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Student's Attention Monitoring System in Learning Environments based on Artificial Intelligence

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1. ABSTRACT-

The attention of a person, in this case a student plays a critical role in the process of learning. Only through the attention of one can we determine whether a student is conscious while attending the classes/meetings. Key features to monitor one's attention can be done using facial expressions while in a video conference. Facial expressions include movement of eyes, ears, lips, head turn and tilt, or any other social contact. Analyzing these features while in a video conference can be done using Artificial intelligence which requires some machine learning concepts and algorithms. This paper consists of one such experimental operation to analyze and monitor the student's attention during a video conference such as a virtual class/ meeting. The teaching and learning cycle may be regarded to be the most critical operation in the academic institution. During classes, attendance and student behavior are closely monitored alongside teaching activities. This project encloses the information related to the real-time student facial expression detection in other words student behavior detection. This can be made possible with the help of the algorithms of deep learning, which is a subsection of machine learning such as the YOLO V3 algorithm and OPENCV module. The primary work that takes place in this process is matching the accuracy of the pixels. This accuracy measurement helps the user in analyzing the movement or change in the facial expressions. A set of data is initially fed to the learning machine and data in real time is compared to derive the results.

The primary objective of this project is to develop a platform that can be used on two sides during a video conference. One side being the Teacher and a student on the other. The level of student involvement is directly related to important academic outcomes like critical thinking and the marks students get in a topic.

Keywords- ***Video conferencing, Machine learning and Deep learning.***

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2.INTRODUCTION-

An additional contribution to the research on human live behavior includes detection and analysis of physical movement of humans in real-time. As dedicated research is still being done in many parts of the world this could be a small contribution to it. Learning is a daily activity in each and every individual's life. The very essence of life is to find out new things and to learn how to adapt to them. For eInstance during the age of early man they had to learn how to adapt to the environment as a part of survival. Coming to the modern days Learning became more sophisticated. In this paper, single-person analysis was used in detecting the face of each student to determine the student behavior. An experimental setup was installed for data collection. The researchers aim to present a new approach of predicting student behavior (attentive or not attentive) based on face recognition during class sessions. This demonstrates a real-time detection of student behavior. Using a deep learning approach, the acquired data utilized the YOLO (you only look once) v3 algorithm in predicting student behavior inside the classroom.

A virtual mode of learning is no less than a physical mode of learning. Although it has its limitations and is not completely efficient. Ultimately these virtual learning methodologies are implemented and are currently in use, which shows the importance of such methods of learning. During classes the activities of students along with the teacher are monitored closely. Student's participation is directly proportional to his/her performance. For a teacher, an analysis on the performance of a student is crucial. But Monitoring and analyzing a student's behavior all the time is no cake walk. It needs time and effort and it is a challenging task.This is when the student attention monitoring system using artificial intelligence and machine learning algorithms come into picture. This makes the work of the teacher easy and gives detailed information on the analyzed behavior during the real time virtual classes.

Many Machine learning and Artificial Intelligence based applications have been introduced and are widely used in many applications from over a decade. This is due to the rate of success of the applications that utilize these advanced machine learning algorithms, concepts and artificial intelligence. However the application of these advanced technologies that are used in this project are the image detection, Pixel segmentations, Accuracy prediction and motion detection. A simple machine to compare the training dataset to the data that is extracted by using these above mentioned processes is created using the algorithms. This will be efficient and sufficient for analyzing the student behavior in real time.

The Input dataset which can also be considered as the training dataset is given in the form of a vector. The values of this vector are the pixels, their addresses, coordinates and color code. Upon activation of the employed machine learning algorithms in this process, The data that is extracted from the face detection medium is also converted into the vector form to be compared to the training dataset and it then produces results. Any movement or change in facial expressions can be found out using the mean average accuracy function.

3. LITERATURE SURVEY-

TheResearch on the study of Student attention monitoring systems using artificial intelligence and machine learning algorithms can lead to some profound and important ideas that are concluded from the past research. Few of those important profound things are Face recognition, Yolo v3 algorithm, Computer vision technologies and data mining methodologies. Computer vision techniques cover a part of the computer graphics studies.

The YOLO algorithms that are used collect the dataset using image detection which is basically reading the pixels. The position of the pixels are considered during the behaviour analysis of the student. This project can be viewed as a progressing work since this project is an adaptation of applications like face detection, motion detection, etc. This project can be viewed as if it moved or advanced from human action recognition to human behaviour analysis.The face recognition algorithm marks a field for analysing the facial expressions of a student. This monitoring system detects the face of the listeners or the audience and detects if they are paying attention or not. So there is need to create a self-sufficient agent that can offer information to both teachers and pupils. Hence many educational institutions make can use of this technology which centers have come to rely on digital tools.

