Virtual learning surveillance processing

V Jacintha¹, Shakthi Murugan K H², M Gomathi³, T Gency³, J Jenifer³ and J Jesy³

¹Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, India
²Jeppiaar Maamallan Engineering College, Srirerempudur, Tamil Nadu, India
³Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College Chennai, Tamil Nadu, India

E-mail : jacinthaeece@gmail.com, khshakthimurugan@gmail.com

Abstract: Virtual learning is an environment where trainees make use of computerized technologies for accessing educational modules exterior to conventional classrooms consigned completely through online. Though it takes over a huge benefit today, learners could lose their concentration easily. To overcome this major drawback, we put forward the idea of surveillance of eye gaze. This uses the technique of Feature extraction method called Kalman filter for gaze movement process. First the eye area is located by Haar’s cascade classifier and once found, the classification is done with the trained datasets which is done through support vector machine (SVM). The salient patches on the image of the face which detects the state of emotions facial landmarks using automatic follow free facial landmark detecting technique. This gives the result of the attentiveness of the learner by moving to the next webpage if they losses their concentration over it. This technique gives rise to better performance in an e-learning process by almost 3% when compared to the existing system. Thus the eye gazing process increases a better environment for virtual learning process.

Keywords: Concentration, Kalman filter, Haar’s cascade, SVM, Virtual learning

1. INTRODUCTION

Facial expressions are the most essential thing in interpersonal communication and for the social interaction. In pragmatic learning environment learners can have a chance of disturbance and losing their concentration. Recording of eye movements is a set of techniques used in eye tracking. This technology is introduced for identifying the eye positions and the eye movements. By introducing the tracking of eye technology to follow and analyse the learner’s attentiveness which gives a greater pros over the virtual sessions. Pose detection is possible in low imaging scenario also [1]. In the e-learning process it’s important to create greater interaction between learners and the trainer. Apart from communicating through questions the introduction to eye tracking techniques bring up their interest towards the session. These technologies bring about the researches in the psychological, psycholinguistics, and ergonomics bases, virtual-learning and the pre-testing of the advertising by observing those eye positions. This technology commences the path to a better learning atmosphere with the amusement of learning. In positioning of the pupil various disturbing factors(such as IR spotlight on the eye areas like eyelashes, uneven lighting, hair, glasses etc.) will affect the extraction process of the edges of the pupil [2-5].
2. RELATED WORK

The existing system reveals the estimation of gaze direction plays an important role in computer and the human interaction. Formally a scene camera and an eye camera are being used in gaze estimation device. The capturing of eye image is done using eye camera, which estimates the direction of gaze to the users at the coordinated systems of the eye camera and after that the evaluated gaze direction is being mapped to the scene camera for the determination of the gaze point that has been observed as the scenes [2]. The existing system reveals about the detection of the pupil mechanism for head mounted cameras which are near- infrared. There are around three important characteristics in this following method. First, a centre calibration of eyeball method is proposed for building an eye model. Second, the efficient ellipse fitting that describes the pupil boundary is being determined, by utilizing some model of pupils under head mounted cameras and circular pattern of the edge gradients. Third, an algorithm of pupil fitting based eye model with those three criteria is proposed to tune final contour pupil finely. While a number of methods for the detection of movement of the eyes are available, the commonly used technique is via capturing of images using a video camera, in either of visible or infrared domain [3].

The proposed system receives the geometric representation of the details and boosts the pupil detection performance. Experimentally this method could achieve almost the detection rate upto 72.62% which is superior to that of the previous best one. The technology of eye tracking is most diversely used in the field of interaction between the human and the computer, psychological testing, marketing fields and advertising areas, and even in industrial engineering and in the analysis of human factors. Movement of pupil is a randomized structure, which would be difficult to obtain with greater accuracy of the pupil movement by certain particular models [6]. In the authentication of iris procedure the pre-processing step is iris detection. This novelty approach is being expected in reduction of the number of retries possible to improve its usability in personal authentication [7].

In this method, canny filter is used first for detecting the edges by, after that the edges are being filtered by the morphologic approach; fitting of ellipse is being performed in each of the edges for obtaining the set of pupil contour which is possible. By using the possible pupil contour set, the coarse ellipse evaluation is being carried, judging it by its aspect ratio and size. For eliminating the extremes we are setting a very loose threshold. Then by pupil deformation model and circular pattern of gradients the apt pupil contour is being selected. Next the comparison of fitted ellipse contour and original edge is being carried out. If the rate of reappearance is above 90%, the acceptance is made that the fitting is very well. Then the further level of processing will be stopped. Else we use our algorithm which is being proposed for the fitting of the pupil with the three parameters for tuning it finely till the final contour. An eye model which is known will be the base of the proposal of deformation model and for the pupil fitting algorithm. Thus, we are calibrating the centre of eyeball at the starting. Although the introduced of projection information is made in the detection of pupil, in this method the pupil detection accuracy will damage in the absence of head mounting stand. Facial expression provides thought and emotion [8,9]. A number of applications are available including data acquisition [10-16]. Figure 1 shows the flowchart of existing system.
3. THE PROPOSED MODEL

