基于证据理论的医学图像分割及FPGA片上实现

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立项背景

立项背景

医学图像分割是医学图像处理和分析中的关键技术，它根据区域内的相似性以及区域间的不同把图像分割成若干区域，可用于研究解剖结构、组织定量化测定、病灶确定、疾病诊断等，在生物医学研究和临床应用中具有重要的意义。

如何从图像中把有关结构(或感兴趣区)分离出来是图像分析与识别首要解决的问题,也是制约医学图像处理中其它相关技术发展和应用的瓶颈。

查阅了相关论文后，我们针对医学图像分割技术挖掘研究，利用多学科领域的相关知识，基于证据理论、幂均算子、FPGA等提出新的医学图像分割算法。

研究内容

研究内容

1. 采用幂均算子优化FCM初始聚类中心
2. D-S证据理论融合隶属矩阵
3. 证据理论融合算法在FPGA上的硬件实现
4. 图像分割方法的有效性验证和应用

创新特色

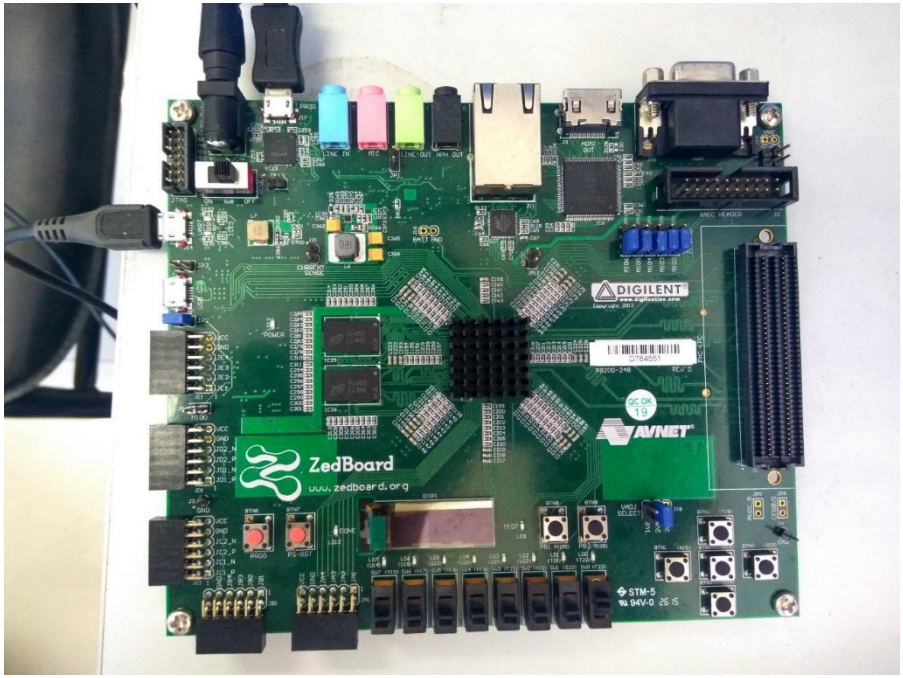
创新特色

- 结合幂均算子来实现初始聚类中心的优化
- 将证据理论与FCM结合用于医学图像分割处理
- 基于FPGA的D-S证据理论算法实现

项目成果

项目成果

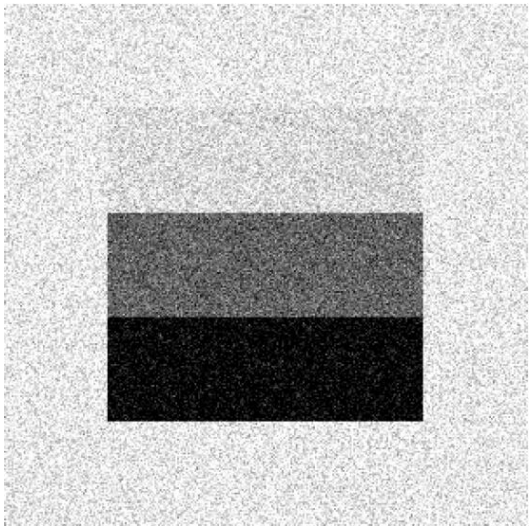
