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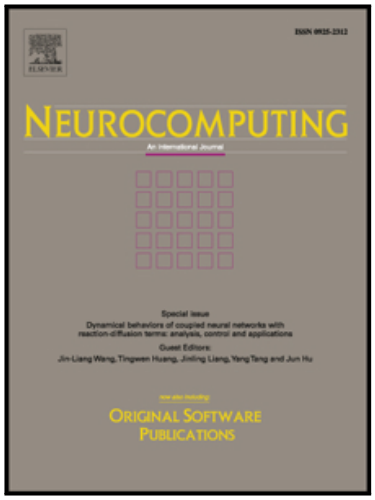

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Discriminant Sparse and Collaborative Preserving Embedding for Bearing Fault Diagnosis

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Abstract

Background noise and small sample size would usually add to the difficulty of extracting most effective information for bearing fault diagnosis in rotating machines. To address this issue, a novel supervised dimensionality reduction algorithm referred to as discriminant sparse and collaborative preserving embedding (DSCPE) is proposed in this paper for bearing defect classification, which utilizes collaborative representation (CR) for an intrinsic graph and sparse representation (SR) for a penalty graph. In the intrinsic graph, CR helps to involve more bases of the dictionary composed by the same labeled samples and generate less sparse solutions; meanwhile in the penalty graph, SR would avoid the mix-class interference when using the dictionary constituted by different labeled samples. DSCPE aims to seek the optimal projection directions that could minimize the intraclass compactness and maximize the interclass separability. After dimension reduction and data projection by DSCPE, the 1-Nearest Neighbor method is applied to classify the bearing defects. The experimental results demonstrate that DSCPE possesses more effective and robust classification performance than other compared algorithms when dealing with small-sample-sized problem and interfered vibration signals.

Keywords: Bearing, defect classification, feature extraction, dimensionality reduction, sparse representation, collaborative representation

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