International Journal of Electrical and Electronics Engineers
Volume 14, Issue No. 01, Jan-June 2022
ISSN (O) 2321-2055
ISSN (P) 2321 -2045

EFFECTIVE CLASSROOM LEARNING

Akhilesh Kanse[1], Sahil Tamboli[2], Kajal Mangwani[3],

Prof. Baliram B. Deshmukh[4]

[1,2,3,4]*Computer Engineering, Trinity Academy of Engineering, Pune, India*

Abstract

The initial stage in the learning process is to pay attention. When there is no sufficient attention, it is impossible to understand, learn, or remember. Most people find it easy to pay attention to things when they finds it interesting or exciting. It is up to the instructor's techniques to create an engaging lecture. Many students find it difficult to understand the instructor's teaching technique that results in a dull lecture that has an impact on their performance. Furthermore, it is challenging for the instructors to know whether or not the students are grasping the principles clearly. In addition, students find it difficult to assess their overall focus during a lecture. The major goal is to present a system which can recognize the learners' attention during a lecture and provide a feedback to the instructor on how well they are paying attention. The instructor will develop new tactics based on the system's input that are both effective and easy to understand. The system collects data using a video camera, which includes face recognition, facial expressions, gaze tracking and head pose analysis. Convolutional Neural Network (CNN) model is used for facial expression analysis. The training dataset contains attributes like angry, confused, sad, neutral and happy. Further, the system will analyze all the behavior of the students and classify them into attentive and inattentive groups using machine learning technique.

Keywords - attention, convolutional neural network, machine learning.

I. INTRODUCTION

The base of the learning process is attention. Attention is a mental activity rather than a mental power. Other brain processes, such as imagination, learning, and thinking are feasible with attention. To think about something, one must focus his entire attention on it. The ability to pay attention is determined by the level of interest. There can't be entire attention to a thing if one's interest isn't present. The focus of attention is always shifting. With the aid of attention, one can generate a state of preparation for doing a task, as well as raise the object's clarity. In the teaching-learning process, attention is crucial. It aids students in grasping concepts more thoroughly and quickly. Learning a skill or executing any work is ineffective without it. If a learner pays close attention to a skill or instruction, it will last longer.

Automated learning analytics is rapidly becoming a valuable asset in the educational world, necessitating the development of as system that can monitor the learning process and provide feedback to teachers. Recently, there has been as significant breakthrough in visual sensor and computer vision technologies, allowing for automated monitoring of behavior and emotional states of learners at all levels, from university to pre-school. Students' affective states, such as interested, fatigued and puzzled, are automatically derived from facial expressions, and their attention state is computed using several visual signals, such as face gazing, head motion and body position.

The objective is to use deep learning to assess learner behavior during a lecture in a classroom which was recorded by a video capturing device. We train the model that collects the data from video-capturing device which consists features such as facial emotions, gaze tracking and head position of a learner in classroom. The data will be gathered on a local device. The attention level of each student will be assessed based on their behavioral characteristics. Further, machine learning algorithm will classify learners based on their attentiveness. The instructor will receive the data analysis as feedback to help them improve their techniques.

II. LITURATURE SURVEY/BACKGROUND

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. Machine Learning techniques were used in several of the studies, which used data from RGB-D sensors. Mu-Yen Chen [1] proposed personalized curriculum generation approach based on the proposed Genetic algorithm based module for personalized learning path generation CBR-based module for personalized knowledge database and summative assessment analysis. This approach can simultaneously consider the curriculum difficulty level and the curriculum community of successive curriculums while implementing personalized curriculum generation in the learning process. This method consist of three main contribution presents a genetic based curriculum sequential approach that provides personalized 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 analyze 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 goal of this model is to help instructors notice when a student's attention is waning so that they can take appropriate counter measures like short breaks which can recover the level of attention. The system use wave message fromstudents 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 a wave message subscriber. The lecturer receives information from the class quake. It processes both the wave messages and stored messages for the presentation. Class-quake warning. It's a mobile app that uses a basic traffic light-like indicator to alert the instructor about the students' concentration levels in class and also vibrates during the critical classroom situation.

Manus Ross [4] the data obtained during the study represented the number of hand rises and brow lifts made by students during the lecture. 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 an instructor as well as students to make their personalized learning strategies and increase their classroom performance.

