Development of a low-cost android application to detect human eyes, irises and pupils [瞳孔大小偵測系統]

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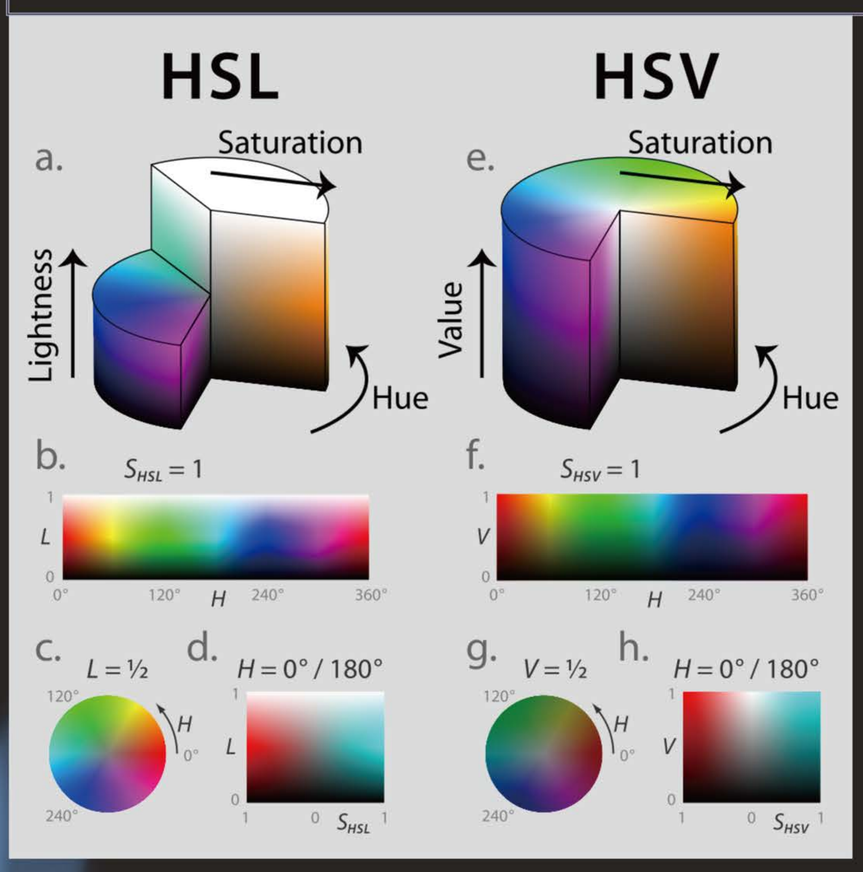
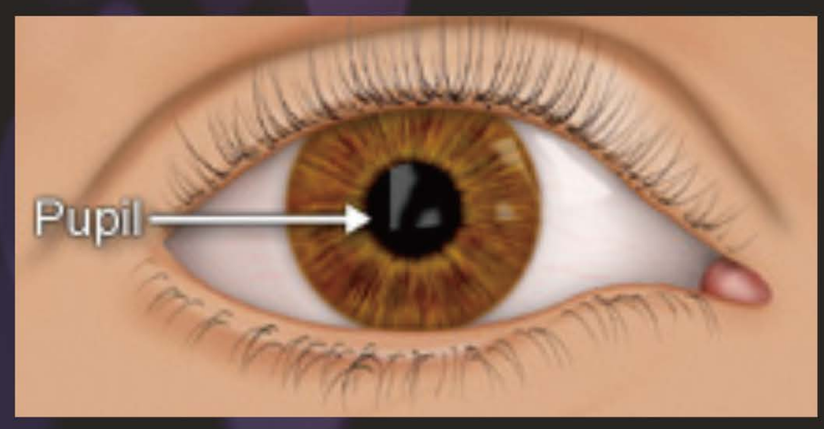


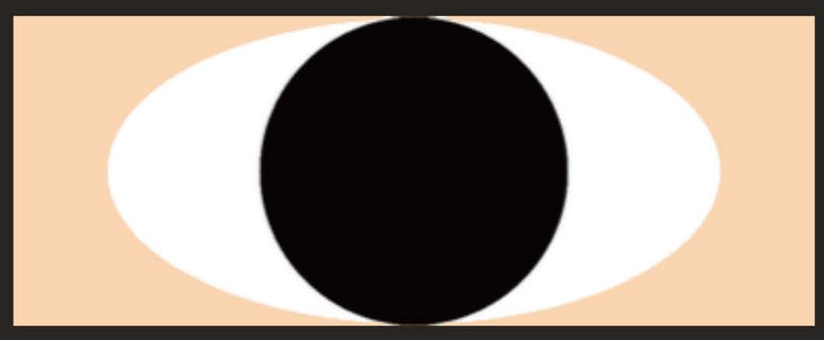
Background

- Overuse of smartphone can cause serious eye diseases such as macular degeneration or retinopathy.[1]
- Pupil size can reveal the fatigue of a person.[2]
- Android application that detects pupil size may reveal users' tiredness and thus prevent overuse of smartphone.

Methodology[3]

- Digital image stores numerical values in each pixels.
- Pupil, sclera and iris have different values in luminosity and saturation.
- The app multiplies the values with corresponding applied masks and searches for the best fit region in a rough eye area.
- After finding the best eye area, the app estimates pupil size by a gradient-based method.





Iris Detection Tolerance-Based Accuracy			
Proposed Method	e ≤ 0.05	e ≤ 0.10	e ≤ 0.25
	79.12	**94.82**	99.85
[Petridis et al 2013]	47	82	99
Pupil Detection Performance			
Proposed	Precision	Recall	F1
Method	45.28	69.53	46.17
i-a.a.	74.64	91.75	76.62
i-a.a.: inter-annotator agreement			

Results

- Results shows that Iris Detection Tolerance-Based Accuracy of our proposed method(79.12% for e ≤ 0.05 and 94.82% for e ≤ 0.10) outperforms previous reported values.
- However, improvement on Pupil Detection Performance (45.28% - 69.53%) is needed before further development on revealing fatigue.

References

1. Smartphone overuse may 'damage' eyes, say opticians. (2014). Retrieved from http://www.bbc.co.uk/newsbeat/26780069

2. Morad, Y., Lemberg, H., Yofe, N., & Dagan, Y. (2000). Pupillography as an objective indicator of fatigue. Current Eye Research, 21(1), P.535-542.

3. Petridis, S., Giannakopoulos, T. & Spyropoulos, C. D. (2013). Unobtrusive Low Cost Pupil Size Measurements using Web cameras. International Workshop on Artificial Intelligence and Netmedicine, abs/1311.7327.