1、实物： DS证据理论加速系统



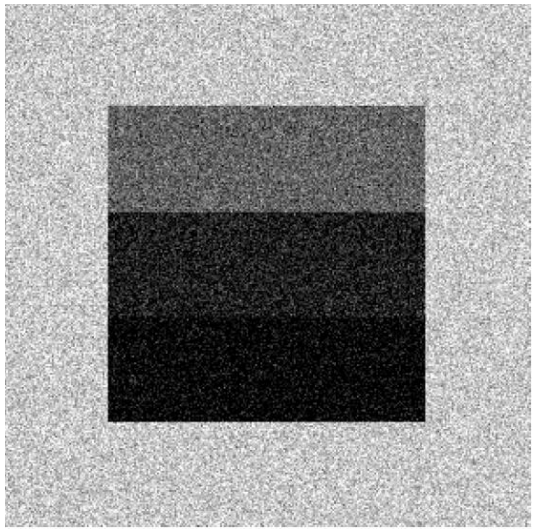
项目成果

1、实物： DS证据理论加速系统

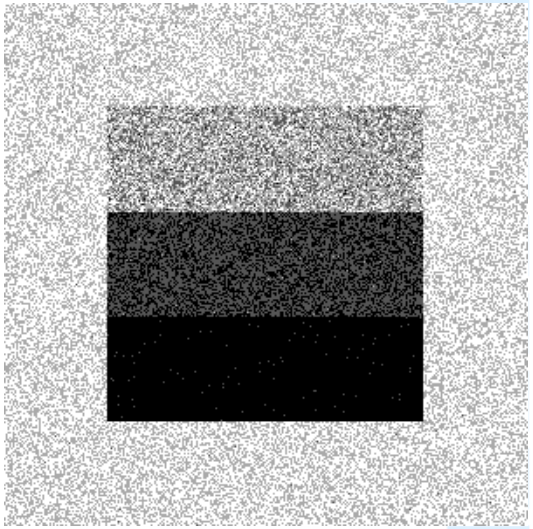
融合分割案例1（像素块）



(a)强X光图像



(b)弱X光图像

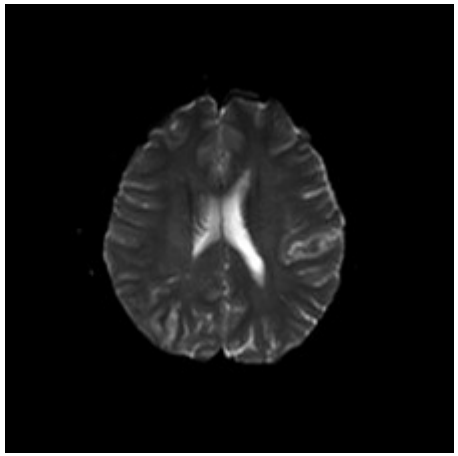


融合分割结果

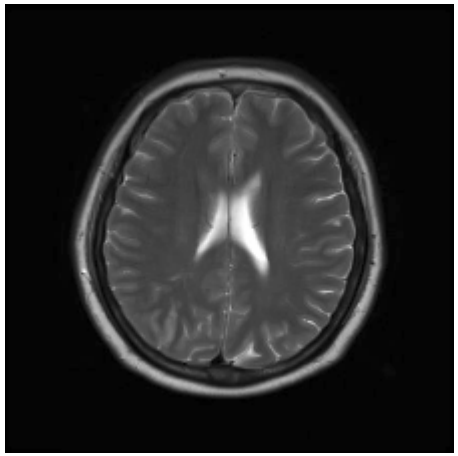
项目成果

1、实物： DS证据理论加速系统

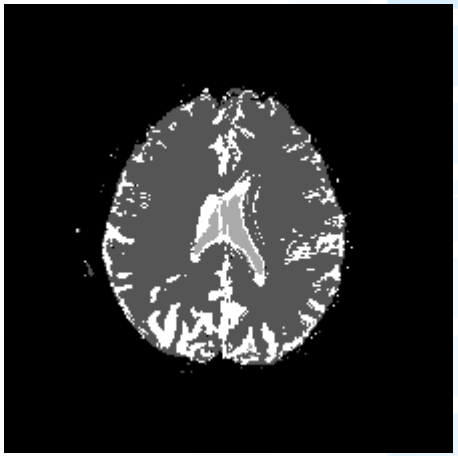
融合分割案例2（医学图像）



(a)医学图像1



(b)医学图像2



融合分割结果

项目成果

2、两篇已发表SCI论文：

[1] **Song M, Jiang W**, Xie C, et al. A New Interval Numbers Power Average Operator in Multiple Attribute Decision Making. *International Journal of Intelligent Systems*, 2017, 32:631-644. (SCI：000398626400003)

