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Effective Classroom Learning Using Support Vector Machine Algorithm

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ABSTRACT: Attention is the first step in learning process. One cannot understand, learn or remember when there is no proper attention. Usually, it is easy for most people to pay attention to things that are interesting or exciting to him. To form an interesting lecture it depends on the instructor strategies. Sometimes, many learners find it difficult to understand the instructor teaching method which creates an uninteresting lecture, this affects their performance. Moreover, for instructor it is hard to know that the learners are understanding the concepts in much clarity. Also, learners struggle to analyze their overall concentration during a lecture. The main objective is to propose a system which recognizes the attention of the learners during the lecture and gives the estimation of the attention-level to the instructor as a feedback. Based on the feedback provided by the system the instructor will form new strategies which are effective and convenient for learners to understand. Further, to assess learners by keeping a track on individual attention so that one can improve himself in the weak areas. The model uses a video capturing device to obtain data which includes facial emotions, gaze detection and body posture. Machine learning algorithm is used to classify the student as attentive or inattentive. The model can be used to enhance instructor teaching strategies at all levels and can help them in implementing a personalised learning system.

KEYWORDS: Machine learning, attentiveness, instructor strategies.

I. INTRODUCTION

Attention is the root in learning process. Attention is not a mental power but it is a mental process. With attention, other mental processes are possible such as imagination, learning and thinking, etc. To think about anything one has to concentrate his attention on it completely. Attention depends upon the interest. If one's interest is absent then there cannot be complete attention towards object. Attention keeps on changing, it is continuous. With the help of attention one can create readiness for doing a work and it increases more clarity of the object. Attention plays an important role in teaching learning process. It helps learners to grasp things better and faster. Without it, learning a skill or doing any work is ineffective. If any learner learns any skills or lessons with good attention, it lasts longer.

Automated learning analytics is becoming an important asset in the educational community, that requires an effective system to monitor learning process and provides feedback to the instructors. Recently, there is a great advancement in the technology of visual sensor and computer vision that enabled automated monitoring of behaviour and affective states of learners at different level from university level to pre-school level. The affective states of students such as interested, tired and confused automatically extracted from facial expressions and attention state of student is computed from different visual cues, such as, face gaze, head motion, body posture.

The goal is to analyse the behaviour of learner during a lecture in a classroom recorded by a video-capturing device using deep learning. In this we train the video-capturing device to collect the features such as facial emotions, gaze direction and body posture of a learner in classroom. The data collected will be collected at host device. According to behaviour properties of individual learner the attention level will be evaluated. Further, machine learning algorithm Support Vector Machine(SVM) will separate the learner's by their attentiveness. The data analysis will be sent to the instructor as a feedback to improve their strategies.



II. LITERATURE SURVEY

There have been a wide research done on attention level of a learner while attending a lecture in a classroom as well as online teaching. Some research also done by using Machine Learning algorithms by taking data from RGB-D Sensors.

Mu-Yen Chen [1] proposed personalised curriculum generation approach based on the proposed Genetic algorithm based module for personalised learning path generation CBR-based module for personalised knowledge database and summative assessment analysis. This approach can simultaneously consider the curriculum difficulty level and the curriculum community of successive curriculums while implementing personalised curriculum generation in the learning process. This method consist of three main contribution presents a genetic based curriculum sequential approach that provides personalised curriculum sequential generation. It uses empirical study to indicate that the proposed approach can generate appropriate course materials to the learners according to their requirement and help each of the learner to learn more effectively in the automated web-based environment.

Hong-Ren Chen [2] studied used practical video-capture facial-recognition technology that detects facial expression to analyse the learning attention straight of the learners during the learning process. The system also give students timely learning assistance and stimulation to enhanced learning. Kai Michael Hover [3] proposed a model, the aim of this model is to support instructor so that they can recognise a decline of student's attentiveness in order to start appropriate counter measures like short breaks which can recover the level of attention. The system use wave message from students smart phone and pass it as an input to the Pub-Sub channel for message exchange and loosely coupled integration. Two subscribers that further processed the wave message of the smart phone. For each lecture hall there is an wave message subscriber. The class quake provide the information for the lecturer. It processes both the wave messages and stored messages for the presentation. Class-quake alarm it is a mobile application to inform the instructor with a simple traffic light like indicator about the attention status of the students of the class and also vibrates during the critical classroom situation.

Manus Ross [4] studied that the data that was generated represent students number of hand raises and number of eyebrow raises during lecture. They used RGB-D camera such as Kinect sensor to collect data. The data that was generated is clustered in two groups and labelled them as attentive and inattentive. These labelled data used as training and testing dataset in a supervised learning algorithm to make a decision boundary. The decision boundary can automatically classify between two students. The result is provided to a instructor as well as students to make their personalised learning strategies and increase their classroom performance.

III. METHODOLOGY

A. Behaviour Analysis :-

Anticipating future actions is a major component of intelligence, specifically when it applies to real-time systems, such as robots or autonomous cars. Predicting the behaviour of humans in strategic settings is an important problem in many domains. Analysing the human behaviour is one of the important aspect to predict any circumstances in future. In the education system, learners behaviour during the lecture is key aspect for the instructors. The behaviour of learners can be analysed using the classroom CCTV cameras. During lecture the camera will analyse the behaviour of learner according to selected features.

