Automatic Eye Detection Error as a Predictor of Face Recognition Performance

Abhishek Dutta[1], Raymond Veldhuis, Luuk Spreeuwers

University of Twente, Netherlands.

May 13, 2014

35th WIC Symposium on Information Theory in the Benelux, May 12,13, 2014

[1] http://abhishekdutta.org

Verification Experiment





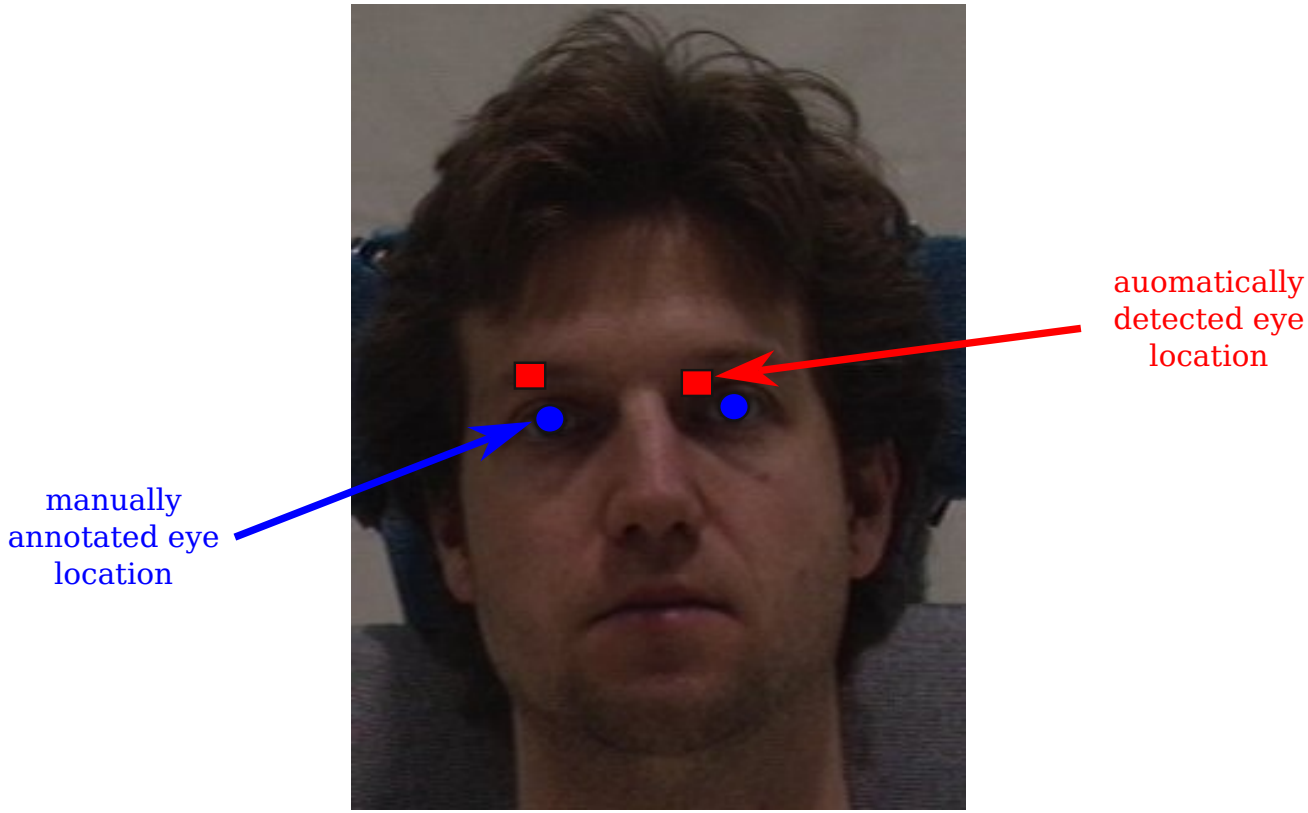

Verification Experiment

	Verification Decision	Uncertainty in Decision
  frontal pose and illum.	YES	least uncertain
  uneven illumination	YES	more uncertain
  non-frontal pose	YES	most uncertain

Predictor of Face Recognition Performance

- many existing predictors: pose, illumination, noise, blur, etc.
- we propose a novel predictor: Automatic Eye Detection Error (AEDE)

Automatic Eye Detection Error (AEDE)



- $p^m_{\{l,r\}}$ manually annotated eye locations
- $p^d_{\{l,r\}}$ automatically detected eye locations

$$J = \frac{max\{||p^m_l - p^d_l||, ||p^m_r - p^d_r||\}}{||p^m_l - p^m_r||}$$

Does AEDE respond to image quality variations?

