Age Estimation of Adolescents and Adults Using Dimensions of the Eye and Pupil in “Selfie” Photographs

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Abstract

Investigating digital images and correlating an age with the photographed individual has become a challenge in digital forensics and criminal investigations. Individuals in the teenage age range, who often appear older in age due to the use of make-up, posing, and filter technologies, are often documenting themselves and their activities by taking a picture of themselves – otherwise known as a “selfie.” By analyzing features of the face, particularly the eye and pupil regions, the human eye and pupil have natural responses to estimated light in the image environment. With this information, the pupil diameter was determined by measuring the boundary of the inside and outside of each pupil, as shown in Figure 4. Results of the measurements are shown in the scatter plot below.

Methods & Materials

Participants were recruited through personal contacts and e-mail advertisements. Those willing to participate were required to have parental permission, if under the age of 18, and sign an informed consent form. A brief survey was given to participants to record actual age, birthday, mood, medications taken, and eye problems. Using a Dr. Lux® light meter, the luminescence of the room was documented. Images were taken at Marshall University Forensic Science Center in the MISDE digital laboratory. The first series of images were taken at a distance of 3.5 meters from the participant using a Nikon® D3100 digital camera. One image was taken while the participant looked directly at the camera; another was taken while the participant took past the camera. In Figure 2, the observer was glasses, this second series was repeated again without the glasses. Figure 1 shows examples of images in this series.

RESULTS

The age distribution of the participants are shown in Table 1. Only 10 participants were included in this study.

Table 1: Participant Ages

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Participants</th>
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<tbody>
<tr>
<td>11-19 years</td>
<td>8</td>
</tr>
<tr>
<td>20-29 years</td>
<td>2</td>
</tr>
</tbody>
</table>

Diameter of the pupil was determined by measuring the boundary of the inside and outside of each pupil, as shown in Figure 4. Results of the measurements are shown in the scatter plot below.

Conclusions

Ultimately, the sample size was too small to find a significant age estimation process. Ideally, the sample size needs to include at least 50 individuals of each age in order to determine a range of the measurements that are unique to each age.

Nevertheless, the analysis is possible and simple with digital images. Measurements of the left and right pupil diameters can be assumed to be the same, which is consistent with other studies.

It is also necessary to develop a sufficient methodology to differentiate pupils from darker colored irises. This would allow all ethnicities to be included and differentiated by these measurements.

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