A New Interval Numbers Power Average Operator in Multiple Attribute Decision Making

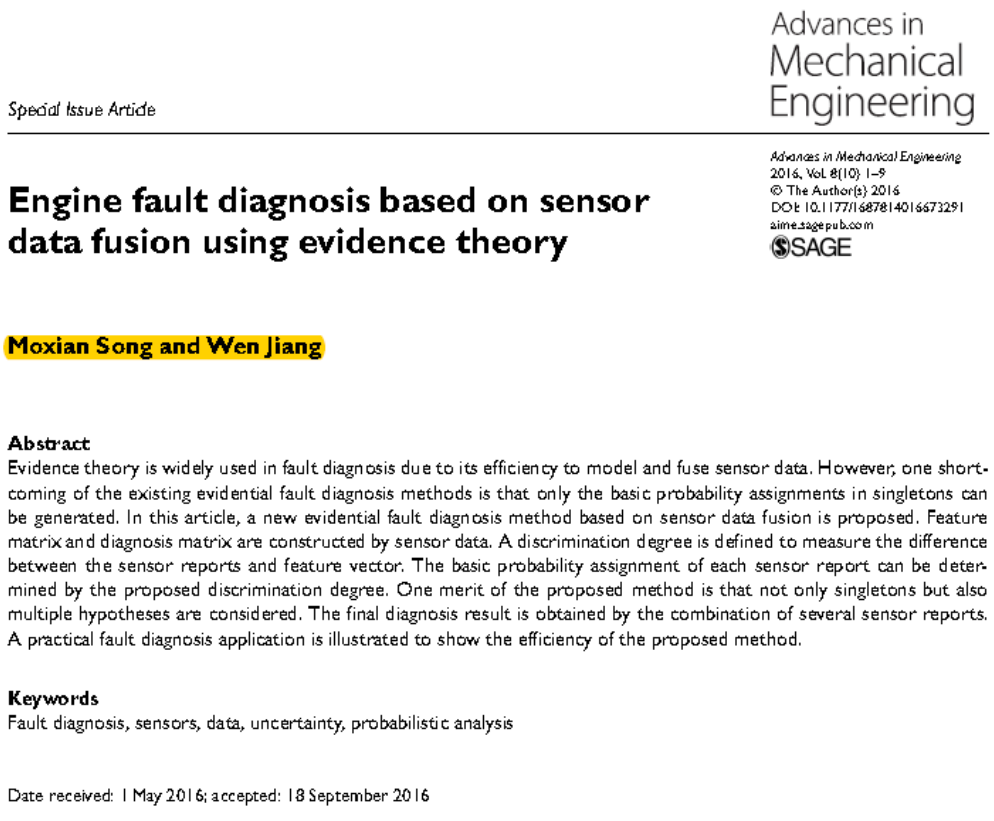
Moxian Song, Wen Jiang,* Chunhe Xie, Deyun Zhou
School of Electronics and Information, Northwestern Polytechnical University, Xi'an 710072, China

How to fuse uncertain information in multiple attribute decision making (MADM) efficiently is still an open issue. The power average operation is an effective tool to aggregate interval data. However, existing methods to aggregate interval numbers based on power average operator are relatively complicated. In this paper, a simple and effective support function of interval data is proposed. Then, a novel interval number power average operation operator is presented. Finally, a practical MADM problem is used to show the efficiency of the developed method. © 2016 Wiley Periodicals, Inc.

项目成果

2、两篇已发表SCI论文：

[2] **Song M, Jiang W**. Engine fault diagnosis based on sensor data fusion using evidence theory, 2016, 8(10): 1–9. (SCI：000386917900025)



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Engine fault diagnosis based on sensor data fusion using evidence theory

Moxian Song and Wen Jiang

Abstract

Evidence theory is widely used in fault diagnosis due to its efficiency to model and fuse sensor data. However, one shortcoming of the existing evidential fault diagnosis methods is that only the basic probability assignments in singletons can be generated. In this article, a new evidential fault diagnosis method based on sensor data fusion is proposed. Feature matrix and diagnosis matrix are constructed by sensor data. A discrimination degree is defined to measure the difference between the sensor reports and feature vector. The basic probability assignment of each sensor report can be determined by the proposed discrimination degree. One merit of the proposed method is that not only singletons but also multiple hypotheses are considered. The final diagnosis result is obtained by the combination of several sensor reports. A practical fault diagnosis application is illustrated to show the efficiency of the proposed method.