International Journal of Electrical and Electronics Engineers
Volume 14, Issue No. 01, Jan-June 2022
ISSN (O) 2321-2055
ISSN (P) 2321 -2045

III. PROPOSED WORK/SYSTEM

A. Behavior Analysis:-

Anticipating future behaviors is a key component of intelligence, especially in real-time systems like robots or self-driving cars. In many disciplines, predicting human behavior in strategic contexts is a significant challenge. Analyzing human behavior is one of the most significant aspects of predicting future events. In the educational system, the behavior of students during lectures is a critical factor for instructors to consider. The classroom CCTV cameras can be used to examine student conduct. During the lecture, the camera will assess the learner's behavior based on selected features.

B. Feature Extraction:-

Feature extraction is a method for converting raw data into numerical features that may be processed while keeping the original data set's content. It produces better outcomes than simply applying machine learning to raw data. The important parts of an image are represented as a compact feature vector in feature extraction for image data. Previously, specialized feature detection, feature extraction, and feature matching algorithms were used to do this. Deep learning is currently widely utilized in image and video analysis, and it is well-known for its capacity to process raw picture data without the need for feature extraction. Computer vision applications such as picture registration, object recognition and classification, and content-based categorization, regardless of which approach you pick, are all useful.

C. Classification:-

The Classification algorithm is a Supervised Learning technique that uses training data to determine the category of new observations. A program learns from previous observations or a dataset and then classifies fresh observations into one of several classes or groupings. The primary purpose of a classification algorithm is to determine which category a dataset belongs to, and these algorithms are primarily used to anticipate the output for categorical data. Classification accuracy is a useful indicator for assessing a model's performance based on the multiple anticipated class labels. Although classification accuracy is not the most important criterion, it is a decent place to start for most classification problems.

D. Convolutional Neural Networks (CNN):-

A convolutional neural network (CNN or ConvNet) is a deep learning network design that learns from data without the requirement for human feature extraction. CNNs are particularly useful for recognizing objects, faces, and settings by looking for patterns in images. They're also useful for categorizing non-image data including audio, time series, and signal data. A convolutional neural network can include tens or hundreds of layers, each of which learns to recognize distinct picture features. At various resolutions, filters are applied to each training image, and the result of each convolved image is utilized as the input to the next layer. The filters can start with very basic qualities like brightness and edges and progress to more complicated attributes that describe the object uniquely.

International Journal of Electrical and Electronics Engineers
Volume 14, Issue No. 01, Jan-June 2022
ISSN (O) 2321-2055
ISSN (P) 2321 -2045

Like other neural networks, a CNN is composed of an input layer, an output layer, and many hidden layers in between. A deep learning model following the connections between the input data, multiple layers, and outputs. These layers perform operations that alter the data with the intent of learning features specific to the data. Three of the most common layers are: convolution, activation or ReLU, and pooling. Convolution puts the input images through a set of convolutional filters, each of which activates certain features from the images. Rectified linear unit (ReLU) allows for faster and more effective training by mapping negative values to zero and maintaining positive values. This is sometimes referred to as activation, because only the activated features are carried forward into the next layer. Pooling simplifies the output by performing nonlinear downsampling, reducing the number of parameters that the network needs to learn. These operations are repeated over tens or hundreds of layers, with each layer learning to identify different features.

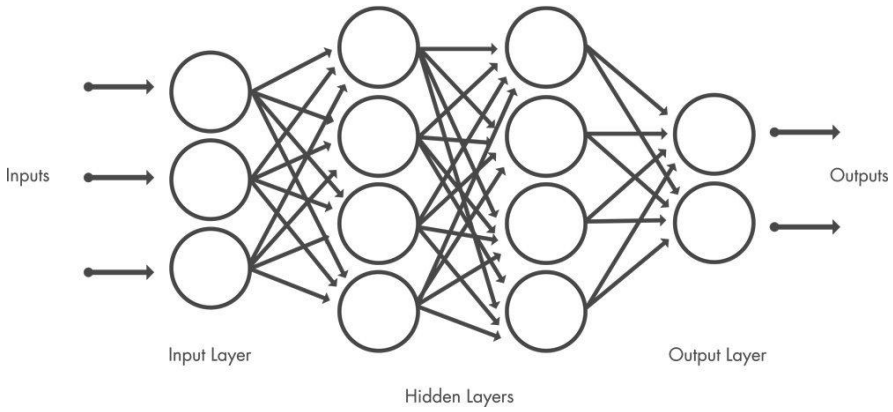

Fig. 1.1. Diagram of Convolutional Neural Networks.

