**Active Attendance Monitoring through**

**Facial Expressions and Iris Gesture Recognition**

This synopsis outlines different techniques that can be used for monitoring student attendance in the University/College. The system can be made active through the use of facial expressions and the movement of eye pupil that is iris.

Due to the shortage or lack of quality teachers in today’s date, the online education system through MOOC or other online sources solves the problem and made the quality teachers available at any time anywhere in the world.

The students may or may not actively participate in the discussions or classes which are conducted online or offline. So the monitoring of such students must be done somehow.

To solve the problem of lively detecting the student behaviour about his/her involvement in the class can be monitored through the facial expressions or through iris gesture recognition methods.

1. **Through the use of facial expressions and micro-expression**

The micro-expression are instantaneous and involuntary reflection of human emotions. Because micro-expressions are lasting only a few frames within video sequence.

Unlike regular facial expression, it is difficult to fake or hide the micro-expression. Thus detecting liveness of the individual can be done through the micro-expression.

Those micro-expression will help in detecting the person which are involved in the discussion. The persons who are actively participating in the class will get recognized by those micro-expressions appropriately.

Some existing methods such as Active Appearance Modelling (AAM), Spatio-Temporal Strain and Local Binary Pattern solve the facial expression recognition to certain extent but not completely.

But these methods are ineffective at handling subtle face displacements, which can be prevalent in typical micro-expression applications due to the constant movements of the individuals.

* For accessing the micro-expression high speed camera is necessary. The data required for processing should be of large number of frames. Thus high speed cameras to be used to capture multiple frames.
* Facial Dynamic Map is one of the technique used by the researcher to identify and classify such micro-expression.
* Optical flow technique can be used as descriptor for tracking the movement of mass points in the data. The captured number of frames are tracked for the movement of facial muscles to track movement.
* Before applying the flow estimation, landmark location on the face are used to crop the region of interest here the face. The cropped frame sequence is then used to get the optical flow of region of interest.
* The quality of alignment in micro-expression tasks is more critical the landmark-based approach alone is not sufficient for identifying the micro-expressions. Thus fine-scale in-sequence alignment i.e., a pixel-level alignment needs to be done.
* After the fine alignment is attained, a more compact representation is needed to characterize the dynamics of the micro-expression for better recognition. Because facial expressions are generated by the movement of facial muscles, thus the spatial and temporal direction of movement of muscles need to be considered. This step uses the facial dynamics.
* In facial dynamics map the face area can be split into n x m equally-spaced grids and construct a spatiotemporal cuboid by introducing T temporally consecutive grids. By facial dynamics principle direction of movement of muscles is acquired.
* Using the classifier such as SVM, minimum distance classifier, k nearest neighbour could be used to classify the individual into the percentage of involvement in the class.

1. **Through the use of Pupil Dynamics**

For more than a decade liveness detection has been an important element in Active Monitoring of the attendance. Liveness detection refers to the detection of living symptoms. The focus is on iris liveness detection, i.e., identification of liveness symptoms that could prove the authenticity of the eye and the willingness of the subject to be registered by the sensor. Instead of more commonly used static properties of the eye or its tissue, this uses dynamics of the pupil registered under visible light stimuli. Since the pupil reacts involuntarily when the light intensity changes, it is difficult to conceal this phenomenon.

As will be shown in the Method, the pupil dynamics are not trivial, making it difficult to mimic them for artificial objects. This tests may be decided not to use static objects such as iris paper printouts or patterned contact lenses, since in such cases would be assured of success (static objects do not present significant dynamics, apart from some measurement noise, and thus are easily recognizable when dynamics is the key).

Instead, to assess the proposed method performance, classify spontaneous pupil oscillations (often called hippus) and normal pupil reactions to a positive surge of visible light, thus making the tests more realistic. This is the only work that employs pupil dynamics for liveness detection and which is evaluated on dynamic, real objects rather than static artifacts.