The paper deals with live eye gazing by exact pupil monitoring during the virtual learning sessions. This process is carried over by considering the exact centre of the eye pupil as the innuendo for many fields of application. In this research the pupil features of the listeners in the virtual session are been observed in different levels of intensities from the captured picture of eye and determining if the former gets on with the session that had been taken over. This concept mainly relies on a scope for better virtual sessions, e-learning classes, class room training as well for observing if the learner concentrates completely and recognizing their mood and attentiveness by tracking up the eye ball by first locating it using Haar’s cascade classifier and using Support Vector Machine (SVM) with datasets trained are used for classification. This proposal includes automated technique of learning-free facial landmark detecting by using the state of emotion landmarks in face of pertinent points which have a greater extension over many applications. Depending on the situations, for making the technology of eye tracking more suitable for applying it generally, the issues we need to take care are: the cost efficient, easy and convenience for use and reduced load calculation [4]. The ultimate goal of this proposed system is to observe and analyze the conduct of the trainee’s behaviour and their attentiveness of them in order to improve the stage of online learning by localizing the learner at the centre of the learning process and feedback sent on them based on the execution time taken over on the whole. The process had been implemented in Python software and the hardware of Raspberry Pi which had increased the accuracy by about 3% over the execution system by the pupil tracking technique.

Haar-like feature are digital image lineaments which deals with object recognition which are used in initial live face detector. The lineament calculations were expensive when functioning with intensities of image alone. To overcome this, the idea of Haar wavelets which were developed into Haar-like features which acts like bounding box for specifying at objects. The latter works on the operation by considering regions over adjoining rectangles at precise location which lie above the eye and cheek region in the detection window and sums the intensities of pixel over each region and determines the difference among these sums which is used to assort the subsections of the image. The features of Haar are like classifier cascade which is well organized for determining stronger learning environment. Using integral image any size of lineaments can be calculated. Figure 2 denotes the diagrammatic representation of our proposed model. Figure 3 shows the cascade structure of Haar classifier.
Support Vector Machines (SVM) is superintended learning modules correlated with algorithm of learning that examines the data’s that are utilized for the determination of classification and regression. Figure 4 Shows the SVM in 3D. The data close to the decision boundary. The SVM is a portrayal of example such as points are in the space mapping where they are separated to various classes based on a full gap. New examples are also mapped on the surface and their classes are predicted by the surface of the gap they fall. Including the operation of linear classification, SVM performs a non-linear way of classification in an efficient way using the trick used in kernel, which is mapping their inputs into higher space of dimension. Supervised learning is impossible when the data is unlabelled so unsupervised learning is approached, to find the common assembling of the data to the groups and to map the new data into these groups. This technique is developed by Hava Siegelmann and Vlasimir Vapnik, which is most widely used clustering algorithm in industrial
applications. The SVM develops a hyper plane set in higher space dimension that is being used in the classing, reversing and other tasks. Hyper plane which is having the greatest distance to the closest of any class training-data point for achieving a good separation i.e. bigger the margins, smaller the error. Problem may arise only when they are set for discriminating which is linearly inseparable in infinite space of dimension.

![Support Vector Machine in 3D](image)

**Figure 4.** Support Vector Machine in 3D

3.1. **Pre-processor**
In pre-processing phase, we remodel the colour image into grayscale image so that, it need to revamp from RGB into grayscale. The average value of RGB is said as grayscale. Grayscale=(R+G+B)/3

3.2. **Face Detection Technique and Eye Localization Method**
Determination of the gaze point needs the knowledge of the pose and position of face helps to obtain region for eye detection which helps in reduction of positive rate being false as well as time computation. Due to its higher accuracy and faster execution, Haar-like feature methods are used in face detection.

3.3. **Segmentation**
Segmentation methods have greater impact on digital analysis of images and even performance. Multi-label segmentation method is used for selection of backgrounds. For determining the probability quickly for a given number of pixels that at each unlabeled pixel start a random walker reaches the pre-labelled pixel. Segmentation is obtained for an image by assigning each of the pixels to a consequent label for computing the highest probabilities.

