SEMINAR NOTICE

Department of Electrical and Systems Engineering

NON-CONTACT BIOMETRICS USING LASER DOPPLER VIBROMETRY MEASUREMENTS OF THE CAROTID PULSE

PhD Preliminary Research Examination

Alan Kaplan
PhD Candidate
Department of Electrical and Systems Engineering
Washington University in St. Louis

Abstract: The use of identity recognition systems based on biometric markers is growing rapidly. Some of the more popular modalities are fingerprint, iris, and face; each having operational benefits and disadvantages. We investigate the application of a laser Doppler vibrometer (LDV) to measure surface velocity of the skin overlying the carotid artery for use in identity recognition. The carotid LDV signal, acquired from non-contact methods, harbors significant detailed information of the cardiovascular and respiratory systems. Consequently, it depends on the current physiological state of the individual.

We consider a recognition system design in which a parameterized model, estimated from training data, is stored for each individual. When presented with testing data, a normalized score is computed and compared to a threshold for the decision. System performance is evaluated with receiver operator characteristic (ROC) curves.

A template matching algorithm is used to segment the signal into 700 ms portions corresponding to single heart beats. Initially, a cross correlation based system was tested on data acquired from an experiment where the state of each subject was controlled to the greatest extent possible, yielding an identity verification error rate of 1%. This error rate increases to 20% when using test data recorded several weeks later. The cause of this degradation in performance is due to the lack of robustness to state in the system.

State changes occurring from beat to beat, which are primarily due to breathing effects, are studied to gain further insight into the nature of the state dependencies. A hidden Markov model is used to capture the effect of breathing dynamics on the carotid LDV signal, and the results are interpreted in terms of the underlying physiology.

DATE: Monday, March 22, 2010
TIME: 10:00 a.m.
PLACE: Bryan Hall, Room 305

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