Innovation for Better Education System using Artificial Intelligence

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Abstract

In today's world, Gen Z finds it difficult to maintain attention during classes. Students tend to get distracted easily. With the flow of information all around them, a constant search for new activities is on the rise. To understand the needs of individual students the emotional status of the students are taken into account. Our education system uses Local Binary Pattern (LBP) algorithm for feature extraction and emotion intensity recognition. The extracted features are used as input for the AI algorithm which creates the personalized lessons for each individual according to their needs. The lessons are categorized into three categories based on their understanding capability along with the personalized time-line. This innovation helps students to achieve greater heights by using personalized lessons according to their capacity. A tracking system is implemented to monitor the emotions and attention level of the students, thereby ensuring successful completion of academics. As teachers, continuous acquiring of knowledge is vital. This innovative AI system helps teachers stay updated in their respective field. To provide security for the students while they are in the campus, the AI system using surveillance camera detects suspicious activities and alerts the respective in-charge to take necessary actions. As a result, we provide a better education system in all aspects.

Keywords: Artificial Intelligence; Education system; Emotion; Security; Surveillance; Personalized; Detection; Attention; Performance

1. Introduction

Each student has a unique learning technique which best suits them. Understanding differences and providing required learning material becomes time consuming on the instructor's end. As a result, students are forced to study in a particular manner which may or may not be comfortable for them. Some students grasp concepts quickly whereas others may require some time to understand. This may result in poor grades causing them to have low self-esteem and confidence. The emotions of students are not being taken into consideration which greatly affects the performance of the students. Teachers find it difficult to keep track of student's individual interest and capability. It is vital for teachers to be updated with their respective subjects in-order to increase student performance. The learning environment must be safe and secure for the students to make sure they give their full effort. The proposed education system covers all aspects of a learning environment to be effective using Artificial Intelligence.

a. Current Education System

The traditional method of education finds it difficult to adapt to the necessity of each student because of difference in the capacity and capability of the student to understand certain topics. The traditional way of teaching assumes that 'one-size-fits-all' and gives the same kind of teaching pattern to the entire class. But that becomes difficult for the students to be able to give their best performance. Only the students, whose learning pattern incidentally matches with the teaching pattern, are benefitted and the other students are still in search of an apt method that will help them to do a little better each time.

Another drawback in Traditional Education System is that teachers are not constantly being updated with the

Doi : https://doi.org/10.54216/JCHCI.020103
Received: August 3, 2022 Accepted: December 2, 2022

emerging concepts of their respective fields. Hence students get the feeling being taught the 'old-fashioned 'concepts. It is difficult at the teacher' send, to be constantly in search of new information.

Security on campus has always been a serious issue to be solved. Crimes are happening in the campus every now and then. Providing safety for the students becomes mandatory. Traditional education system has made good improvements in this area, but it is just not enough to prevent the scrims from happening.

b. Integrating Education with AI

The traditional education system can be made better by incorporating Artificial Intelligence in the education system. The Student Monitoring System will continuously monitor the emotions and performance of the students process the data and will decide which learning pattern matches the personality of that particular student. This system, after determining the personalized learning pattern of the particular student, will update the teachers. This is to make sure that teachers will know about the need of the student and thereby teaching the students in the effective manner.

c. Evaluation of Student Emotion and Progress

Adding on to already piled up workload of teachers is taking care of their students. Teachers are responsible for the performance of their students and are constantly finding new ways of teaching. [5] In is more difficult for teachers to identify how individual students behave. Student's emotions like self-esteem, motivation, commitment, and others that are believed to be determinant in student's performance cannot be ignored, as they are known (affective states and also learning styles) to greatly influence student's learning. The ability of the computer to evaluate the emotional state of the user is getting bigger attention. We could use these inventions to track emotions of students, provide personalized lessons, thereby improving overall performance.

2. Ways in which we can evaluate the emotions of students:

1. Aclassroomsurveillancecameracanbefixedtomonitorthebehavioroftheentireclassroom.

[9] Real-time facial emotion recognition, in general, is divided by several phases. The first phase would be detecting general area of human face, this process include tracking system which require the hardware to monitor the general movement of facial layout. Second phase would be Facial land marking, which pointing out more accurate facial point to be extracted. Using machine learning tools and algorithms, we can process.The captured images and identify if a particular classroom is [6] "very engaged", "nominally engaged" or "not engaged at all".