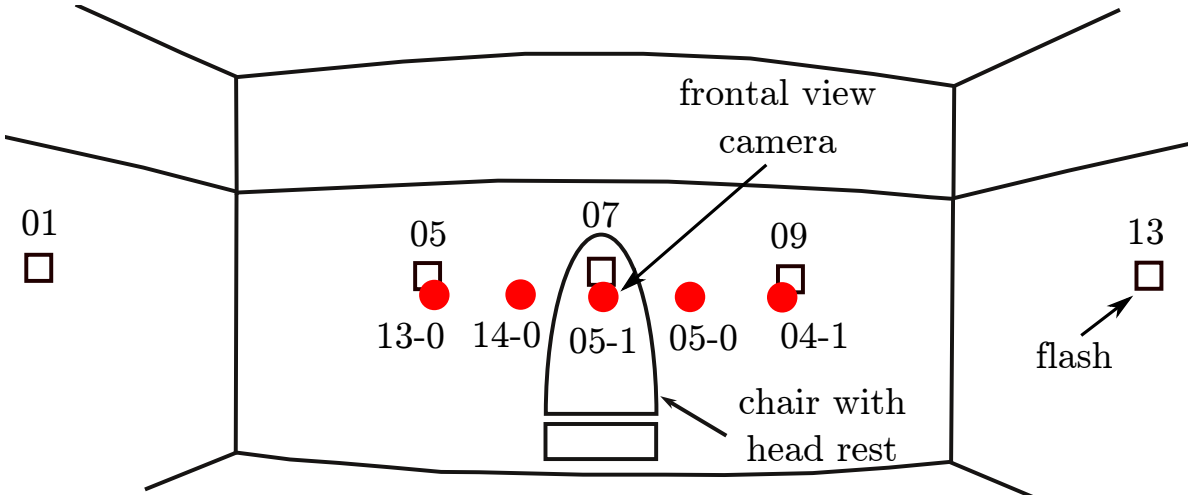


Figure: MultiPIE camera and flash positions.

We visually inspect the distribution of AEDE (J) for different pose and illumination variations

Does AEDE respond to image quality variations? ...