B. Feature Extraction :-

Feature extraction is a process used in transforming raw data into the numerical features that can be processed while preserving the information present in original data set. It gives better results than applying the machine learning directly to the raw data. Feature extraction for an image data represents the interesting parts of an image as a compact feature vector. In the past, this was accomplished by specialized feature detection algorithms, feature extraction, and feature matching algorithms. Today, deep learning is commonly used in image and video analysis, and has become known for its ability to take raw image data as input, skipping the feature extraction step. Regardless of which approach you take, computer vision applications such as image registration, object detection and classification, and content-based image retrieval, all require effective representation of image features – either implicitly by the first layers of a deep network,



or explicitly applying some of the longstanding image feature extraction techniques. In the classroom for analysing the behaviour or to estimate the attentiveness of a learner there are some features that need to be extracted during lecture such as Facial emotions, Gaze direction and Body posture.

C. Clustering :-

Clustering is the task of dividing the population or data points into a number of groups such that the data points in the same groups are more similar to other data points from same group than those in other groups. Putting

simply, the motive is to segregate groups with similar traits and assign them into clusters. K-means is an iterative clustering algorithm which aims to find local maxima in each iteration. This algorithm works in these 5 steps :

- Specify the desired number of clusters K : Choose $k=2$ for these 5 data points in 2-D space.
- Randomly assigning each data point to a cluster : Assign three points in cluster 1 and two points in cluster 2.
- Compute cluster centroids : The centroid of data points in the cluster 1 and those in cluster 2.
- Re-assign each point to the closest cluster centroid : Note that only the data point at the bottom is assigned to the cluster 1 even though its closer to the centroid of cluster 2. Thus, we assign that data point into cluster 2.
- Re-compute cluster centroids : Hence now, re-computing the centroids for both the clusters.

D. Classification :-

The Classification algorithm is a Supervised Learning technique that is used to identify the category of new observations on the basis of training data. In classification, a program learns from the observations or given dataset and then classifies new observation into a number of classes or groups. The main goal of the Classification algorithm is to identify the category of a given dataset, and these algorithms are basically used to predict the output for the categorical data. Classification accuracy is an interesting metric to evaluate the performance of any model based on the various predicted class labels. Classification accuracy might not be the best parameter but is a good point to begin for most of the classification tasks. Support Vector Machine or SVM which is most popular Supervised Learning algorithms, it's used for Regression based problems and also for classification. Yet basically, it's used for Classification of the problems in Machine Learning. The main agenda or the aim of the SVM algorithm is creating the best line or decision boundary that can segregate n-dimensional space into separate classes so that we can easily and efficiently insert the new data point in the correct corresponding category in the future. This best decision boundary is known as hyperplane. SVM chooses and uses the extreme points/vectors that help in creating the hyperplane. These extreme are cases called as support vectors, and hence the algorithm is named Support Vector Machine.

IV. SYSTEM ARCHITECTURE

The main goal of our system is to enhance the teaching-learning method in the education system and improve personalised learning methods of learners. Following are the steps of working of our system:

- Initially, by using the classroom CCTV cameras we will capture the images of learners in the classroom.
- Further, these image will be pre-processed to extract features such as learners facial emotion, gaze direction and body posture.
- After extracting the features the dataset will be generated according to the attention level of each learner.
- This dataset will be stored in the database by the host device connected to the CCTV.
- To classify between attentive and inattentive learner we need to apply machine learning algorithm.
- Before classifying we will cluster the data into different groups using K-Means algorithm.
- Further, we will classify the clustered data by Support Vector Machine Algorithm.
- Analysis of data will be generated as an outcome for the instructor to gain insights and improve their strategies.

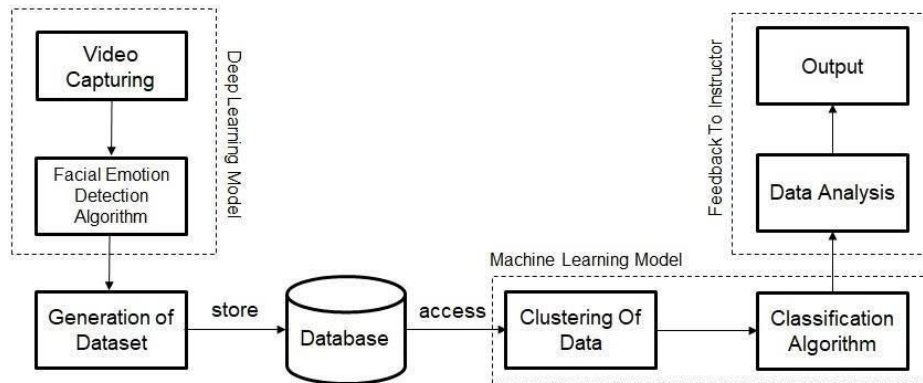


Fig. 1. Flow Diagram of Effective Classroom Learning Method.

V. CONCLUSION AND FUTURE SCOPE

Analysis of attention for learners is an important topic in educational sector. We conclude with the survey of recent advance in deep learning approaches for estimation for learners attentiveness. Compared to the manual method, this model reduces the efforts and keep track on each and every learner's performance for effective learning. Most researchers studied about this topic of attention analysis based only on qualitative parameter and introduce their limitations by using RGB-D sensors. The model aids instructor for evaluating the performance of every learners and form new strategies to make the teaching-learning method interesting.

Further we are trying to create a better learning experience and suitable teaching environment to produce effective performance. Our model can be used by the individual learners for improving their weak areas. However it requires more computational time and speed, we are trying to find better solution. Colleges, schools, private institutes and other learning platform can use our model to form an effective teaching-learning method

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