This system checks if the listener is facing the screen. If yes it shows attentiveness or else not attentive. Using the YOLO V3 yields better accuracy than the conventional versions of the algorithm. With better accuracy better analysis can be made based on the results generated. Because of its improvement in object detection using deep learning, many researchers used this algorithm in different areas such as vehicle targeting detection, real-time face detection and medical applications.

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4. IMPLEMENTATION-

a. Attention Monitoring is a powerful tool in the teaching field or in a learning environment. Here is some example code for student attention monitoring using the Python programming language:

```
def yawn(self, frame):
frame = resize(frame, width=450)
gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
subjects = self.detect(gray, 0)
if (len(subjects) == 0):
return 0
for subject in subjects:
shape = self.predict(gray, subject)
shape = face_utils.shape_to_np(shape)
mouth = shape[self.mStart:self.mEnd]
mar = self.mouth_aspect_ratio(mouth)
return mar
def get_head_pose(self, shape, object_pts, cam_matrix,
dist_coeffs, reprojectsrc):
image_pts = np.float32([shape[17], shape[21], shape[22],
shape[26], shape[36],
shape[39], shape[42], shape[45], shape[31], shape[35],
shape[48], shape[54], shape[57], shape[8]])
_, rotation_vec, translation_vec = cv2.solvePnP(
object_pts, image_pts, cam_matrix, dist_coeffs)
reprojectdst, _ = cv2.projectPoints(reprojectsrc,
rotation_vec, translation_vec, cam_matrix,
dist_coeffs)
```

The given code snippet is a crucial component of a computer vision system designed for facial analysis. It consists of two methods, namely yawn() and get_head_pose(). The yawn() method resizes the input frame, converts it to grayscale, detects faces, predicts facial landmarks, extracts the mouth region, and calculates the mouth aspect ratio. Meanwhile, the get_head_pose() method estimates the head pose by solving the Perspective-n-Point (PnP) problem. It utilizes 3D object points, camera matrix, distortion coefficients, and reprojected source points.

b. This code gives a brief note or explanation of FaceAction Class: Facial Analysis and Head Pose Estimation in Computer Vision:

The provided code defines a class called `FaceAction`, which encapsulates functionalities related to facial analysis. It initializes various attributes and constants required for face detection and facial landmark prediction. It uses the `get_frontal_face_detector()` function from the `dlib` library for face detection and the "shape_predictor_68_face_landmarks.dat" file for predicting 68 facial landmarks. Additionally, it defines indices for the left eye, right eye, and mouth landmarks. The class also sets up camera calibration parameters, including the camera matrix and distortion coefficients.

```
import requests
from bs4 import BeautifulSoup
# send a request to the webpage and get the HTML content
url = "https://www.example.com/news"
response = requests.get(url)
html_content = response.content
# parse the HTML content using BeautifulSoup
soup = BeautifulSoup(html_content, 'html.parser')
# extract the data you need from the webpage
headlines = []
for headline in soup.find_all('h2', {'class': 'headline'}):
headlines.append(headline.text.strip())
# write the data to a CSV file
import csv
with open('headlines.csv', 'w', newline='') as csvfile:
writer = csv.writer(csvfile)
for headline in headlines:
writer.writerow([headline])
```

The provided code defines a class named `FaceAction` that encapsulates functionalities for facial analysis, including face detection, landmark prediction, and head pose estimation using camera calibration parameters.

5. Results-

5.1 Entry /Login page

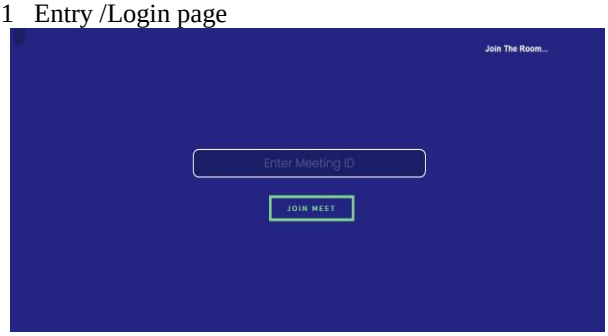

Fig.1 The above diagram shows the UI to Enter the MeetingID to attend the class.

