An Experimental Analysis of Video Eye Tracker Data in Predicting Human Engagement Behaviour

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Abstract

In this work seven descriptors were utilized to rank twelve participants' engagement performance with eighteen common intermediate format (CIF) videos which included experimental results from an Tobi X120 eye tracker, video experts' opinion, and data from graph based visual saliency (GBVS) model- a well known saliency modelling algorithm.

Experimental Results and Analysis

Based on following seven descriptors, the performance of the participants are graded in order to comprehend their engagement behaviour (EB) with the videos:

- Left pupil size (PS_L).
- Right pupil size (PS_R).
- Blinking pattern (F).
- Distance between individual's average gaze location to all participants' average gaze location as obtained by the eye tracker data (D_A) .
- Distance between individual's average gaze location to the average gaze location as predicted by the GBVS model (D_G).
- Distance between individual's average gaze location to the centre of the videos (D_C).
- Distance between individual's average gaze location to the most significant points according to the video experts (D_E).

The pupil sizes are measured in millimetre (mm), blinking patterns in percentage (%) and all the human gaze distances are measured in pixels in analysing the eye tracker extracted video data. Both the pupil sizes (left and right) and fixations are directly proportional to the EB, while any distance considered in this experiment is inversely proportional. Hence the EB can be expressed by the following function-

$$EB = f\left(PS_L, PS_R, F, \frac{1}{D_A}, \frac{1}{D_G}, \frac{1}{D_C}, \frac{1}{D_E}\right)$$

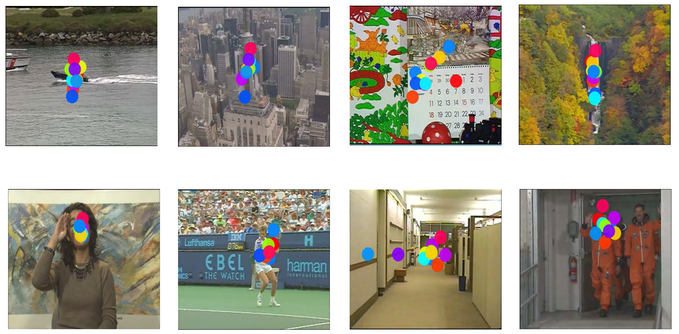

Fig. 1.: Participants' eye gaze points for frame 1 of different video clips as indicated by the colored dots.

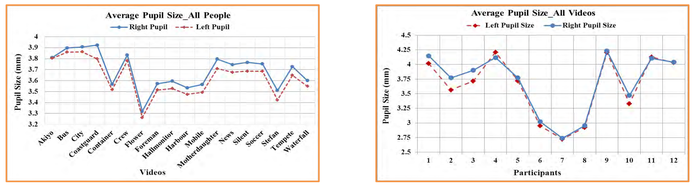

Fig. 2.: Average pupil sizes of 12 participants over 18 videos.

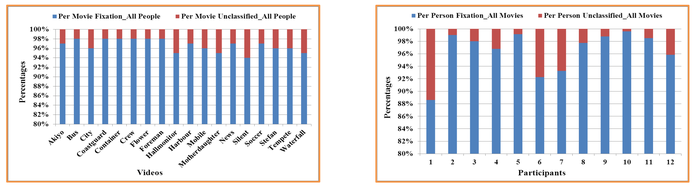

Fig. 3: Video wise and person wise average fixation percentage

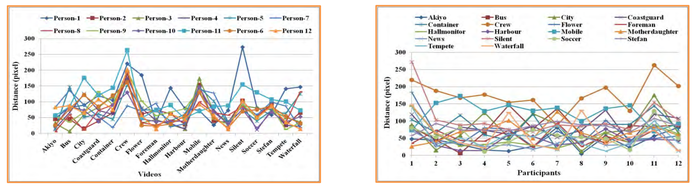

Fig. 4.: Video and person wise average pixel distances from the videos' centers.

Fig. 5: Tobi X120 eye tracker has been employed in collecting data (picture courtesy: www.wired.com).

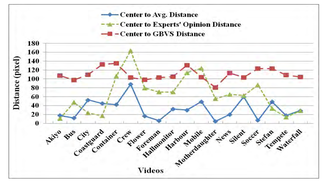

Fig. 6: Video wise average pixel, Experts' opinion and GBVS distances from the videos' centres.

Participants	Video Clips and Corresponding Scores of Each Participants																		Final Grades	
	Akiyo	Bus	City	Coastguard	Container	Crew	Flower	Foreman	Hall monitor	Harbour	Mobile	Mother daughter	News	Silent	Soccer	Stefan	Tempete	Waterfall	Overall Score	Overall Rank
1	46	59	54	53	43	54	64	51	58	58	41	43	57	48	29	49	52	51	910	3rd
2	58	56	34	53	55	49	50	49	49	61	50	53	51	39	59	52	61	59	938	2nd
3	48	30	54	42	39	47	32	51	55	46	53	44	32	53	53	54	47	22	802	8th
4	56	54	51	42	45	56	58	50	61	50	56	62	57	61	57	46	50	57	969	1st
5	38	30	59	52	45	51	42	37	55	54	47	51	37	53	53	35	41	58	838	5th
6	34	43	41	48	40	38	46	35	36	35	30	45	32	40	33	45	43	29	693	11th
7	47	51	42	31	36	31	28	31	21	29	29	33	32	37	44	35	39	35	631	12th
8	60	31	42	45	49	39	40	52	38	36	40	34	35	43	51	51	47	51	784	9th
9	30	57	58	53	54	48	56	44	46	55	60	47	56	39	32	31	43	52	861	4th
10	45	48	31	43	48	41	51	46	48	38	48	44	45	46	50	45	35	51	803	7th
11	47	44	43	43	39	49	49	43	41	37	33	44	60	62	38	48	55	45	820	6th
12	37	43	37	41	53	43	30	57	38	47	59	46	52	25	47	55	33	36	779	10th

Table 1: Overall ranking of the twelve participants over eighteen videos

Future Work

At the moment equal weights are used for all the descriptors. In future different descriptors would be provided with different weights based on their relative importance so that the human engagement behaviour could be analyzed with greater efficiency.

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