3.4. **Iris Tracking**
In a video sequence Haar’s cascade is used for tracking IC, with tracking approach searching region for iris When eyes are closed the IC localization may also return up false positives and to overcome them threshold on peak magnitudes are used and hence this machine learning based approach is used to check if the state of eye is opened or closed

This paper proposes the consideration of corners of the inner eye to be the reference point for detection of gazing which could be done easily in ROI of eye using Gobar jet for owning high accuracy. For gaze position calculation the vector that connects eye corner and iris centre are used. The tracking of eye corner in subsequent frame is done by flow of optics and cross correlation which is the normalized method and it is reinitialized automatically if the value obtained is less than that of the threshold value which is pre-set.
4. RESULTS AND DISCUSSIONS

Figure 5 – Figure 8 shows the screenshot of the captured images of the responses captured at different positions. Figure 9 – Figure 10, shows the demonstration kit that was done and experimented.

Figure 5. Response while pupil tracking in Right

Figure 6. Response while pupil tracking in left

Figure 7. Response while pupil tracking in bottom
5. CONCLUSION

The analysis of eye movement in evaluating the learner’s attendance in the session they take up and this technology finds over a greater pro on it. This technique shows the state of the learner and make them realize how the mental state of the learner is, by moving on to the next page when missing their concentration. Though the eye tracking system is high still, it can be reduced in some of years by the time of implementation. The attention of the listener can be observed by pausing the video sequence rather than going to the next page. This can even save the time a lot and hence reducing the unwanted storage by also sending the reading time of the learners.
REFERENCES

[1]. Lin Tang, Chenqiang Gao, Xu Chen, Yue Zhao, “Pose detection in complex classroom environment based on improved Faster R-CNN, *IET Research Journals* -2018.

[2]. Jianfeng Li, Shigang Li, Tong chen and Yiguang Liu, “A Geometry Appearance- Based Pupil Detection Method for Near-Infrared Head-Mounted Cameras”, *IEEE*. 2018.2828400.

[3]. Constantin Barabaşa, Radu Gabriel, Cristian Rotariu “Servo Control Based on Pupil Detection Eye Tracking”, *International Symposium for Design and Technology in Electronic Packaging*, 978-1-5386-5577-1/18.

[4]. Chenyang Zheng,Tsuyoshi Usagawa, “A Rapid Webcam-based Eye Tracking Method for Human Computer Interaction” *International Conference On Control Automation & Information Sciences*, 978-1-5386-6020-1/18.

[5]. Xing Jin, Zhicheng Li, Jingjing Zhang, “Xiang Yang, Research on Pupil Centre Localization in Eye Gaze Tracking System”, the *37th Chinese Control Conferene*-2018.

[6]. Wang Changyuan, Jiang Guangyi, Chen Hua, Jin Ruiming, “A Pupil Tracking Method Based on Particle Filter” *International Conference on Systems and Informatics*-2018.

[7]. Riki Ishikawa, Tomohiko Ohtsuka, “Pupil Centre Detection by Abstracted Contour Graph Analysis for Iris Detection” *International Conference on Systems, Man, and Cybernetics*-2018.

[8]. Steven Hickson, Nick Dufour, Avneesh Sud, Vivek Kwatra, Irfan Essa, “Eyemotion: Classifying Facial Expressions in VR Using Eye-Tracking Cameras”, *Winter Conference on Applications of Computer Vision*-2017.

[9]. V. Jacintha, K. H. Shakthimuruzan, V. Kripakaran and S. Lokeshwaran, "FPGA Based Dual Redundancy CAN Controller with Fault Tolerance" 2018 4th *International Conference on Electrical Energy Systems (ICES), Chennai*, 2018, pp. 667-671, doi: 10.1109/ICES.2018.8443204.

[10]. K. H. S. Murugan, V. Jacintha and S. A. Shifani, "Security system using raspberry Pi," 2017 Third *International Conference on Science Technology Engineering & Management (ICONSTEM), Chennai*, 2017, pp. 863-864, doi: 10.1109/ICONSTEM.2017.8261326.

[11]. Jacintha,V, Nagarajan.J, Yogesh,K, Tamilarasu,S, Yuvaraj.S” An IOT based ATM surveillance system”, IEEE International Conference on Computational Intelligence and Computing Research (ICCIC) , 2017.

[12]. Boobalan J, Jacintha.V, Nagarajan.J, Thangayogesh.k, Tamilarasu,S, “ An IOT based Agriculture monitoring system”, *IEEE International conference on Communication and Signal Processing(ICCSP)*, 2018.

[13]. Shakthimurugan, K.H.. (2014). Hardware implementation of TCP/IP over visible light communication on FPGA (A concept of light fidelity). 10. 31095-31101.

[14]. Shakthimurugan, K.H.. (2015). Multi-carrier frequency offset estimation for carrier aggregation-orthogonal frequency division multiplexing communication. 10. 31035-31041.

[15]. Manickam, Sumathi & Shakthimurugan, K.H. & Sumathi, K.. (2016). Performance study of 4:1 multiplexer CMOS logic structures. 9. 565-574.

[16]. Murugan, K. & Manickam, Sumathi. (2017). Wireless data acquisition system for underwater environment. 1-6. 10.1109/ICECCT.2017.8118014.