IV. RESULT AND DISCUSSIONS

The system's major purpose is to improve the teaching-learning process in the educational system and learners' tailored learning ways. The steps of our system's operation are as follows:

At first, we'll use the classroom CCTV cameras to capture photographs of students in the classroom.

These images will also be pre-processed in order to extract elements like the learner's facial mood, gaze direction, and body posture.

After extracting the features, a dataset will be constructed based on each learner's attention level.

The host device connected to the CCTV will save this dataset in the database.

We need to use a machine learning method to distinguish between attentive and inattentive learners.

We'll then use the Support Vector Machine Algorithm to classify the clustered data.

International Journal of Electrical and Electronics Engineers
Volume 14, Issue No. 01, Jan-June 2022
ISSN (0) 2321-2055
ISSN (P) 2321 -2045

As a result of the data analysis, the instructor will obtain insights and improve their techniques.

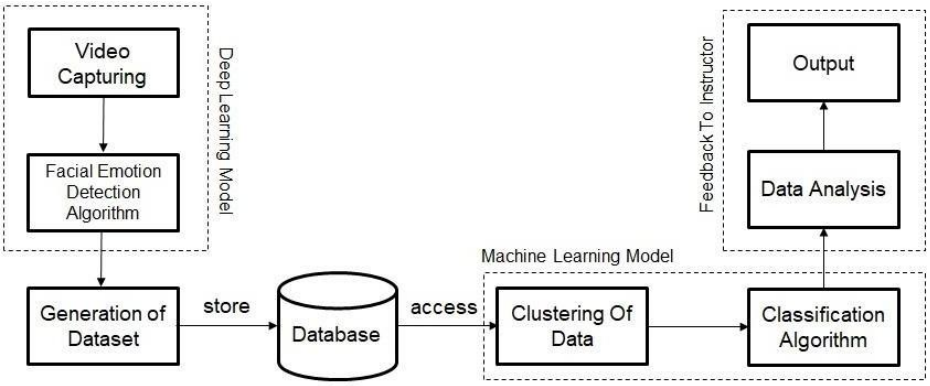

Fig. 1.2. Flow Diagram of Effective Classroom Learning Method.

V. CONCLUSION

The study of learners' attention is an important topic in the educational field. Finally, we review recent advances in deep learning algorithms for estimating student attentiveness. This model, in comparison to the manual method, lowers effort and keeps track of each learner's performance for successful learning. The majority of scholars have examined this topic of attention analysis using just qualitative parameters and have introduced their limitations using RGB-D sensors. The approach assists instructors in evaluating each learner's performance and developing new tactics to make the teaching-learning method more engaging.

In addition, we are working to improve the learning experience and provide an appropriate educational atmosphere in order to deliver effective results. Individual learners can use our model to strengthen their weak areas. However, because it necessitates more computing time and speed, we are looking for a better alternative. Our concept can be used to create an effective teaching-learning method in colleges, schools, private institutes, and other learning platforms.

REFERECNES

[1] Chen, Hong-Ren. ”Assessment of learners’ attention to e-learning by monitoring facial expressions for computer network courses.” Journal of educational computing research 47.4 (2012): 371-385.

[2] Huang, Mu-Jung, Hwa-Shan Huang, and Mu-Yen Chen. ”Constructing a personalized e-learning system based on genetic algorithm and case based reasoning approach.” Expert Systems with applications 33.3 (2007): 551-564

[3] Hover, Kai Michael, and Max Muhlhauser. ”Class quake: Measuring ¨ Students’ Attentiveness in the Classroom.” 2015 IEEE International Symposium on Multimedia (ISM). IEEE, 2015.

[4] Ross, Manus, et al.”Using support vector machines to classify student attentiveness for the development of personalized learning systems.” 2013 12th international conference on machine learning and applications. Vol. 1. IEEE, 2013.