# Face Identification and Verification using Polar Frequency Components

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**Abstract.** We present a novel face recognition method based on global polar frequency features. The algorithm uses Fourier-Bessel transformation for polar frequency components extraction, conversion to a dissimilarity space, and a Linear Discriminant classifier. Although the algorithm performance was below that of state-of the-art methods w.r.t. recognition rate tests, it was equivalent on verification tests. These results indicate that recognition rates can be improved by considering more sophisticated decision rules based on confidence levels.

## 1. Introduction

Neurophysiologic and psychophysical evidence indicates that the human visual system extract global shape polar components from the visual scene, but were rarely explored in face recognition algorithms or cognitive models. Filling partially this gap, we present a novel face recognition method based on polar frequency features.

## 2. Methods

The proposed algorithm operates in three steps: (1) polar frequency extraction from face images by Fourier-Bessel transformation (FBT); (2) conversion to a dissimilarity space, in which objects are represented by their distance to the other objects; (3) construction of a Linear Discriminant classifier. The algorithm performance was evaluated by identification and verification tests according to the FERET database protocols [1].

### 3. Results

Figure 1 shows the recognition rate as a function of the rating score recognition test and the receiver operating characteristic (ROC) curve (verification test). The FBT algorithm performed better than the classical Principal Component Analysis (PCA) on the recognition test, but was not comparable to state-of-the-art algorithms. On the verification test, on the other hand, it performed better that the PCA and PCA+Bayesian algorithms, and almost as good as the PCA+Elastic\_Bunch\_Graph\_Matching (EBGM). Only the PCA+Linear\_Discriminant\_Analysis (LDA) algorithms clearly outperformed the FBT method. These results indicate that recognition rates can be improved by considering more sophisticated classifiers.

# 4. Conclusion

We showed that the biologically motivated approach used in the FBT-based algorithm is applicable for face recognition technology. The study also point for the potential of the Fourier-Bessel analysis in human perceptual and cognitive investigation.



Figure 1 Result for the FBT and previous methods.

## 5. References

[1] P.J. Phillips, H. Wechsler, J. Huang and P. Rauss, "The FERET database and evaluation procedure for face recognition algorithms", *Image and Vision Computing J*. 16 (1998), 295-306.