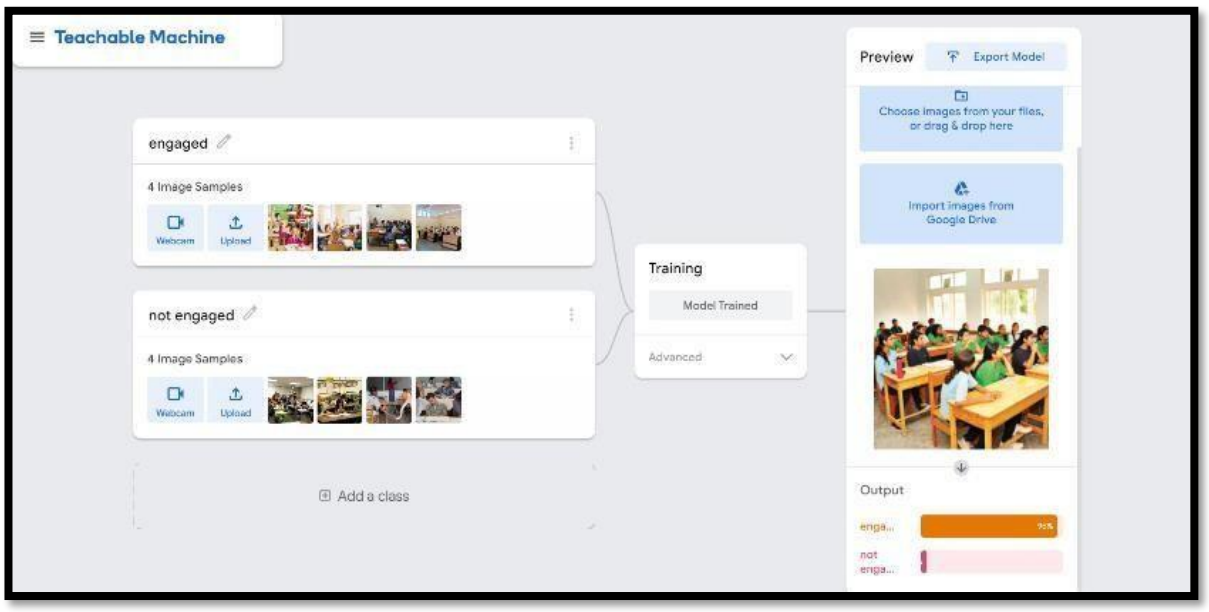

Figure 1: Sample image processing with ML tool to process the images and further classify

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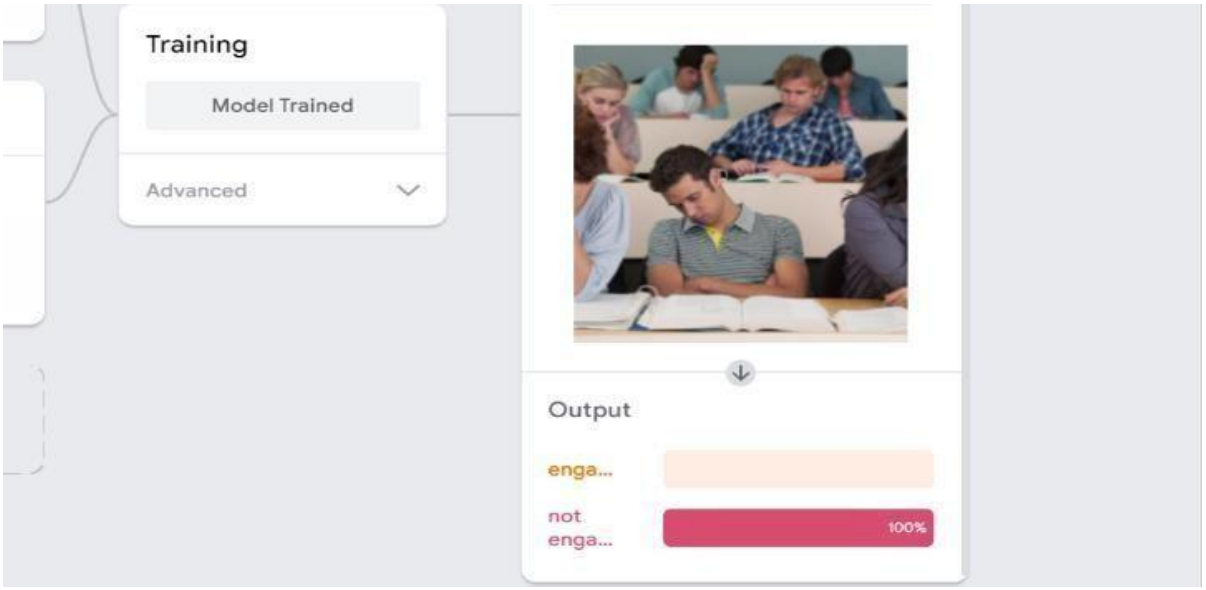

