Learner Attention Detection and Dynamic Tutorial Recommendation using Image Processing Techniques

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ABSTRACT

India is always considered as one of the largest network of educational institutions. Although several constraints are been associated with our learning system. We try to provide the same content of teaching to all students with different inter personal skills. The most important factor is lack of student motivation towards a subject, course etc. Adaptive learning is an academic method that utilizes computers as an interactive teaching device. In most of the educational models, engagement is not monitored explicitly, but rather they assume the engagement based on the student's responses to questions and tasks and provide the learning based on it. Thus dynamic student behavior analysis is a first step towards an automated teacher feedback tool for measuring student engagement. In our system, we propose a hybrid architecture system invoking student facial emotion recognition, eye gaze monitoring, head movements identifications based analyzing dynamic student engagement / behavior in classroom and towards a specific course at e-learning platforms. Our proposed architecture uses feature extraction algorithms like Principal Component Analysis (PCA) for facial emotion recognition, Haar Cascade for pupil detection and Local Binary Patterns for recognizing head movements. For machine learning approach and to provide accurate results we propose Open CV. Thus based on the students input weightage is allocated, based on the final score, we do compare with the threshold value. If the students attention value is greater than the threshold value, theory based deliverance is recommended. If the students attention value is lesser than the threshold value, video, smart class, motivational video based deliverance is recommended. For Experimental results are been implemented using Pycharm tool.

Keywords: *Engagement, Dynamic Student Behavior, Facial Emotion, Eye gaze, Head movement, Haar Cascade, Principal component analysis ,Local binary patterns*

1. INTRODUCTION

In a virtual learning environment, learners can lose motivation and concentration easily, especially during a platform that's not tailored to their needs. Our research is predicated on studying learner's behavior on a learning platform to make a system ready to clustering learners supported their behavior, and adapting educational content to their needs. As the cost of education (tuitions, fees and living expenses) has skyrocketed over the past few decades, prolonged graduation time has become a crucial contributing factor to the ever growing student graduation. In fact, recent studies show that only 50 of the more than 580 public four-year institutions in the United States have on-time graduation rates at or above 50 percent for their full-time students. To make college more affordable, it is thus crucial to ensure that many more students graduate on time through early interventions on students whose performance will be unlikely to meet the graduation criteria of the degree program on time. A critical step towards

effective intervention is to build a system that can continuously keep track of students' attention level and accurately predict their mood of listening and based on that data the teaching can be delivered.

2. RELATED RESEARCH

In [1], Online teaching and e-learning methodologies have transcended to new levels after the boom of information technology age. As a result, the quality of education and number of online learners has increased substantially. Still, the modernized way of e-learning creates problem that affects a student's learning curve due to unavailability of any direct supervision. As per M. Feidakis, T. Daradoumis, S. Caballé and J. Conesa[2]**,** an instructor can provide some insight into student's satisfaction during lectures, therefore student's involvement in class has direct correlation with the professional aptitude of the instructor. Direct supervision not only facilitates learning but also keeps the student synchronized with the course objectives due to instant communication with the instructor at any time during the lecture. Due to lack of communication, affected students may experience high levels of frustration.

In [3], Natural feedback on the content being delivered are often taken automatically from learners by using their facial expressions as a tool to live interestingness of the content and engagement of student in the online lecture. Hend et al. [4] argued that a person's interest and attention level can be indicated from the information collected from eye tracking devices. Information about user levels of attention, stress, relaxation, problem solving, learning success, and fatigue can be found from eye position tracking and such indirect measures such as fixation numbers and duration, gaze position, and blink rate.

Ismail and Mohamed[5] integrated eye tracking technology to live and analyze learner behaviors on an e-learning platform. User emotion attention, stress, relaxation, problem solving, and fatigue were reflected by the interesting parts of courses they focused. Pushpaja V. Saudagare and D.S Chaudhari4[6] came forward with a way to detect expression from emotions through neural networks. It reviews the varied techniques of expression detection using MATLAB (neural network toolbox).