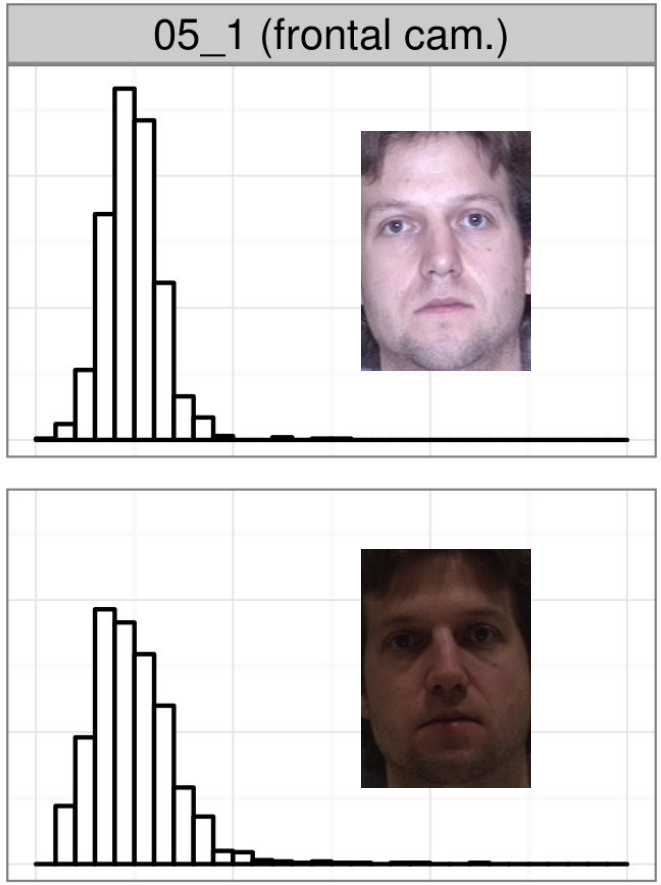
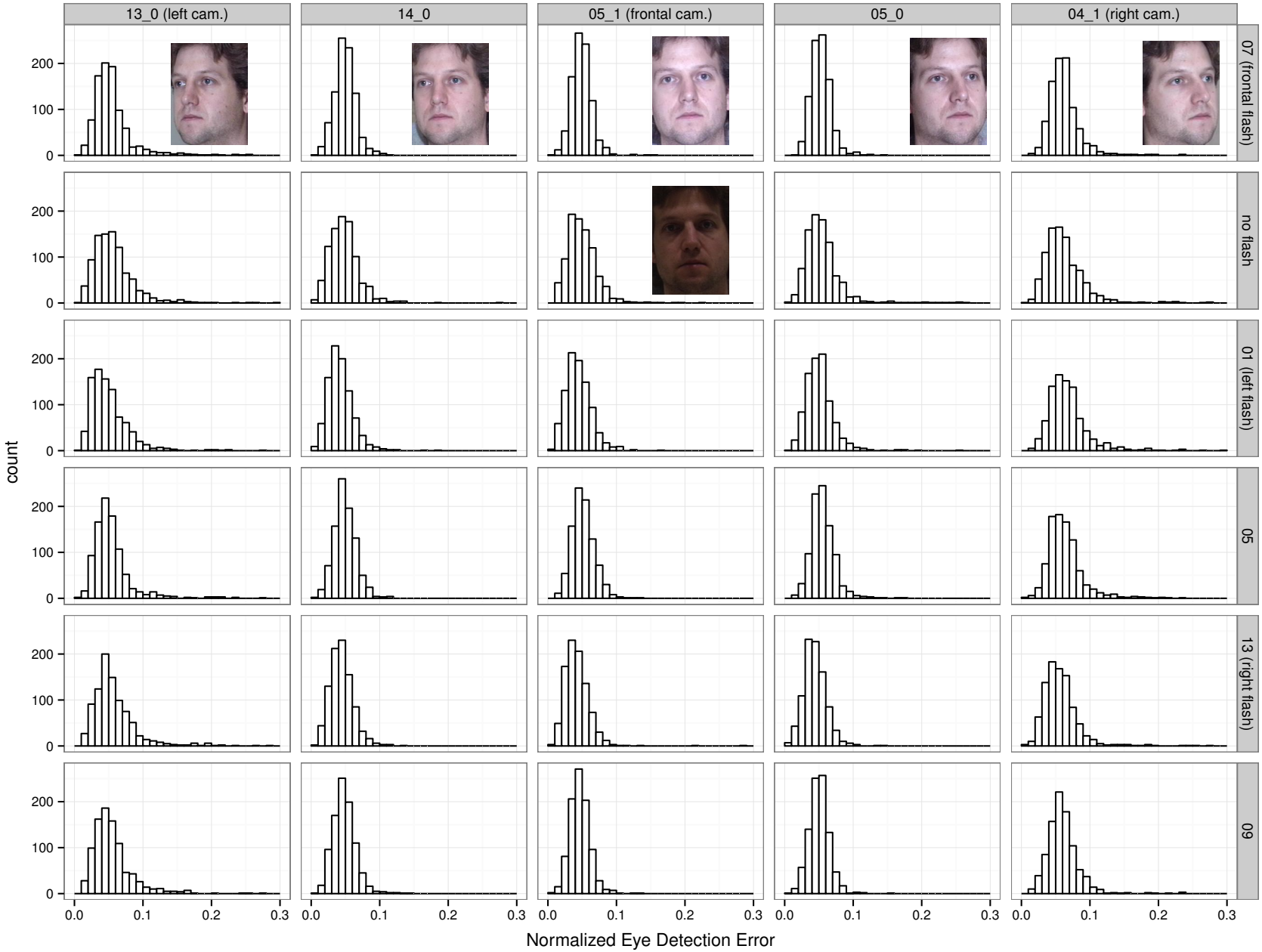
