SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

CARDIOVASCULAR BIOMETRICS: FUSING THE ELECTRICAL AND MECHANICAL SIGNALS FROM THE HEART

PhD Preliminary Research Examination

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Abstract: Classical biometric traits such as fingerprints, facial images, speech, iris and retinal scans are plagued by potential circumvention – they could be copied and later used by an impostor. To address this problem, other bodily traits such as the electrical signal acquired from the brain (electroencephalogram) or the heart (electrocardiogram) and the mechanical signals acquired from the heart (heart sound, laser Doppler vibrometry measures of the carotid pulse) have been investigated. These signals depend on the physiology of the body, and require the individual to be alive and present during acquisition, potentially overcoming circumvention.

We investigate the use of the electrocardiogram (ECG) and carotid laser Doppler vibrometry (LDV) signal, both individually and in unison, for biometric identity recognition. A parametric modeling approach to system design is employed, where the system parameters are estimated from training data. The estimated model is then validated using testing data. A typical identity recognition system can operate in either the authentication (verification) or identification mode. The performance of the biometric identity recognition systems is evaluated using receiver operating characteristic (ROC) or detection error tradeoff (DET) curves, in the authentication mode, and cumulative match characteristic (CMC) curves, in the identification mode.

The performance of the ECG- and LDV-based identity recognition systems is comparable, but is worse than those of classical biometric systems. Authentication performance below 1% equal error rate (EER) can be attained when the training and testing data are obtained from a single measurement session. When the training and testing data are obtained from different measurement sessions, allowing for a potential short-term or long-term change in the physiology, the authentication performance degrades to about 6 – 7%.

Leveraging both the electrical (ECG) and mechanical (LDV) aspects of the heart, we obtain a performance gain of over 50%, relative to each individual ECG-based or LDV-based identity recognition system, bringing us closer to the performance of classical biometrics, with the added advantage of anti-circumvention.

DATE: Monday, February 25, 2013
TIME: 10:10 a.m.
PLACE: Green Hall, Room 0120

Thesis advisor:
Dr. Joseph O'Sullivan

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE