Old Dominion University
Batten College of Engineering & Technology
Department of Electrical and Computer Engineering

Thesis Defense

MACHINE LEARNING APPROACH FOR GENDER CLASSIFICATION USING FULL-BODY BIOLOGICAL MOTION

Christina Maree' Williams

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By observing a person's gait, humans are generally able to distinguish many demographic features such as age, race, and gender. Gender-related differences in subjects while running have increasingly become an area of interest. Performing gender classification using full-body motion is beneficial in applications such as demographic studies, sports medicine, human-computer interface, surveillance and high-level character animation, to name a few. This has led to the emergence of many gait analysis methods for subjects while engaging primarily in activities such as walking for discrimination between males and females. However, there is critical need to improve the gender classification performance by considering other less explored human activities such as running for gender classification. Consequently, this thesis studies full-body motion capture data for running in statistical machine learning analysis of spatio-temporal patterns for gender classification. The overall approach include preprocessing steps followed by statistical feature extraction and machine learning classification algorithms. Techniques are formed by implementing preprocessing steps using either principal component analysis or kernel principal component analysis in conjunction with linear discriminant analysis (LDA), support vector machine (SVM), and decision-stump with AdaBoost. These pattern classification and machine learning techniques are compared to determine the performance of the methods for gender recognition while running. They are further extended to a more complex dataset containing samples from both running and walking through a process known as feature fusion. By means of experimentation, the results obtained indicate that gender classification is possible with motion capture data and suggest that linear classification approaches are less adequate in classifying gender while running or while using a combination of running and walking for a large dataset captured in a moderately uninhibited environment. Further analysis also determines that nonlinear dimensionality reduction outperforms linear methods and thus improves gender classification rates.

Committee:
Dr. Khan Iftekharuddin (Chair)
Dr. Jiang Li
Dr. Steven Morrison