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论文与报告

基于稀疏性非负矩阵分解和支持向量机的时频图像识别

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摘要
针对机械故障诊断领域对反映设备运行状态的图像识别困难以及选择和提取敏感特征困难的问题, 将基于图像的机械设备运行状态判别问题当作图像的识别问题来处理, 提出使用稀疏性非负矩阵分解(Sparse non-negative matrix factorization, SNMF)和支持向量机(Support vector machine, SVM)对时频图像进行识别进而判断机器运行状态, 从而避免特征的选择和提取. 稀疏性非负矩阵分解在对时频图像进行大规模压缩的同时, 能够很好地保留图像的隐含特征, 从而大大减少自动识别时频图像的计算复杂度, 并有效地提高支持向量机的识别精度. 此外, 本文还对影响识别率的稀疏性非负矩阵分解的各参数进行了讨论. 实验结果表明, 该方法对时频处理方法依赖性低, 在大多数情况下都能获得较传统方法高的识别率.

关键词 时频图像 稀疏性非负矩阵分解 支持向量机 模式识别

分类号 TP39

Time-frequency Spectra Recognition Based on Sparse Non-negative Matrix Factorization and Support Vector Machine

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Abstract
In the field of mechanical fault diagnosis, it is difficult to recognize the running condition of machines by human based on images corresponding to the condition such as time-frequency spectra, obit, power spectra, and so on. The most meaningful features required by learning machines, which can reorganize running condition of machines automatically, are always difficult to select and extract from the images. In this paper, the problem of machine running condition recognition based on images is treated purely as image recognition problem, so the procedure of meaningful features selection and extraction can be avoided. Sparse non-negative matrix factorization (SNMF) and support vector machine (SVM) are introduced to recognize the time-frequency spectra and therefore the corresponding running condition of machine automatically. After applying SNMF to image, the dimension is reduced obviously while the connotative and main features of image are reserved, therefore the computation cost of image recognition with SVM is saved and the recognition accuracy is possibly improved. Experimental results show that the proposed method can obtain higher recognition accuracy than conventional method and is dependent only weakly on the time-frequency analysis method.

Key words Time-frequency spectra sparse non-negative matrix factorization (SNMF) support vector machine (SVM) pattern recognition

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