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基于1-DI SVM的聚类模型及直升机齿轮箱故障诊断应用

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Unsupervised 1-DI SVM Based Clustering Model for Fault Diagnosis of Helicopter Gearbox

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摘要

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摘要 针对当前故障诊断中存在的训练样本少、知识难获取的问题,结合SVM小样本学习的特点,提出一种基于SVM的自学习聚类模型。通过改进无监督1-SVM算法上的不足,形成一种改进决策1-SVM(1-DISVM)算法,由此构建了多模式训练与分类算法,并设计出基于1-DISVM的自学习聚类模型。最后对其进行仿真验证,并应用于直升机齿轮箱的故障诊断,结果表明该方法能从少量样本中自学习输入模式的内在规律,自适应地对未知故障模式进行准确地分类识别。

关键词: 故障诊断 聚类 支持向量机 无监督学习

Abstract: To solve the problems of insufficient fault-samples and diagnosis-knowledge, and according to the merit of Support Vector Machines (SVM) that can be trained with small-sample, a SVM based unsupervised clustering model is presented. By modifying the decision-function of One-Class Support Vector Machine (1-SVM), which has the ability to find outliers from a dataset without any class of information but rarely is applied to pattern-recognition for its algorithm limits, a Decision-Improved 1-SVM (1-DISVM) is formed. Based on it, multi-pattern training and classing method is designed, then an unsupervised clustering model is constructed. The simulation and diagnostic experiment results of a helicopter's gearbox show that this clustering model can not only recognize the unknown fault patterns adaptively and precisely, but also learn the nature of the input-patterns from small samples and diagnose the faults successfully.

Keywords: fault diagnosis clustering support vector machine unsupervised learning

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