* Collection Stand

To our best knowledge, there are no public collections of iris movies that would allow for this study of pupil dynamics. These decided to build suitable measuring equipment and gather our own set of *eye movies* captured in near infrared light. The core of the collection stand is the IrisCUBE camera embedding The Imaging Source DMK 4002-IR b/w camera equipped with a SONY ICX249AL 1/2” CCD interline sensor of increased infrared sensitivity. The scene was illuminated by two near infrared illuminants (*λ* = 850 nm) placed horizontally and equidistantly to the lens. The equipment applies a near infrared filter to cut any light with a wavelength lower than 800 nm. The IrisCUBE camera can capture 25 iris images per second, and the image quality significantly exceeds minimal ISO/IEC 19794-6 and ISO/IEC 29794-6 recommendations related to those aspects that are independent of the imaged subject.to guarantee repeatable capture conditions in the entire experiment, The Method enclosed the camera in a large, shaded box with a place where the subject positions his or her eyes for acquisition of the image. These used visible LEDs, embedded into the frontal part of the camera case to help the user in positioning the head, as a visible light stimulus.

This configuration guarantees the fixed position of the subject’s head in each attempt and a stable distance between the subject’s head and the camera (approximately 30 cm). It allows to measure the pupil’s reaction in complete darkness (regardless of external lighting conditions) as well as during the visible light step stimulation. However, one should be aware that pupil reaction may be less distinct when the eye is observed under bright ambient light (due to higher pupil constriction before the stimuli is applied).

* Database Statistics

The collected images for 52 distinct irides of 26 subjects. For 50 irides The Method captured 4 movies, and only 2 movies for a single person, making for 204 eye movies in total. Each movie lasts 30 seconds and presents spontaneous oscillations of the pupil size (first 15 seconds) and reaction to a step increase of light intensity (next 5 seconds), as well as the reaction to a negative step change in the illumination (last ten seconds). Since these capture 25 frames per second, the database volume sums up to 204×30×25 = 153 000 iris images illustrating pupil dilation and constriction processes. Figure presents example frames and illustrates the moments of visible LED set-on and set-off.

* Representation of Actual and Odd Pupil Reaction

The work may go beyond limitation and develop the method that may recognize correct pupil dynamics and reject any behavior that mimics real pupil movements, or presents some odd, unexpected oscillations. This research decided to analyze the alive eyes only and to treat the spontaneous oscillations of the pupil as odd reactions to hypothetical (nonexistent in this case) light stimuli. This approach perfectly corresponds to what understand under the ’liveness’ term, namely the detection of vital symptoms of the analyzed object. Only an alive and authentic eye should demonstrate correct dynamics specific to a human organ. If after a sudden visible light impulse. This observes nothing but hippus, this may denote that we observe a non-living eye. To organize our data according to our assumptions, then consequently crop two five-second sub-movies from each eye movie in the database.

The first cropped sub-movie, representing odd eye reaction, starts when the measurement takes off, and ends after the fifth second of the measurement. The second sub-movie starts in the sixteenth second (exactly when the eye is stimulated by a visible light) and finishes in the twentieth second (exactly when the visible light is set off), see Fig. This results in 204 movies lasting 5 seconds and representing odd reactions, and 204 movies representing expected pupil dynamics, also 5 seconds long.

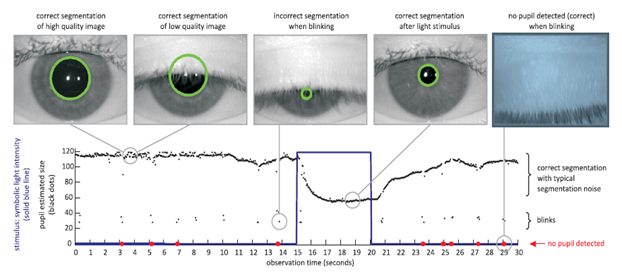


Fig: Pupil size (black dots) measured automatically during a single experiment under the light stimuli (blue solid line). Note that capture of a real object results in a non-ideal sequence of pupil size due to blinks (black dots departing from the expected sequence), eye closure (red dots of zero ordinate denoting that no pupil is detected), or fluctuations of the segmentation process (revealing as a ’noise’ in the sequence). Illustrating exemplars are shown at the top and linked to the corresponding moments of the sequence.