Figure 2: Image process output

In the above Fig.1 and Fig.2, we have trained a basic machine learning model to identify whether a class is engaged or not using images taken from surveillance cameras of the classroom. The datasets are prepared based on each classification and the model is trained. We feed relevant images of each classification such as -engaged, not engaged creating a dataset the model can use to get trained.

The images obtained from the surveillance cameras are given into testing. Our trained model classifies the image as engaged classroom or not engaged classroom. A classification output of an engaged classroom is shown in the Fig.1and an output of a non-engaged classroom is shown in Fig.2. The basic system can be advanced to a larger scale in-order to get more precise predictions.

Thesepredictionscanbeofgreathelptotheteacherstryingtoimprovetheperformanceoftheclasswithpersonalized lessons and time lines.

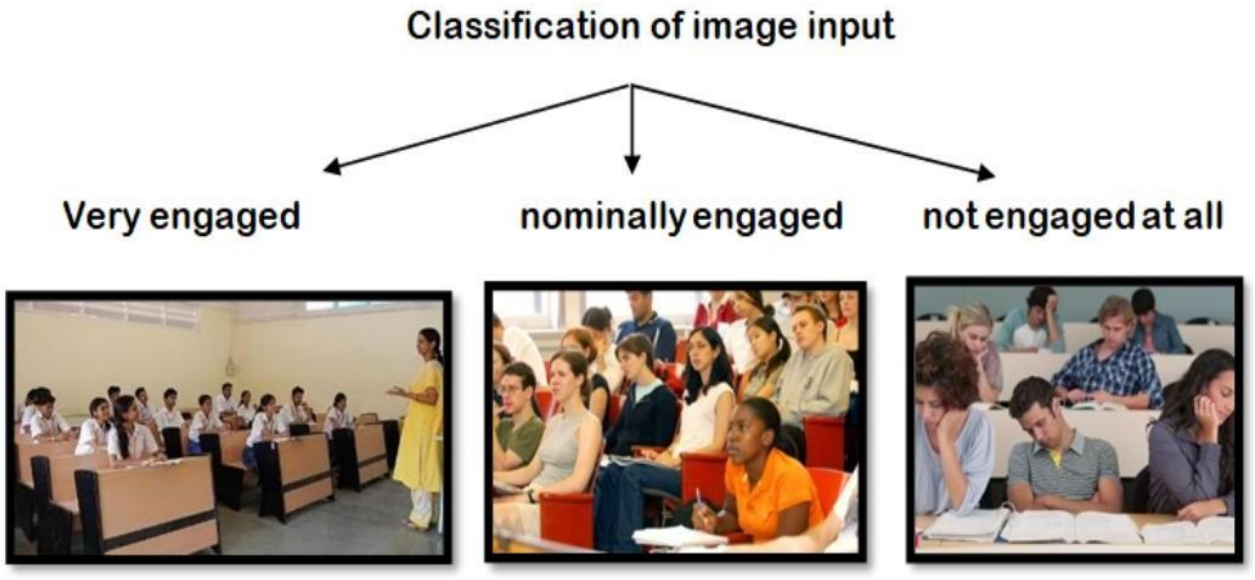

Figure 3: Classification of Image Input

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Once in a while, students are asked to fill in a questionnaire on their inner feeling and all the hardshipstheyfaced.Whiletheyfilltheform,theyarecloselyobservedusingawebcamandimagesaretakenasthe input. This input is being processed to get the emotions and emotional state of each individual student. Based on this input students can be provided with personalized learning material, thereby increasing enthusiasm smtowardslearning.