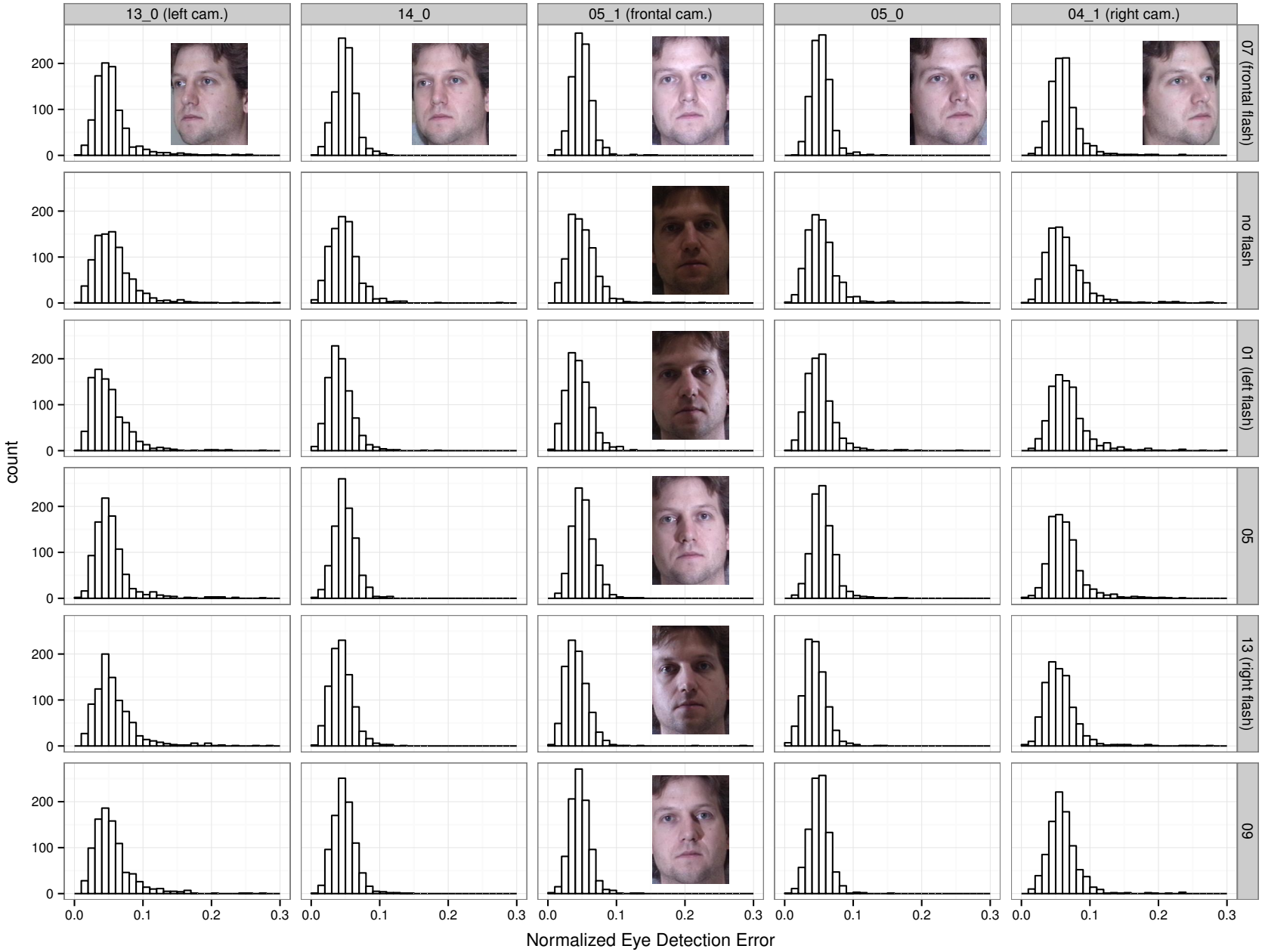


