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# NEW SUPERVISED LOCALLY LINEAR EMBEDDING FOR DIMENSIONALITY REDUCTION USING DISTANCE METRIC LEARNING

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**Abstract:** Feature reduction is an important issue in pattern recognition. Lower feature dimensionality could reduce the complexity and enhance the generalization ability of classifiers. In this paper we propose a new supervised dimensionality reduction method based on Locally Linear Embedding and Distance Metric Learning. First, in order to increase the interclass separability, a linear discriminant transformation learnt from distance metric learning is used to map the original data points to a new space. Then Locally Linear Embedding is adopted to reduce the dimensionality of data points. This process extends the traditional unsupervised Locally Linear Embedding to supervised scenario in a clear and natural way. In addition, it can also be seen as a general framework for developing new supervised dimensionality reduction algorithms by utilizing corresponding unsupervised methods. Extensive classification experiments performed on some real-world and artificial datasets show that the proposed method can achieve comparable to or even better results over other state-of-the-art dimensionality reduction methods.

Key words: *dimensionality reduction, manifold learning, locally linear embedding, distance metric learning*

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## 1. Introduction

Dimensionality reduction plays an important role in fields of machine learning and pattern recognition. High feature dimensionality not only increases the complexity of classifier, but also increases the risk of overfitting in designing classifier. Many methods have been proposed to reduce the feature dimensionality, which can be roughly categorized to feature selection and feature extraction. Feature selection abandons redundant features and only keeps the most useful ones, whereas feature

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