In [7], Facial expressions can provide critical information on student's interest and participation in online educational learning. Faces provide detailed information about an individual's state of mind, mood and also emotional state. Studies throughout history have shown that facial expressions are the prime representation of human emotions. Facial expressions can be considered as the main source of information, after words, in estimating an individual's thoughts and state of mind. In [8], Facial features (Forehead, eyes, nose, mouth, etc.) are the fundamental attributes that are extensively used in face recognition systems as their movements help determine the construction of expression on a human face.

In [9], a supervised learning-based video saliency detection algorithm was proposed. It utilizes the eye fixations information from multiple subjects to detect the saliency factor. Mai Xu, Yuhang Song, Jianyi Wang, Minglang Qiao and Liang Yu Huo, Zulin Wang [10] came forward with a database that collects subjects' Head Movement in sequences of Panoramic video.

3. PROPOSED METHOD

Dynamic student behavior analysis is a first step towards an automated teacher feedback tool for measuring student engagement. Our proposed system can be applied in both traditional / e-learning systems. In our system, we propose a hybrid architecture system invoking student facial emotion recognition, eye gaze monitoring, head movements identifications based analyzing dynamic student engagement / behavior in classroom and towards a specific course at e-learning platforms. Our proposed architecture uses feature extraction algorithms like Principal Component Analysis (PCA) for facial emotion recognition, Haar Cascade for pupil detection and Local Binary Patterns for recognizing head movements. For machine learning approach and to provide accurate results we propose Open CV. Experimental results are been implemented using Pycharm.

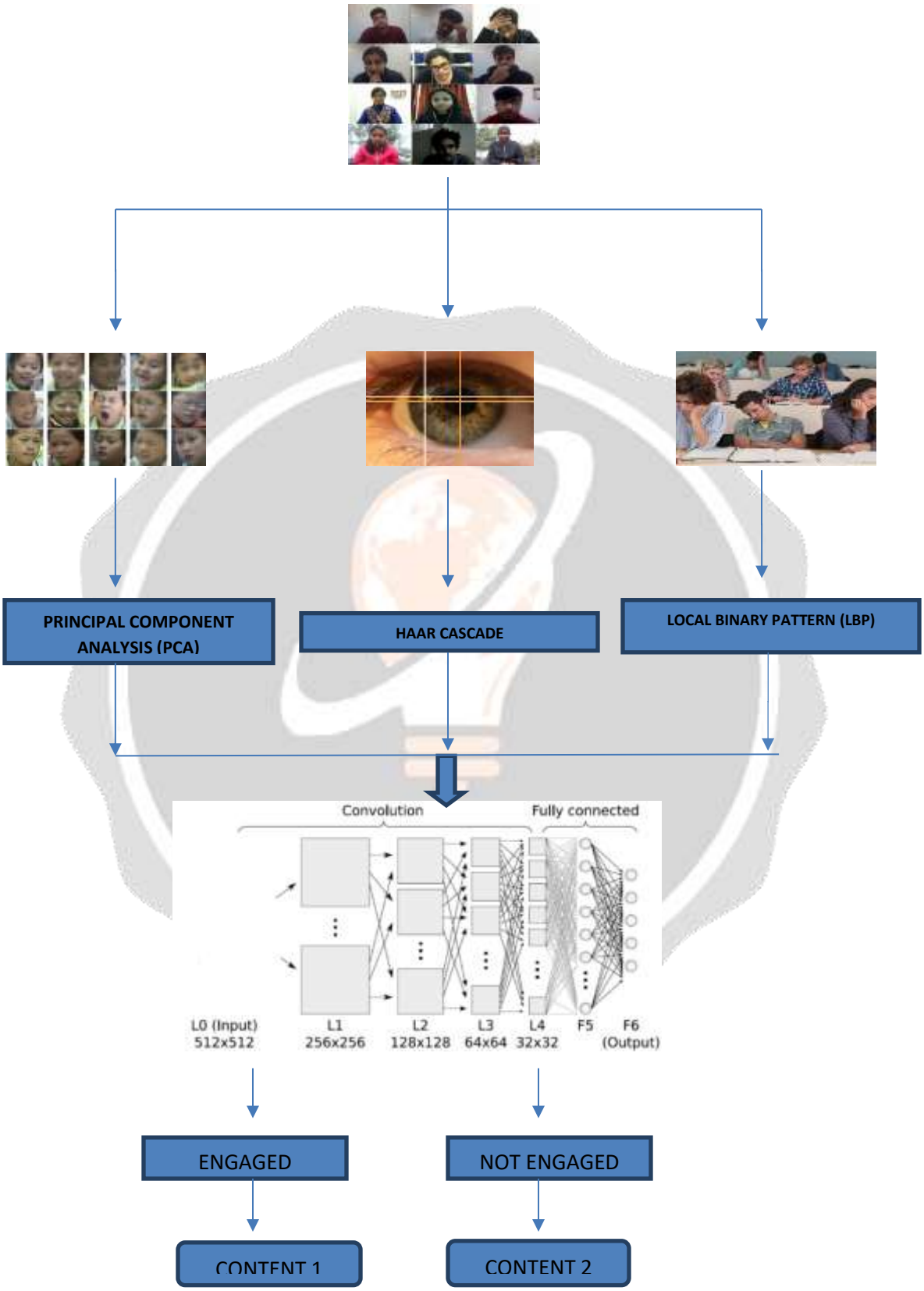
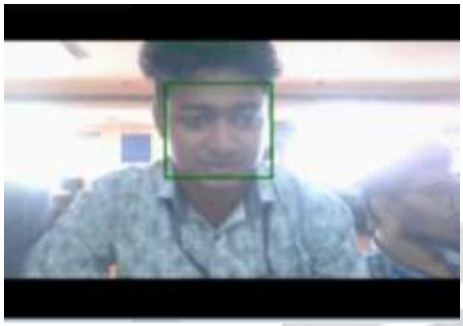


