Comparative Study of Time Series Model based Techniques for Personnel Verification using Ear Biometrics

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In this paper usefulness of time series based modeling techniques namely Autoregressive (AR) and Complex AutoRegressive model (CAR) has been explored for personnel verification. To facilitate application of the models, time series is obtained from the contour coordinates of the ear. Models are applied to ear contours and AR and CAR coefficients are obtained that serve as feature vectors. Classification accuracy is obtained using Support Vector Machine (SVM) classifier. Comparison of the results obtained using two models demonstrates potential of AR model for personal verification.

Keywords : Autoregressive Model, Classification Accuracy, Complex Autoregressive Model, State Vector Machine, Time Series Modeling, Verification of Person.

1. INTRODUCTION

Biometric Technology has been researched and developed for the past three decades. This technology is gaining popularity for the purpose of security. Any physiological or behavioral biometric characteristics that are able to generate computable and stable invariants that do not change with time can be used as a biometric. Apart from being used in forensics, the biometric applications range from airport surveillance to electronic banking.

From classification point of view, a biometric can either be part of verification system or identification system. In verification system an individual presents himself or herself as a specific person and the system verifies his or her claim by matching his or her biometric trait in the already stored database (1 to 1 match). Identification system seeks to identify an unknown person and the system tries to answer the question who is this person and checks the biometric presented against all others already in the database (1-to-n). Thus identification is a kind of classification that allows recognition of a given person among a large group of members. Thus we can say identification is a n-class classification whereas verification is a two-class classification. With technology advances the biometric identification and verification has become one of the reliable and convenient method compared to traditional ways of identification and verification.

Most of the current research in biometrics is focused on iris, fingerprint, face, hand shape and gait etc., [1-5]. However human ear offer some distinct advantages over other biometric modalities. It does not change with emotions, states of mind, sadness, fear or cosmetic changes. It can be easily captured from a distance, even if the subject is not cooperative. This makes ear recognition interesting especially for smart surveillance tasks and for forensic image analysis. Moreover, it may be realized that, most of the biometrics systems do not live up to their expectations, usually due to the requirements of well controlled environments. This motivated us to use contour of ear sub structure as biometrics modality for the verification of humans.

1.1. Related Work

Current ear recognition techniques have exploited 2D and 3D ear images for human identification. Although 3D ear recognition performs well in illumination variation and pose varia-
Figure 6. Typical ROC Curves Corresponding to Minimum, Intermediate and Maximum Classification Accuracy

demonstrated its usefulness for personnel verification.

10. CONCLUSIONS

In this paper performance of AR and CAR model has been compared for verification of a person on the basis of ear biometrics. To facilitate application of the models, ear con-
tour is obtained in terms of coordinates that are used to fit AR and CAR model. Application of the models gives feature vector in terms of AR and CAR coefficients. SVM is used for classification; to test the efficacy of these models. Comparison of these models on the basis of ROC curves established superiority of AR model over CAR models. With AR model accuracy of upto 100 percent could be achieved. Thus potential of AR model for the purpose of personnel verification is demonstrated.

For future studies, we feel that the concept of fusion in which two biometric modalities are fused is likely to increase the classification accuracy further.

REFERENCES


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