality. Using the number of images captures in 25 sessions in 17 weeks the accuracy up to 95% to 97% is achieved after using the FaceNet algorithm.

Paper [5] gives the approach of marking the attendance by using the ibeacon System which make use of the BLE(Bluetooth Low Energy) or Bluetooth 4.0. Using Bluetooth Devices ibeacon identifies the location of the student and marked the attendance accordingly. In this system students have to registered for a specific course according to norms of the college or school. School or colleges have to create the smart system using ibeacon and user interface is created using PHP and java android programming language. Student will receive a notification about the lectures. After clicking on student will get the information about the class details and teachers or professors will get notification about the students attending the class. Attendance will marked only and only if the student is present in the range of ibeacon present in the classroom. One student can only attend one class at the time and students cannot attend the classes for which they are not registered. If students attend such classes then the attendance will not be considered or marked.

Author gives such approach to check the attention level of the student in classroom[6]. This system make use of the 2D and 3D features obtained by Kinect one sensor and with different machine learning or deep learning algorithm by mapping various kinds of trees and their confusion matrices. There are many points which are include in checking the attention level of the student present in the class and various feature are extracted from the images captured by Kinect one sensor. Features such as facial features head posture, body posture and facial gaze point are extracted by making use of Kinect one sensor. Then using this extracted features various trees are mapped and after that by using the confusion matrix of the trees the attention level of the student or user is determined. The result created by the system are very positive. After using 780 different samples Linear discriminant classifier and Simple Tree classifier accuracy achieved by the system is around 75%. And the best accuracy is provided by bagged tree. It achieves the accuracy up to 85% to 86.9%.

Author gives another such method to determine the attention level of the students during the classes[7]. This paper provides the method which make use of minimum amount of the hardware instead of using different sensors mentioned in paper [6]. It only requires the hardware camera for the system to capture the image. After capturing the images it uses different types of Convolution Neural Network (CNN) to achieve the desired results. This system is divided into different number of models and each model uses different methods, algorithm or CNN to implement the assigned task. First model is self-calibration of the camera. In this model camera calibrates itself according to the environment in which it present. It make use of histogram of luminance to adjust the camera according to the intensity of the light. Next model is divided in two parts face detection and face recognition. Face detection method uses multi-task cascade convolution neural network (MTCNN) to detect the face. MTCNN works in 3 different stage to ensure the accuracy of the system. Face recognition method uses ResNet-101 layers CNN which is trained on around 65 million samples with use of Labelled Faces in the Wild (LFW) database. Due to high number of sample present in training database the accuracy of the system is around 98.87% which is almost a perfect result and the really efficient system. Next model is for features and pose extraction. This model make use of multi-person 2D pose estimation (OpenPose) to determine the head and body postures and different features of head and body. In this model OpenPose makes use of MPII Multi-Person database test and determine different features of the body with the precision of 75% to 80%. In such a way this system makes use of different algorithms and CNN to determine the attention level of the student or user present in the classroom.

Author presents the another way to check the attention level of students in classroom[8]. It make use of the wearable devices to check and gather different parameters required for the system. System makes use of moto 360 smartwatch which contains the sensors like 3-axis accelerometer, PPG (photoplethysmographic) sensor and it also includes gyroscope. The whole process is basically divided into 5 different sessions. First one is writing detection. This detects the writing done by the students and amount of notes taken by the students which determines the amount of concentration paid by the student in the lecture. It also records the way of writing and the speed of writing of the students. Next session contains the processing raw data without containing the writing movements. Because there is lot amount of noise present in the writing methods module doesn't consider that information. Instead it make use of a information gathered by PPG to check the motion artefact and the time varying confidence. It also detect the heart rate and calculate SDANN(standard deviation of means of NN intervals) and SDNNIDX(mean of standard deviations of NN intervals). In next session the normalization of the pre-processed data and collected data is done and it forward to next step of feature selection. Feature selection step makes use of modified algorithm to determine the best subset of the features. Last step is classification and it uses different types of supervised algorithms for classification. It uses decision tree, nearest neighbor, Naive Bayes and support vector machine algorithm for classification. And it also uses Scikit-learn library for purpose of classification task. After testing the wearable devices on 30 students the system produce the result with accuracy around 95.79% to 98.99%. It gives very accurate results.

Author present another method to measure the attention level of student in large classrooms[9]. In this paper author uses already existing system Avabodhaka which is a e-learning tutoring system explain in [10]. In this system it make use of the query asked by the and recognize the approx. attention level. But it needs manual monitoring and teachers also have to check the updates of the system manually. In [9] author uses the same method with more improvements in it. Students asked the queries and the response of the students noted in three different categories known as LIKE, KNOW-IT and CONFUSED. Depending on the number of responses the attention of the students is decided and it again divided into three categories of good(G), medium(M) and low(L). Also there is second approach in which teacher asks the queries with one word answers and depend on answers it determine the understanding of the students and depend on that the attention level is determine. This system generates the result with 22.22% deviation in the accuracy of the system.