Figure 4: Sample training model and output

A basic implementation of emotion tracking is shown in Fig.4. Here an ML Model is designed to track the facial reactions and expressions of the student using images taken from webcam as input. The students' emotions can determine if they require a personalized learning pattern or can cope up with the current syllabus. In Fig.4 the student expresses confusion and anxiety which results for her to have a personalized lesson plan along with motivation.

This basic implementation can be improvised to predict various emotions thereby improving performance of students in academics.

Six basic steps that make up the analysis of emotions[5]:

1. Image acquisition
2. Detection and facial rejection
3. Pre-processing
4. Feature Acquisition
5. Emotion classification
6. Final processing and correction.

Three popular ML algorithms[8], Gabor filters, a Histogram of Oriented Gradients (HOG), and Local BinaryPattern(LBP),SupportVectorMachine(SVM),RandomForest(RF),andNearestNeighborAlgorithm(kNN)areuse

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d for feature extraction and emotion intensity recognition. Use of an adequate amount of data is required fortrainingandtestingclassifiersforitsbestperformanceintermsofaccuracy.
The accuracies for various algorithms (LBP, HOG, and Gabor) indicate that LBP achieves the highest accuracy in most cases[8]. The LBP method is based on a texture descriptor that is useful in extracting features from any textured image. We used an LBP for extracting facial features that are used for estimating the intensity of the emotion depicted in the image. The LBP is non-overlapping and uniform when applied to an image. Initially, a user specified number of uniform blocks are used to segment the image. For each patch on the image, the LBP matches the center pixel to its surrounding neighboring pixel to generate an *LBP* value. Equations (1) and (2) mentioned below are used for computation of *LBP*, where *N* represents the adjacent pixels, *k* is the neighboring size, and C is the center pixel. For this research, we have considered the value of *k*= 8.

$$LBP(N,C)=\sum k=07P(Nk-C)2k \quad (1)$$

$$[y]=\{10fory\geq 0fory<0 \quad (2)$$

The function LBP (N, C) (from Equation (1)) uses the P (Nk-C) as seen in Equation (2), generates a 1 or a 0depending on the difference between the center pixel and the neighbor. Figure 5 shows an example of neighboring pixel with their intensity values. Later the differences are calculated considering the center pixel. Equation (1) is used for the transition from difference matrix to Bit String Matrix (is a sequence of 0's and 1's).The most important step in LBP is that the starting position must be arbitrarily chosen for calculation. This is done by unwrapping the bits tring and decoding it.

200	190	50
120	150	150
225	40	150

50	40	−100
−30	N/A	0
−75	−110	0

1	1	0
0		1
0	0	1

Figure 5: Pixel Intensity values

The number of bit string pattern within a patch is counted to create a feature vector that is used in a distance measure. For an 8-bit string, there are a total of 256 possible bit strings. Furthermore, for simplification of the process, the string is either considered to be uniform or non-uniform. A string is considered to be uniform when its bits, parsed in a circular sequential manner, has a shift of values two or fewer times. Similarly, a string is non-uniform when its bits have changed more than two times. e.g., consider the string 00011110. Here only two shifts occur. One between the third and fourth position and one between the seventh and eighth position. Out of the total 256 patterns, only 58 are uniform. For every patch of an image, a histogram is created which is composed of 59 bins. All the 58 uniform patterns are assigned to those 58 bins in the histogram, where each bin stores the frequencies of the patterns. The one bin which is left (59th bin) keeps an account of all the non-uniform patterns found in the patch. Furthermore, all the histogram vectors from patches are concatenated to represent a histogram representing the features extracted by the LBP.