* **RECOGNITION OF PUPIL DYNAMICS:**

**A  *Data Pre-Processing:***

***1 Pupil Detection, Segmentation and Calculation of Its Size:***

Pupil dynamics is expressed by changes of its size. The *pupil size* is however an imprecise and general dimension that may be calculated in various ways.In this Method decided to use the most common, circular approximation of its – possibly irregular – shape. This is done intentionally due to three factors:

a) High speed of circular segmentation,

b) Commonness of circular modeling in already deployed iris recognition methods, and

c) Unimportance of non-circular deviations when describing the dynamics.

Having no ground truth related to iris location, this detect and localize the pupil in each frame independently. While *detection* refers to a statement of whether the pupil exists within the frame, the *localization* delivers its position. To localize a boundary between the pupil and the iris, apply a Hough transform operating on *directional image* (estimation of an image gradient delivering both a gradient value and its direction). These parametrized the transform to make it sensitive to dark circular shapes and almost unresponsive to other dark shapes and light circles, such as specular reflections. Use of gradient and sensitivity to circular shapes makes this method surprisingly robust even if the pupil is 50% covered by eyelids. Consequently each eye movie is transformed into a time series of pupil radii, Fig. 1. We do not use gradient values that do not exceed a minimum threshold (set experimentally to the hardware setup that we employed). If there is no single gradient value exceeding the threshold, the method reports that no pupil could be detected. The latter realizes pupil detection, and helps to identify time moments when the eye is completely covered by eyelids.

**This may be include**

1 Artifacts Removal

2 Searching For Liveness Features Fitting the Model

3 Goodness of fit

4 Classification of the Liveness Features

**References:**

**[1]** IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY, VOL. 10, NO. 4, APRIL 2015 “Pupil Dynamics for Iris Liveness Detection” Adam Czajka, Senior Member, IEEE.

**[2]** A. Czajka, “Database of iris printouts and its application: Development

of liveness detection method for iris recognition,” in Proc. 18th Int.

Conf. Methods Models Autom. Robot. (MMAR), Aug. 2013, pp. 28–33.

**[3]** J. Connell, N. Ratha, J. Gentile, and R. Bolle, “Fake iris detection

using structured light,” in Proc. IEEE Int. Conf. Acoust., Speech, Signal

Process. (ICASSP), May 2013, pp. 8692–8696.

**[4]** E. C. Lee, K. R. Park, and J. Kim, “Fake iris detection by using

purkinje image,” in Advances in Biometrics (Lecture Notes in Computer

Science), vol. 3832, D. Zhang and A. K. Jain, Eds. Berlin, Germany:

Springer-Verlag, 2005, pp. 397–403.

**[5]** F. M. Villalobos-Castaldi and E. Suaste-Gómez, “A new spontaneous

pupillary oscillation-based verification system,” Expert Syst. Appl.,

vol. 40, no. 13, pp. 5352–5362, 2013.

**[6]** T. Pfister, X. Li, G. Zhao, and M. Pietikainen, “Recognising spontaneous facial micro-expressions,” in IEEE Int. Conf. Comput. Vision, 2011.

**[7]** S.-J. Wang, H.-L. Chen, W.-J. Yan, Y.-H. Chen, and X. Fu, “Face recognition and micro-expression recognition based on discriminant tensor subspace analysis plus extreme learning machine,” Neural Proces. Lett., vol. 39, no. 1, pp. 25–43, 2014

**[8]** T. Pfister, X. Li, G. Zhao, and M. Pietikainen, “Recognising spontaneous facial micro-expressions,” in IEEE Int. Conf. Comput. Vision, 2011.

**[9]** D. Sun, S. Roth, and M. J. Black, “A quantitative analysis of current practices in optical flow estimation and the principles behind them,” Int. J. Comput. Vision, vol. 106, no. 2, pp. 115–137, 2014.