치아 측정 기반 개인 식별

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Individual Identification Based on Teeth Biometrics

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Introduction

Current image-base individual human recognition methods such as fingerprints, face, hand geometry, voice, signature and iris biometric modalities are most generalized biometrics technique [1,2,3,4]. Biometric technologies need some requirements in order to be used in real applications. Iris identification requires a complicity of the data collection. Face can be deformed by expressions of a user. Fingerprint can be contaminated with materials such as sweat or dust. Voice can be changed by catch a cold. Teeth images give merits for recognition because teeth, rigid objects, cannot be deformed at the moment of image acquisition. In this paper, we used principal component analysis techniques for data reduction and feature extraction of the teeth image. The main idea of the principle component is to find the vectors that best account for the distribution of teeth images within the entire image space.

Method

PCA is a standard technique used in statistical pattern recognition and signal processing for data reduction and feature extraction. As the pattern often contains redundant information, mapping it to a feature vector can get rid of this redundancy and yet preserve most of the intrinsic information content of the pattern. These extracted features have great role in distinguishing input patterns. As the pattern often contains redundant information, mapping it to a feature vector can get rid of this redundancy and yet preserve most of the intrinsic information content of the pattern. These extracted features have great role in distinguishing input patterns. Image normalization refers to eliminating image variations.

Let the training set of teeth images be Γ_1, Γ_2, …Γ_M, (where M=64), then the average of the set is defined by equation (1).

$$\psi = \frac{1}{M}\sum_{n=1}^{M}\Gamma_n \tag{1}$$

Each tooth differs from the average by the vector Γ_i and the average ψ is determined by,

$$\Phi_i = \Gamma_i - \Psi \tag{2}$$

$$C = \frac{1}{M}\sum_{n=1}^{M}\Phi_n\Phi_n^T = AA^T \tag{3}$$

$$U_l = \sum_{k=1}^{M} v_{lk}\Phi_k,\ l = 1,..........M \tag{4}$$

A new teeth image (Γ) is transformed into its eigenteeth components by a simple operation.

$$w_k = U_k^T(\Gamma - \Psi) \quad (5)$$

For k=1,….M. The weights form a projection vector,

$$\Omega^T = [w_1 w_2 ...... w_{M'}] \quad (6)$$

This comparison is based on Euclidean Distance between the training teeth classes and the test teeth image. This is given in below Eq. (7).The idea is to find the teeth class *k* that minimizes the Euclidean Distance.

$$\varepsilon_k = \|\Omega - \Omega_k\| \quad (7)$$

Conclusion

Teeth images give merits for recognition because teeth, rigid objects, cannot be deformed at the moment of image acquisition. In this paper, we used principal component analysis techniques for data reduction and feature extraction of the teeth image. These vectors define the subspace of teeth images, which we call teeth space. Our system extracts PCA representation included only 64 principle components from 15x30 pixels and person identification can recognize 95.7% successfully.

References

1. Jain, A.K., Chen, H.: Matching of dental X-ray images for human identification, Pattern Recognition 37(7), (2004) 1519-15322
2. Phillips, P.J: Support vector machine applied to face recognition, Technical Report, NISTIR 6241, National Institute of standards and technology 1999.
3. Nassar, Diaa Eldin M., Haj-Said, E., Fahmy, G., Howel, R. and Ammar, H.H.: Challenges of developing an automatic dental identification system, Biometric Consortium in Crystal city in Arlinton, VA(2003)
4. Nalwa, V.S.: Automatic online signature verification, Proc. IEEE 85(2), (1997) 215-239