Project Title: Dilation Aware Multi-Image Enrollment for Iris Biometrics

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Executive Summary

As iris biometrics technology expands into more and larger commercial and security applications, exploitation of possible weaknesses will increase. One such vulnerability arises from exploiting differences in pupil dilation between the enrollment image and the image to be recognized. It has been shown that variation in pupil size degrades iris biometric performance by increasing the probability of a false non-match. Our research advances a strategy to improve recognition accuracy by creating a dilation-aware strategy for the enrollment phase of an iris biometric system. The method we developed enrolls a given person based on their respective empirical dilation ratio distribution. We found that there is an improvement in performance when compared to the current industry standard enrollment method of enrolling a single best image, and also when compared to a multi-image enrollment that selects images randomly with respect to dilation.

An iris biometric system extracts a code from the texture pattern of an individual’s iris and uses the code for identification purposes. The process takes the texture of a person’s iris and maps it to a binary code called an iris code. It has been demonstrated that a person’s iris code contains enough of the iris texture information so that it can be effectively used for identification purposes. Developing an iris biometrics system requires the enrollment of iris codes for various individuals. This gallery, or database of enrolled iris codes, is required in order for identification and recognition to occur.

Current iris biometric systems enroll a person into the gallery based on the best image taken at the time of enrollment image capture. This type of enrollment is subject to change based on varying conditions both due to the environment and any physical variations of a person’s eye. In particular, pupil dilation is ignored or simply not accounted for during the enrollment phase of most systems. By not accounting for pupil dilation, a given system will inherently be subject to performance degradation that arises from variation in pupil dilation. Therefore, we examined a way in which pupil dilation could be incorporated into the enrollment phase of an iris biometric system.

Our method of improving iris recognition through awareness of pupil dilation divides the empirical dilation ratio distribution into equal intervals and chooses images for enrollment based on the division points of the distribution. The equally spaced points of a distribution are also known as quantiles. Thus our method is referred to as quantile enrollment. Our method was tested against a random enrollment strategy which is currently the most common found in commercial iris recognition systems. Testing data consisted of 294 unique subjects with 10,862 left eye iris images and 10,885 right eye images. We found that the quantile method of enrollment consistently outperformed the random method for each eye and across a varying number of enrollment images per person.