SURVEY ON EYE BASED TRACKING SOLUTIONS FOR PSEUDO COMA PEOPLE

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Abstract*—Machine learning algorithms are evolving in every industry -translating text, identifying faces in photographs, driving cars and so on. This paper is a survey on the use of machine learning for the communication of pseudo coma people. These people are affected by full body paralysis and can only blink their eyes, but they are cognitively active (able to understand what is happening around them and what people talk). Currently they have very few ways of communicating with normal people, some are very expensive while others are intrusive in nature. One way of effective communication for them would be by blinking their eyes in Morse code and a system to convert them into text or voice. The usage of the eye aspect ratio in finding the number of blinks would help in designing a cheaper and faster system.

***Index Terms*— Machine learning, pseudo coma, Morse code.**

I. INTRODUCTION

Machine learning is a subfield of artificial intelligence (AI). The main aim of machine learning generally is to understand the structure of data and fit that data into models that can be understood and utilized by all the people. Machine learning is a continuously developing field Machine learning algorithms allow the computers to train on data inputs and use statistical analysis in order to output values that fall within a specific range. Because of this, machine learning facilitates computers in building models from sample data in order to automate decision-making processes based on data inputs. Facial recognition technology allows social media platforms to help users tag and share photos of friends and detect facial structure of human. Optical character recognition (OCR) technology converts images of text into movable type are some of the usage of machine learning in various fields. Human bias plays a role in how data is collected, organized, and in the algorithms that determine how machine learning will interact with that data.

II. LITERATURE SURVEY

"Biometric Recognition via Eye Movements: Saccadic Vigor and Acceleration Cues", IOANNIS RIGAS and OLEG KOMOGORTSEV [1], this paper is based on the concepts of Saccadic Vigor and Acceleration Cues for tracking the eye movements. Saccadic eye movements are executed via the combined application of agonist–antagonist forces from the oculomotor muscles. Thus, inspecting the acceleration profile of a saccade can provide valuable information regarding the underlying sources of the applied forces. The experiments were conducted with 322 subjects (171 male/151 female), aged 18–46 (M = 22, SD = 4.2). Of those subjects, 163 had corrected vision (67 glasses/96 contact lenses). The subjects performed two recording sessions each, separated by a time interval of approximately 20 minutes for each visual stimulus, leading to the collection of 1,866 unique recordings. They achieved a accuracy of 36% due to the limited number of data sets. Other issues include variable lighting conditions and environmental noise thus requiring a high-grade eye tracking device.

"Invisible Eye: Mobile Eye Tracking Using Multiple Low-Resolution Cameras and Learning-Based Gaze Estimation", MARC TONSEN, JULIAN STEIL YUSUKE SUGANO [2], this paper deals with mobile eye tracking that uses millimeter size RGB Cameras that is fully embedded into normal glasses. The most common issues are that the glasses are intrusive to wear, and many small cameras were required to produce a decent resolution. At a 5*5 pixel resolution the average error when using all 3 camera pairs was 2.9 degree.

"Eye PACT: Eye-Based Parallax Correction on Touch-Enabled Interactive Displays", MOHAMED KHAMIS, DANIEL BUSCHEK, TOBIAS THIERON, FLORIAN ALT, ANDREAS BULLING, [3] this paper presents an Eye Pact method that compensates the input error caused by parallax on public displays. This method uses a display mounted depth camera to detect the uses 3D eye position in front of the display. Eye PACT determines which pair of eyes to correct for depending on the closest arm to the display at the time of the touch event. This is done by utilizing skeletal tracking which provides the position of users' joints in the 3D space in front of the display. The speed and direction of the moving target is randomly decided. EyePACT can be exploited to support interaction.

"Training and Testing Object Detectors With Virtual Images", Yonglin Tian, Xuan Li, Kunfeng Wang, Fei-Yue Wang [4] , this paper presents a way to design artificial scenes and automatically generate virtual images with precise annotations. All the images and annotations were stored in the form of PASCAL VOC. Faster R-CNN is done by initializing the with ImageNet pre-trained weights. Performance of the model is worse on all sub-datasets while a bigger rate of descent of AP occurred on ParallelEye in the testing phase, which resulted from the smaller average area of object of ParallelEye. And it witnessed a huger drop of the rate of AP after the deletion of occluded objects from the training set because it has a higher occlusion rate.