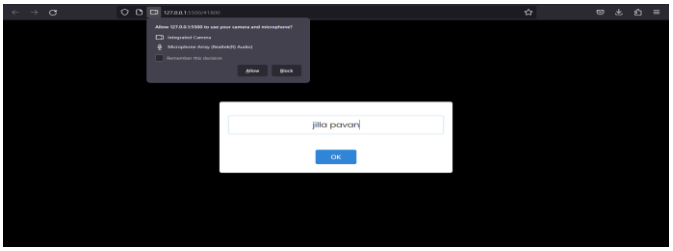

Fig.1(a) The above diagram shows the UI to enter the name of the student to enter the class.

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5.2 Facial Expression Detection Page

Fig.2 Graphical representation of the three attributes (Drowsy, Yawn, Head Position) is shown in this figure

5.3 Change in Values due to change in facial expressions

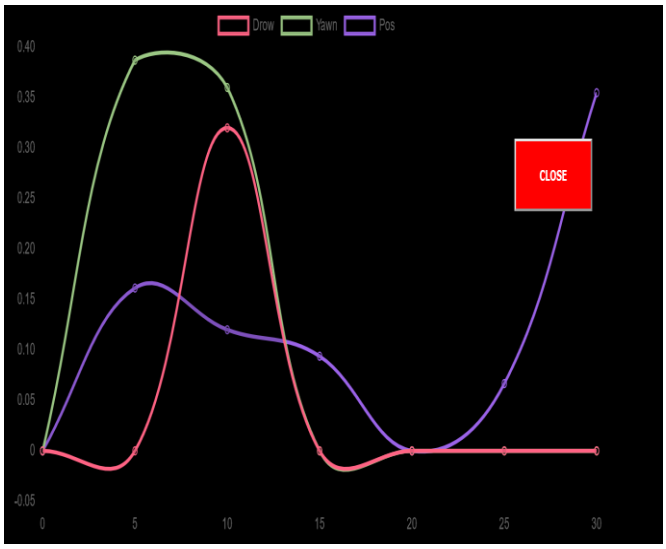

Fig.3 Change in any of the attributes is depicted using the Graphical Representation

5.4 Analysis based on live session

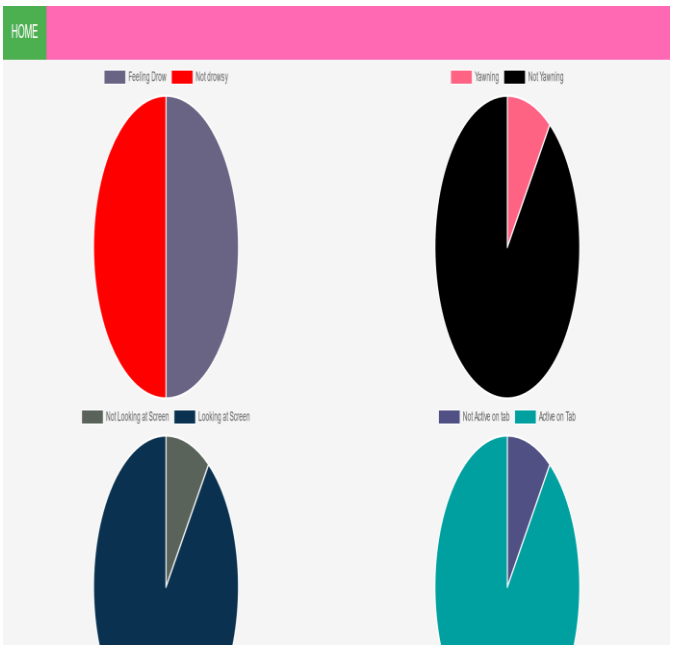

Fig.4 Pie Chart representation of the Attention percentage based on the three attributes (Drowsy, Yawn, Head Position)

5.5 Stores in .csv files

Fig.5 Numerical Values of the changes in facial expressions of the three attributes that are considered (Drowsy, Yawn, Head Position) at a given point of time during the live session.

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6. CONCLUSION-

In conclusion the Artificial intelligence applications and the machine learning algorithm are used to maximum advantage to bring out the best version of the monitoring system which can be used to analyse the student's live behaviour in real time. So there is need to create a self-sufficient agent that can offer information to both teachers
and pupils. Hence many educational institutions make can use of this technology which centers
have come to rely on digital tools. It has the advantages such as:

- Helps in understanding the interest of students for any type of class they attend..
- Teachers can make decisions in improving effective ways of teaching.

7. ACKNOWLEDGEMENT-

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