

### 基于非线性流形学习的人脸面部运动估计

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## Human Face Analysis with Nonlinear Manifold Learning

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摘要

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**摘要** 由于人脸面部运动变化分布在一个低维非线性流形中, 基于线性假设的主动外观模型采用主成分分析算法描述人脸形状的变化必然带来额外的估计误差。为降低或消除这一误差, 该文提出一种改进的局部线性嵌入算法构建人脸形状-纹理空间, 并将其应用于主动外观模型中。实验结果表明, 不仅对于面部形变不大的人脸形状, 局部线性嵌入-主动外观模型拥有更低的估计残差; 而且对于一些变化较大的人脸形状, 在主成分分析-主动外观模型跟踪失败的情况下, 局部线性嵌入-主动外观模型依然可以取得很好的特征估计结果, 弥补了主成分分析-主动外观模型的不足。

**关键词:** 人脸识别 主动外观模型 非线性流形学习 局部线性嵌入

**Abstract:** Since human face movements distribute on a nonlinear manifold, there are inherent alignment residuals brought by the global linearity hypothesis in the traditional Principal Component Analysis (PCA) based Active Appearance Models (AAM). In this paper, a famous manifold learning method, Local Linear Embedding (LLE) is improved to model human face shape space for reducing the inherent alignment residuals. The experimental results show that the method, LLE-AAM, obtains lower alignment residuals to the tiny alterations of human face and still make successful alignment when PCA-AAM failed to some large alterations. According to the statistical analysis, LLE-AAM could reduce the residual to a certain extent.

**Keywords:** Face recognition Active Appearance Models (AAM) Nonlinear manifold learning Local Linear Embedding (LLE)

Received 2011-02-28;

**本文基金:**

国家科技部中日国际科技合作项目(2010DFA11990)和国家自然科学基金(60873269)资助课题

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**引用本文:**

王晓佩, 毛峡, Ishizuka Mitsuru. 基于非线性流形学习的人脸面部运动估计[J] 电子与信息学报, 2011, V33(10): 2531-2535

Wang Xiao-Kan, Mao Xia, Ishizuka Mitsuru. Human Face Analysis with Nonlinear Manifold Learning[J], 2011, V33(10): 2531-2535

**链接本文:**

<http://jeit.ie.ac.cn/CN/10.3724/SP.J.1146.2011.00153> 或 <http://jeit.ie.ac.cn/CN/Y2011/V33/I10/2531>

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