"Learning Discriminative Subspace Models for Weakly Supervised Face Detection", Qiaoying Huang, Chris Kui Jia, Xiaofeng Zhang, and Yunming Ye [5], In this module, a subspace-based generative model is proposed to select positive instances by minimizing rank of the coefficient matrix associated with the subspace models of object instances in images. Based on the subspace assumption of object categories an approach is proposed to learn generative subspace models of object categories in the weakly supervised setting. To reduce the learning difficulty, block coordinate descent method is being used. t the proposed Single+Subspace model can detect the instances that are comparably close to the true instances. To evaluate the model performance, it plots several false positive bounding boxes labeled by Single+Subspace.

"Detecting Gaze Towards Eyes in Natural Social Interactions and Its Use in Child Assessment", EUNJI CHONG and KATHA CHANDA, ZHEFAN YE, AUDREY SOUTHERLAND and NATANIEL RUIZ, REBECCA M. JONES, AGATA ROZGA∗ and JAMES M. REHG∗ [6], This paper proposes approach to eye contact detection during adult-child social interactions in which the adult wears a point-of-view camera which captures an egocentric view of the child's behavior. The Pose-Implicit CNN, deep learning architecture that predicts eye contact while implicitly estimating the head pose is used. Landmark detection is successful only for 75.56% of frames, in comparison to 97.94% for face detection. The main drawback of this module is that the examiner has to wear glasses.

"Development and Analysis of Speech Recognition Systems for Assamese Language Using HTK", HIMANGSHU SARMA and NAVANATH SAHARIA, UTPAL SHARMA [7], Hidden Markov Model Toolkit (HTK) 3.5, is used for deep learning based neural network for the speech recognition model. HVite and HResults tools of HTK are used to recognize mfc files during automatic transcription and to store the results. 78.05% accuracy with 38 graphemes using HTK 3.5 with deep neural network and 65.65% accuracy using HTK 3.4. The accuracy is dependent on graphemes, as lesser graphemes produce higher accuracy. The report analyzes some basic aspects of Assamese speech including the development and transcription of speech corpus, syllabification, automatic transcription, and finally, development of a speech search engine. Assamese is a very less aware language in terms of computing and giving importance is insignificant.

"An AdaBoost-Based Face Detection System Using Parallel Configurable Architecture with Optimized Computation", Shouyi Yin, Peng Ouyang, Xu Dai, Leibo Liu, and Shaojun Wei [8], The proposed system is an AdaBoost-based face detection system using parallel configurable architecture with optimized computation. The AdaBoost-based detection algorithm is mainly an N-stage-based cascade classifier. The design uses the homogenous and configurable arrays reduces the number of logic elements by 50.7%. The experiment result shows that this architecture improves the processing speed and reduces the power consumption for face detection. Subspace methods have been proposed for visual learning and recognition which are sensitive to variations in illumination, pose and occlusion. The characteristic data consumption in the algorithm is exploited.

"Adaboost modular tensor locality preservative projection: face detection in video using Adaboost modular-based tensor locality preservative projections ", Janthakal Rajeshwari, Kwadiki Karibasappa, Madigondanahalli Thimmaiah Gopalkrishna [9], the proposed method combines block-based tensor locality preservative projection (TLPP) with Adaboost algorithm which improves the accuracy of face detection. The proposed algorithm is Adaboost modular TLPPs (AMTLPPs), the face image is divided into overlapping small blocks and these block features are given to TLPP to extract the features where TLPP take data directly in the form of tensors as input. AMTLPP algorithm selects the optimal block features from the large set of the block features which forms the weak classifiers and are combined to form the strong classifier. The face detection is done TLPP for the stored online videos. The face recognition is not done for live streaming of the video.

"DualBlink: A Wearable Device to Continuously Detect, Track, and Actuate Blinking for Alleviating Dry Eyes and Computer Vision Syndrome", ARTEM DEMENTYEV, CHRISTIAN HOLZ [10], In this paper, a series of glasses-mounted devices that track the wearer's blink rate and, upon absent blinks, trigger blinks through actuation: light -ashes, physical taps, and small puffs of air near the eye. The support vector machines (SVM) and wavelet transforms are used in the system and achieved 67% accuracy for normal blinks detection. The emission of achieved 67% accuracy for normal blinks detection.