Figure: Distribution of normalized eye detection error J of probe images for illumination variations.

Does AEDE respond to image quality variations? ...



Does AEDE respond to image quality variations? ...



Relation between AEDE and Recognition Performance

- MultiPIE dataset and FaceVACS (use for eye detection and recognition)
- Gallery: fixed to high quality frontal mugshot
- Probe: pose and illumination variations
- We plot Receiver Operating Characteristics (ROC) curve corresponding to four intervals of J_p

Relation between AEDE and Recognition Performance ...

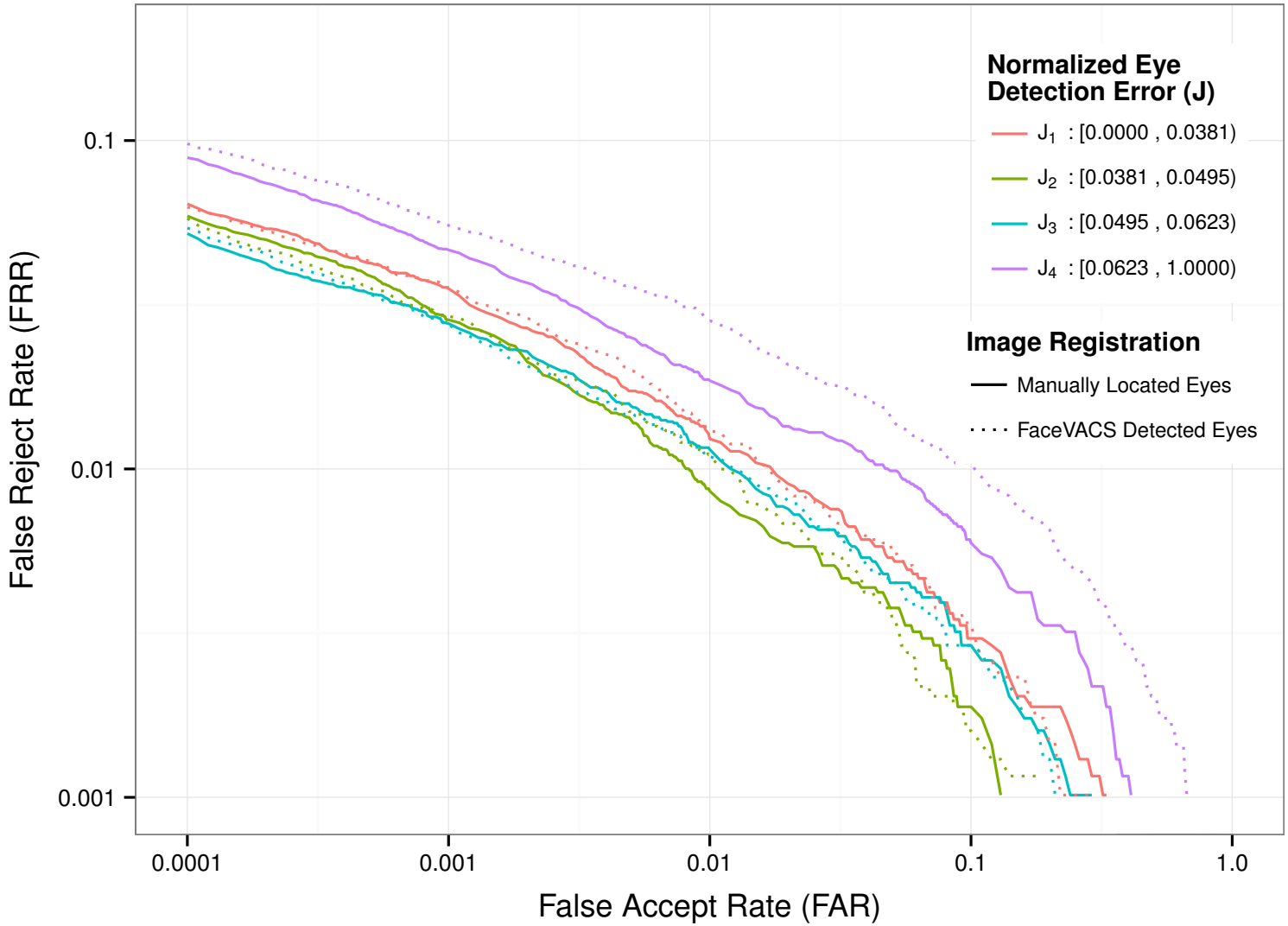


Figure: Recognition performance variation for each monotonically increasing interval of normalized eye detection error J.

Conclusions

- monotonically incresing intervals of AEDE correspond to distinct recognition performance. Therefore, AEDE is a predictor of face recognition performance.
- AEDE can be seen as a summary of many other image quality parameters like pose, illumination etc.
- AEDE has a non-linear relationship with face recognition performance and further work is required to fully understand the reasons for this non-linearity.

Limitations

- AEDE requires manually annotated eye coordinates in order to quantify the quality of a facial image.
- AEDE cannot capture all types of quality variations that may affect face recognition performance. For example, in a photograph containing facial image with closed eye, the eye detection error will be very high. This does not necessarily translate into a difficult verification problem. Therefore, we need more quality parameters to fully quantify the variability in recognition performance.

Questions?