

摘 要

人脸识别不仅具有重要的理论价值，还在安全、金融等领域具有广泛的应用前景。作为一种非常重要的人脸识别算法，Moghaddam等人提出的贝叶斯分类器人脸识别方法已被广泛接受，并在很多方面得以扩展，如：将概率密度函数从单高斯模型推广到多高斯模型（GMM），从最初的使用灰度特征推广到使用其它特征（如Gabor特征）等。在这些有效扩展的基础上，本文从分类器设计与概率密度估计两方面提出改进方案，主要工作包括：

（1）在分类器设计方面，提出了一种基于特征分块的多贝叶斯分类器融合方法（FBBC:Feature Block based Bayesian Classifier）。该方法将人脸图像均分为若干块，然后对每块计算Gabor特征，并分别训练得到一个子贝叶斯分类器，这些子分类器最终融合起来得到集成的分类器。我们还对不同的融合方法进行了探讨。在FERET标准测试数据库上的实验结果表明我们的新方法比传统方法具有更好的识别性能。

（2）在概率密度估计方面，提出采用非参数技术而非传统的高斯模型或者高斯混合模型估计后验概率，并将其应用到了贝叶斯分类器人脸识别方法，以及我们提出的多贝叶斯分类器融合方法（FBBC）中。在FERET标准测试数据库上的实验表明，非参数技术不仅可以取得比传统高斯模型方法更高的识别精度，而且训练更加简单。

本文的上述两个贡献扩展了贝叶斯方法在人脸识别中的应用设计问题，取得了比传统贝叶斯人脸识别方法更优的性能。

关键词： 人脸识别，贝叶斯分类器，特征分块，Gabor 滤波器，非参数估计

Face Recognition based on Bayesian Classifier

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Face Recognition not only has significant theoretic values but also is believed having a great deal of potential applications in public security, law enforcement, information security, and financial security. As one of the most important face recognition methods, Moghaddam's Bayesian classifier has been well understood and extended in many ways, such as from single Gaussian Model to Gaussian Mixture Model (GMM), from image intensity feature to other features (e.g. Gabor). Based on these extensions, we propose our improved scheme both in classifier designing and probability estimating, the main work of the thesis includes:

- (1) In classifier designing, we proposes an approach combining multiple Feature Block-based Bayesian Classifiers (FBBCs). Each FBBC is designed as a Maximal Likelihood (ML) classifier by using GMM of Gabor features computed from some image block uniformly partitioning the whole image. These FBBCs are finally combined together by computing average similarity to make the final decision. We also investigate the use of weighed average similarity to further improve performance. Our experiments on FERET face database have shown the effectiveness of the proposed method.
- (2) Another extension is that we use nonparametric method to estimate the posterior probability instead of Gaussian model. We apply this method to the Bayesian Classifier and FBBC we proposed. Our experiments on FERET Database have shown that the nonparametric method outperforms the Bayesian Classifier using Gaussian model, and also the nonparametric method is easy to train.

The main contribution of this thesis extends the application of Bayesian method in Face Recognition, and achieves better performance than traditional Bayesian Classifier.

Key words: Face Recognition, Bayesian Classifier, Feature Block-based Method, Gabor Filter, Nonparametric Method