III. Conclusion And Future Scope

In this survey, we have collected research papers on how the human eye can be used as an effective tool for communication in the real world. The current communication model based on eyes for people affected by pseudo coma are expensive and intrusive to wear. There are no proper means for them communicate and there are very few solutions available for them. We need to look into various solutions for these people by looking into the papers surveyed here. An extensive study in developing a better communication model for these people is required. There are several possibilities using the algorithms of machine learning and finding a better communication model for the pseudo coma people is not far away. We propose a model where the affected people communicate through blinks using the international Morse code. The blinks would be short and long just like the dot and dashes present in the Morse code. These blinks would be interpreted by a facial landmark detector and is converted into words to be displayed. This could prove to be an effective method of communication for the affected people in communicating with normal people.

Table 1 Research papers

S.NO	*TITLE*	*ALGORITHM USED*	*ACHIEVED RESULTS*	*OPEN ISSUES*
1	Biometric Recognition via Eye Movements: Saccadic Vigor and Acceleration Cues	ANOVA(analysis of variance)	the combined application of agonist–antagonist forces from the oculomotor muscles. Thus, inspecting the acceleration profile of a saccade can provide valuable information	Achieved accuracy of 36% due to the limited number of data sets.
2	InvisibleEye: Mobile Eye Tracking Using Multiple LowResolution Cameras and Learning-Based Gaze Estimation	Machine learning-based approach for gaze estimation	with mobile eye tracking that uses millimeter size RGB Cameras that is fully embedded into normal glasses.	At a 5*5 pixel resolution the average error when using all 3 camera pairs was 2.9 degree.

3	EyePACT: Eye-Based Parallax Correction on Touch-Enabled Interactive Displays	Skeletal tracking	Accuracy of the system on a 5-point scale (1=very imprecise; 5=very precise), responses ranged from 2 to 5 and were more inclined towards high precision (M = 3.28, SD = 0.83)	The speed and direction of the moving target is randomly decided.
4	Training and Testing Object Detectors with Virtual Images	Deep learning	Faster R-CNN is done by initializing the with ImageNet pre-trained weights	A huger drop of the rate of AP after the deletion of occluded objects from the training set because it has a higher occlusion rate.
5	Learning Discriminative Subspace Models for Weakly Supervised Face Detection	Multiple instance learning (MIL)	to select positive instances by minimizing rank of the coefficient matrix associated with the subspace models of object instances in images	It plots several false positive bounding boxes labeled by Single+Subspace.
6	Detecting Gaze Towards Eyes in Natural Social Interactions and Its Use in Child Assessment	Deep learning	to eye contact detection during adult-child social interactions in which the adult wears a point-of-view camera which captures an egocentric view of the child's behavior.	. Landmark detection is successful only for 75.56% of frames, in comparison to 97.94% for face detection.
7	Development and Analysis of Speech Recognition Systems for Assamese Language Using HTK	Deep learning based neural network	78.05% accuracy with 38 graphemes using HTK 3.5 with deep neural network and 65.65% accuracy using HTK 3.4	The accuracy is dependent on graphemes,
8	An AdaBoost-Based Face Detection System Using Parallel Configurable Architecture with Optimized Computation	AdaBoost-based detection algorithm	based face detection system using parallel configurable architecture with optimized computation.	The characteristic data consumption in the algorithm is exploited.
9	Adaboost modular tensor locality preservative projection: face detection in video using Adaboost modular-based tensor locality preservative projections	Block-based tensor locality preservative projection (TLPP) and Adaboost algorithm	Improved accuracy of Face detection in video.	The face recognition is not done for live streaming of the video

10	DualBlink: A Wearable Device to Continuously Detect, Track, and Actuate Blinking for Alleviating Dry Eyes and Computer Vision Syndrome	support vector machines (SVM)	achieved 67% accuracy for normal blinks detection.	Medical reports are not detailed for eye protection.

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