The features taken as output from the Local Binary Pattern (LBP) algorithm is used in our next step to provide personalized lessons for students.

a. Personalized Lessons

On evaluating student's emotion and progress, we prepare a data set containing categorized details of each student. Based on this input data, using AI automation, we generate personalized lessons for each student based on their category.

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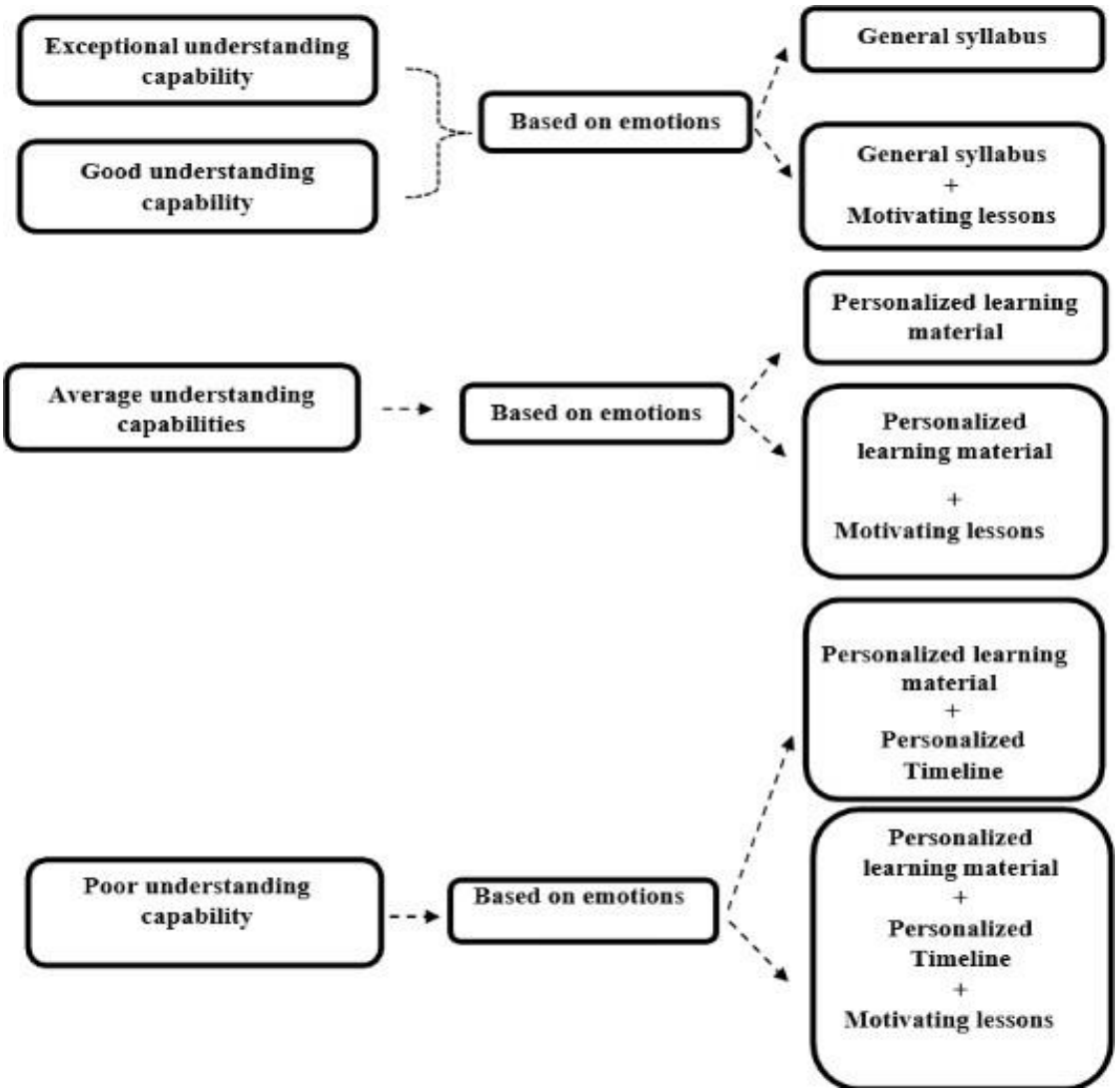