Fig -1: Basic Architecture

3.1 Facial Expression Recognition

The input student's image of face, head, eye gaze to the system can be captured using a web cam and sent for further image processing steps. This image undergoes image enhancement, where tone mapping is applied to pictures with low contrast to revive the first contrast of the image.

Neutral



Happy

3.2 Pre-Processing

PreProcessing plays a key role in overall process. Pre-Processing stage enhances the standard of input image and locates data of interest by removing noise and smoothing the image. Redundancy is removed from image without losing the image detail. Pre-Processing also involves image filtering and normalization of image that leads to uniform size and rotated image.

3.3Segmentation

Segmentation separates the image into meaningful sections. Segmentation of an image is a way of dividing the image into homogenous, self-consistent regions corresponding to different objects in the image on the bases of texture, edge and intensity

3.4 Feature Extraction

The facial image obtained from the face detection stage is used as an input to the feature extraction stage. To obtain real time performance and to scale back time complexity, for the intent of expression recognition, only eyes, lips and mouth are considered. The combination of three features is adequate to convey emotions accurately. We propose Principal Component Analysis (PCA) algorithm for facial emotion recognition

3.5 Eye Extraction

The eyes display strong vertical edges (horizontal transitions) because of the presence of its iris and eye white. Thus, the Sobel mask is applied to an image and the horizontal projection of vertical edges can be obtained to determine the Y coordinate of the eyes.

3.6 Eyebrow Extraction

There are two rectangular regions in the edge image which lies directly above each of the eye regions and are selected as the eyebrow regions. Further refinement is done through the edge images of these two areas. More edges are been obtained from the edge image. These edge images are dilated and the holes are then filled. The eyebrow regions are refined using the resultant edge images.

3.7 Mouth Extraction

The top, bottom, right most and left most points of the mouth are been extracted and the centre of the mouth is calculated.

4. CONCLUSIONS

The hybrid biometric based learner analysis does appear to be a promising new tool for evaluating learners' behavior dynamically. This technology can provide tons of benefits to the e-learning platforms by facilitating adaptive and personalized learning. Thus through this proposed system, the tutor can change the deliverance by dynamically analyzing the learner attention level. This would bring a revolution in the education sector.

In future, the performance of proposed method can be improved and can be extended for detecting the students fatigue by measuring the degree of openness of the eye. Furthermore, the real time implementation can be conducted using video cameras.

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