# Audio-Video Synthesis Methods for Improving Performance of Biometric Systems

DEREJE TEFERI LEMMA

THESIS FOR THE DEGREE OF LICENTIATE OF ENGINEERING

The Licentiate seminar will be held on Tuesday April 24, 2007 at 13.15 in R1107 at Halmstad University, Halmstad, Sweden

The thesis is available at the Department of Signal and Systems, Chalmers University of Technology and at the School of Information Science, Computer and Electrical Engineering, Halmstad University


Department of Signals and Systems
Chalmers University of Technology
SE-412 96 Göteborg
Sweden


School of Information Science,
Computer and Electrical Engineering
Halmstad University
Box 823, SE-301 18 Halmstad
Sweden

Göteborg and Halmstad, Sweden, 2007

# Abstract

System security is important for any automation. It is even more so in the case of biometric systems due to the sensitive nature of the data it uses for enrollment and authentication – the subjects physical or biological trait. The performance quantification of biometric systems, such as face tracking and recognition, highly depend on the database used for testing the systems. Systems trained and tested on realistic and representative databases evidently perform better. In fact, the main reason for evaluating any system on test data is that these data sets represent problems that systems might face in the real world. However, building biometric databases that represent the real world is an expensive task due to its high demand on the side of the participants. This becomes even more difficult and unrealistic if the data is to be collected in a natural environment such as supermarkets, offices, streets, etc.

This thesis presents a procedure to build a synthetic biometric database by damascening images from a studio recorded database with a realistic scenery. To this end, we developed an image segmentation procedure to separate the background of a video recorded in studio conditions with the purpose to replace it with an arbitrary complex background. Furthermore, we present how several degradations such as affine transformation, imaging noise, and motion blur can be incorporated into the production of the new database to simulate natural recording environments. The system is applied to the entire XM2VTS database, which already consists of several terabytes of data, to produce the DXM2VTS – Damascened XM2VTS database.

Moreover, the thesis presents a method to segment a video sequence in the time domain based on its audio content. The video is then reshuffled and used for testing resilience of text-prompted biometric systems against playback attacks. The playback is supported by pyramid based frame interpolation method to reduce discontinuities created at the digit boundaries in time.

**Keywords:** Biometrics, Audio-Video Synthesis, Image segmentation, XM2VTS, DXM2VTS