Figure 6: Classification of lessons based on input

Personalized learning, such as e-annotation and bookmarks[6], content searching, learning process tracking are implemented to improve performance of students. This method provides benefits to the student namely,[7]learning process tracking technique of IELS can provide detailed logs about the actual learning processes which can be used by the system to provide further assistance to individual learner. Such a learning system could achieve better performance grades along with emotional stability.

b. Keeping Teachers Updated

Students must get the most updated information about their subjects. That demands teachers to be on- par with the latest information. To make things easy for the teaching staff, an application is proposed which delivers the latest information straight to the staff's mobile or mail. Each teacher will have an account in the application which maintains the data of teacher's personal information and their domain of teaching. This information is used to bring personalized recommendations [4] and updated information about the respective subjects. The database is connected to the server where the latest information is fed and this information is sent to the respective teacher's mobile-app notification.

The teachers will find this updated information more useful. While teaching, the students will also be interested to know more about current trends than just reading the text.

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c. Campus Security

Thelearningenvironmentshouldguaranteethesecurityofthestudents.Topreventoffensiveactivities,the campus is subjected to surveillance of security cameras. These video-footages have to be manually monitored for suspicious activities which consume lot of time and effort which paved way for a better Security System using Artificial Intelligence.

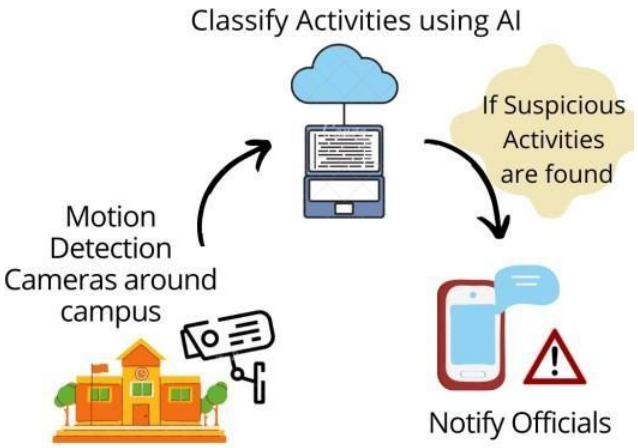
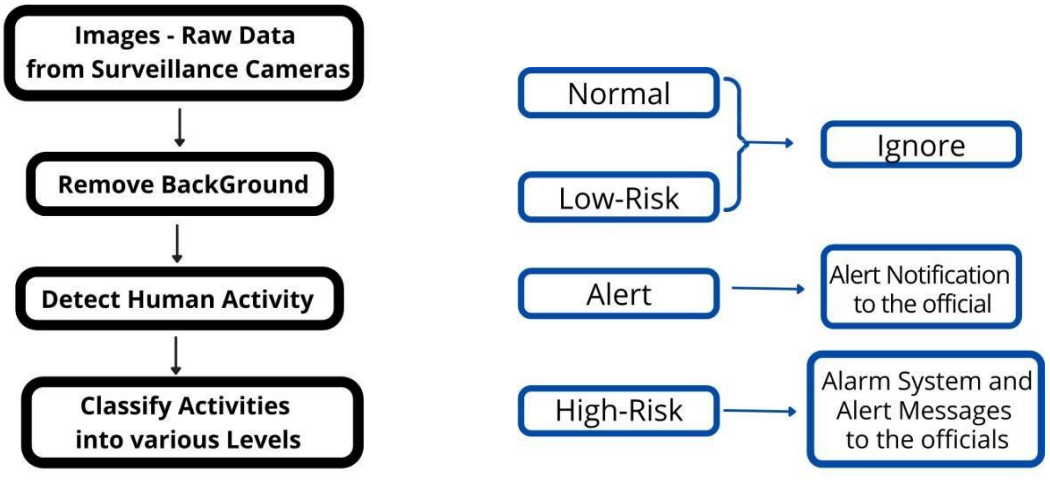