Author presents the approach which uses the the heart rate viability, brain waves and facial features together to check the attention level of the student in classroom[11]. System is divided into four parts. First is data acquisition and in this part the heart rate, brain waves and facial features are collected using the respective sensor. Heart rate is collected using GROVE EAR CLIP heart rate sensor, while facial features are captured using the PC webcams. And Emotiv Epoc device is

used to measure the brain waves of the person. Next step is Pre-processing of the gathered data. Different filters are applied and the unwanted data is removed. In next step features are extracted from the raw data gathered and pre-processed. After extracting the features I the final step the various classification algorithms are used. The algorithms used are SVM and the classification technique such as Naive Bayes, Random Forest and Backpropagation Neural Network models are used in classification. For the result different technique gives different accuracies. SVM gives 71% accuracy, Naive Bayes classifier gives 68% accuracy, neural network gives 65% accuracy and Random Forest gives 94% accuracy.

Author gives the Classroom Attentiveness Classification Tool (ClassACT)[12]. It is smart system used to monitor the attentiveness and academic dishonesty in the students. System collects the information using different types of hardware such as sensors and webcams or camera. After collecting the information two types of processing is done on data. First is image processing and second is sound processing. After the processing in next step data aggregator reads each and every reading and in creates the matrix which will be readable by the classification algorithm. Three different classification algorithms are used. First is support vector machine (SVM), second is proximal support vector machine (PSVM) and the third algorithm is multilayer perceptron (MLP). There are two types of result in the system. Firstly the training results are as follow: SVM: 95.83%, PSVM: 68.75%, MLP: 70.83%.And the testing results are: SVM: 87.5%, PSVM: 75% accuracy.

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Author [13] presents the approach which uses the head-motion of a body to predict student's attention during the class. They have tried to mimic large-scale gaze tracking using this approach. First from a video-stream from the class, head poses are extracted of all the student using Computer vision techniques. After the extraction Support Vector Machines (SVM) classifiers is used to train the model .The result shows drops in attention with decreased intensity of head movement. And head travel became significant when testing the potential to measure the change in behaviour of a student in classroom.

Author [14] present the idea of using EEG signal to measure the attentiveness and inattentiveness of the student during studying. Whether students are attentive or inattentive during instruction is determined by observing their EEG signals. Two significant scenarios were developed for the study to measure the attentiveness of the student. EEG data of each subject are collected using mobile sensor present on the subject. After that various features are extracted from the collected data. Further support vector machine (SVM) classifier are used to calculate and analyze the features extracted to train the model and to identify the combination of features that best indicates whether students are attentive. The result shows accuracy of up to 76.82%.

Author [15] gives a system using Technology-Enhanced Learning (TEL) aimed at capturing and measuring the level of the students' attentiveness in real scenarios and dynamically provide recommendations to the teacher. The on-line environments are used to give instant feedback from online self-assessment through multiple choice question formats. The students are also offered automatically marked self-assessment exercises to ascertain skill/knowledge levels and learning needs before engaging with course content. The raw data is generated based on the feedback and assessment. The raw data is then feed to the TEL based system for the analysis purpose. After that the data is classified and analyze the behavioral pattern and the final outcome is presented to the teacher.

Author [16] gives a system which uses different number of wearable devices which are connected using the raspberry pie and different sensors to check the behaviour and the attention level of students. Main three module presents are head motion, pen motion and visual focus module combined with the attention interface gives astonishing results. If their is movements of head then it is detected by the head motion module and it checks the positioning of the head for whether the head posture is correct or not. If student is looking down then head motion modules is deactivated and pen motion module is activated. And depending on the motion of the pen the attention level of student is cheeped. Last module is visual focus module which checks for the focus of the eyes and the line of sight. Using the visual focus data system determines the attention and behaviour of the student. After collecting all parameters two different approach are used to perfectly estimate the attention level and the behaviour of the student present in the class. Using this methods head motion module gives accuracy around 87%- 88%. While pen motion module gives 97.27%-97.6% efficiency.

Author [17] present three different modules as follow. First is face recognition module, second is motion analysis module and the last on is behavioural analysis module. It uses IoT in the system o improve the performance of the hardware. In face recognition module combines two different methods which are eigenfaces [18] and fisherfaces [19] and combines them to improve the performance of the system. In motion analysis module cascade classifier and histogram of oriented gradients (HOG) [15] are train to check the upper body motion. It consist of three different functions which are body detection, motion detection and the motion recognition. For motion tracking system also uses feature-based tracking with lucas-kanade sparse optical flow [20] [21]. In behavioural analysis module system checks for level of presence in class, attendance status, concentration level of student and overall concentration of the students in classroom using different formulas. This method gives accuracy around 79.39% to 81.94%, which is quite efficient way to use.

3. CONCLUSION

The existing study provides the insight of various techniques to mark the attendance and also to check the attention level of the students in the classroom. This methods are far better than traditional methods and they are more efficient and time saving. Which results in smooth, proper and efficient conduct of class so the performance of both students and teacher will be improved. Based on the existing study new methods with enhanced software and reduced hardware can be implemented.

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