An Evaluation of Fingerprint Quality across an Elderly Population vis-à-vis 18-25 Year Olds

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This study will evaluate fingerprint quality of an elderly population compared to an 18-25 year old population, in order to assess potential factors affecting image quality. Specifically, the examination of a population over the age of 62 and a population of ages 18-25 will occur on three fingerprint recognition devices. Collected individual variables will include: age, gender, ethnic background, handedness, moisture content of both index fingers, occupation(s)/hobby, participant’s use of hand moisturizer, and prior usage of fingerprint devices. In accordance with the Biometrics Best Practice Document, computed performance measures will include failure to enroll, failure to acquire, false match rate, false non-match rate, false accept rate, false reject rate, and detection error trade-off curve.

The issue relating to the elderly is in the quality of the image that they present. According to The Science of Fingerprints, advancement in age causes problems in the image quality of a fingerprint due to worn ridges and dryness of the fingerprint region of the finger (Federal Bureau of Investigation, 1984). According to L.C. Jain et al, the skin condition greatly influences the overall image quality of a fingerprint. Dry skin does not allow for consistent contact between the fingerprint and the platen surface of a fingerprint scanner. The inconsistent contact, results in a very noisy image, which, in turn, do not allow for proper extraction of ridge features of the fingerprint (Jain, 1999). Images of a dry, and normal fingerprint are shown below in Figure 1.

Figure 1. Dry image (left) of low quality and a normal image (right) of high quality. Both images acquired from Digital Person’s U. are U. optical scanner.

An extracted image is determined to be of poor quality by the quality control function in the signal processing sub-system of the general biometric model (Figure 2). Poor quality images are rejected by the system during enrollment and verification attempts, thus causing failure to enroll or failure to acquire.

Biometrics and the Elderly

Publicly available research on biometric testing and the elderly is either proprietary in nature, or available to the research community through the purchase of testing reports. However, in those reports that are publicly available for the research community, several factors have been identified that relate to the elderly population. According to Mansfield (personal communication, 2002), he states: "We did observe that, with fingerprint systems, older people were harder to enroll due to dry skin, etc. Taken over all the tests we have done, this appears to be statistically significant. (In fact in all our trials to date, each biometric system has performed better with the younger half of the population than with the older half, though the differences were not necessarily statistically significant)."

Additionally, Mansfield states that the issues relating to the elderly are their ability to use the device, and the quality of the biometric that they present. Furthermore, he states "Very little objective data is available in either case, but answers are needed. I have a current study on the feasibility of biometrics for national scale id systems and these issues are among the biggest unknowns" (personal communication, 2002).

According to Thieme (personal communication, 2003), information released from the International Biometrics Group (IBG) concluded "for fingerprint systems, there was indeed some performance degradation for users over 55 years of age; certain systems' degradation in terms of increased FNMR [False Non-Match Rate – incorrectly denying an individual] was greater than 10%... in many cases this was a dry finger problem."

According to Wayman (personal communication, 2002) "The subject of the fingerprinting of elderly is VERY important. Some unpublished work has been done by IBG, but more is needed."