Figure 7: Functional Block Diagram of Campus Security System

This proposed Campus Security System uses Artificial Intelligence and IoT to monitor the video footages and classify them into levels of security breaches. Detailed flow diagram is given in Fig 7. The surveillance cameras are connected to a common server that logically arranges the footage obtained from different part of the campus (i.e., different cameras). The main activities of this system include event recognition and human behavior detection. [1] The process of classifying the video- footage takes place in several stages:

1. Separate environment details
2. Detect Motion
3. Classify Moving objects
4. Track the moving objects across cameras
5. Understand behavior and action of the object
6. Classify into levels



(a) (b)

Figure 8a: Stages in classifying video-footages b)Levels of Security and their respectiveoutcomes

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Here, the environment must be first separated from the objects of interest. The moving objects and human activities are detected. Detection happens with the video footages as raw data and the detection algorithm helps in pre-processing it [3] .These pre-processed data is then given into Classifying algorithm like Fuzzy Logic and Temporal Classifier [2]. The algorithms used here are implemented their efficiency is tested and found to be acceptable. Classification happens as basic step, starting with differentiating between humans and other movements. The classified humans are tracked across cameras for better understanding of crowd behaviour and intent of activity of the particular individual. The suspicious activities and normal activities are learnt by the Artificial Intelligence of this Security System [1] by using suitable data-sets and algorithms. A part of the dataset is taken aside for testing and the training set are classified manually or pre-classified according to the level of security. The activities are divided into different levels like Normal, Low-Risk Activity, Alert and High-Risk Activity. The "Normal" level includes walking, talking, playing and standing. Low-Risk Activities are those which does not need any official's attention. These two levels of risks are ignored by Artificial Intelligence of our Security System. But "Alert" level is that which has to be brought to the attention of management officials.

Activities of such levels include fighting among students, injuries or fainting. High-Risk Activities are those which need immediate attention and the situation has to be handled by a higher official. Activities include theft, kidnapping or other serious crimes. These activities are labeled and trained with the AI System so that it classifies them and then takes appropriate action as given in Fig 8(a).

The notifications and messages are sent by the server to the registered officials' phone or mail. By the proposed system, we can prevent crime in campus thereby ensuring better education environment.

d. Advantages of Innovation in Education System using AI

In this proposed system, student behavior is observed which provides an overview of the student individually. The report of student needs, capabilities and performance helps teachers to keep track of the students and make sure they excel in their academics. As it provides personalized recommendation to the students, they show increased interest in their studies and engage in active learning. The facial expressions and gestures of students give us the information of whether the student is struggling to understand the concept or it is easy to follow up. This system also examines the past history of the student to identify their weaker sides and helps to rectify it. Our system helps the students to have better communication with their teachers. Teachers get the latest information in their domain, so that they can teach students and make them 'up-to-date'. Suspicious activities and crimes that may occur inside the campus are prevented using this AI system.

4. Future Improvements

Artificial Intelligence is a novel technology that is on the rise and many new innovations are made in different fields, especially in the field of education. The improvements that can be made are endless with growing technological advancements. To be specific, the administrative work of teachers can be helped with AI. Preparing question papers, correction of test papers, creating assignments that demands the students to apply the concepts and to use their problem solving ability are some the works where AI can assist the teachers.

Selecting the best suited higher-education course is an essential step in every individual's life. AI can be used to evaluate the interests and the natural talent of the student and suggest the most suited under-graduate courses to choose from.

Being not able to attend regular school classes is a serious issue which decreases the literacy rate in our country. This may occur because of financial problems, cultural differences, physical or mental challenges. To cater to the special needs, AI can be a great tool to bring out the best in them.

5. Conclusion

AI can be integrated into many aspects of the Education System and educate the young generation with much more effectiveness. AI can never replace human teacher. It can be a best partner to the teacher and can reduce the work-burden. The power of AI must be used wisely and appropriately to get the maximum benefits with minimum after-effects. This system has maintained the delicate balance of AI and Human interaction in the field of education.

Doi : https://doi.org/10.54216/JCHCI.020103
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Thusthe traditional Education System is integrated with new and innovative AI which can be implemented to make better students and hence a better society of tomorrow.

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Received: August 3, 2022 Accepted: December 2, 2022