Keywords

Fault diagnosis, sensors, data, uncertainty, probabilistic analysis

Date received: 1 May 2016; accepted: 18 September 2016

项目成果

3、一篇在审SCI论文：

[1] **Huang Y, Jiang W**. Modified failure mode and effects analysis and its application in radiation oncology. International Journal of Medical Informatics, under review. (SCI源)

Modified failure mode and effects analysis and its application in radiation oncology

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Abstract

Background and objective: In the field of radiation oncology, how to protect patient safety efficiently and shorten the working hours of employees

项目成果

4、会议论文（在审）：

[1] **徐帅，何子畅**，文涛，蒋雯*，基于多头绒泡菌模型的无人机航迹规划，第八届中国信息融合大会

[2] **黄宇波**，张静宜，谢温特，蒋雯*，基于熵权法和TOPSIS的飞行器发动机叶片故障分析，第八届中国信息融合大会

[3] **何子畅**，薛希哲，杨雨青，蒋雯*，基于模糊元胞自动机的城市规划，第八届中国信息融合大会

基于多头绒泡菌模型的无人机航迹规划

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摘 要：无人机航迹规划是一种复杂的优化问题。目前，随着无人机任务功能的多样化，无人机飞行环境不断复杂，航迹规划对于无人机任务执行，安全保障的作用也更加重要。利用多头绒泡菌管道流量和传导性的正反馈特性，多头绒泡菌模型可以用来解决路径规划问题。通过对威胁源建模，利用航路代价作为边权值，利用多头绒泡菌模型可以获得最优航迹。针对传统的多头绒泡菌路径寻优模型收敛速度慢的缺点，对传统模型加入启发式规则：在算法后期，对流量和传导性连续减少的管道，管道流量直接赋值为零。最后，通过仿真实验来验证多头绒泡菌模型解决无人机航迹规划的有效性。

关键词：无人机；航迹规划；多头绒泡菌

中图分类号： V249.1

A Physarum-inspired model for the path planning of Uninhabited Combat Air Vehicle

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Abstract: The path planning of Uninhabited Combat Air Vehicle (UCAV) is one of the most complicated optimum problems. Nowadays, with the UCAV task function more and more diversified and UAV flight environment more and more complex, path planning of the UCAV is much more important. Based on the positive feedback characteristic between flux and conductivity, the Physarum polycephalum had the ability to find the shortest path. By using the travel cost as weight, the Physarum mode can find the best track for the UCAV. Considering on the low convergence speed of the classical Physarum model, this article changed the

基于熵权法和 TOPSIS 的飞行器发动机叶片故障分析

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1）西北工业大学大学，西安 710072

摘 要：在航空航天领域，故障检测和分析是一个重要的课题，而对发动机的故障检测，则是其中的一个热点。失败模式及其效应分析（FMEA）模型为解决这个问题提供了一个有效工具。但是，这种方法有时却面临着得出不符合直觉和实际工程经验结果的缺点。因此，本文引入模糊 TOPSIS 方法来修正传统的 FMEA 模型。同时，使用熵权法，利用专家评估结果的不确定性赋予不同专家以合适的客观权重，最终得到修正的故障模式风险优先排名。本文分析了一个实际的发动机叶片故障案例，通过本文提出的模型进行计算，得到风险度排名最高的三种失效模式：F9（高循环的机关断裂），F10（低循环的机关断裂），F12（蠕变疲劳断裂）。此结果与实际工程经验得出的结果相一致，因此证明了本文方法的可行性和有效性，同时结果也表明此方法既克服了传统方法的不足，又扩展了传统方法的应用范围。

关键词：直觉模糊数；IFWA 算子；香农熵；失败模式及其效应分析（FMEA）；TOPSIS；飞行器叶片

中图分类号：TU984

Fault analysis of aircraft turbine rotor blades based entropy weight method and TOPSIS

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Abstract: Fault detection and analysis is an important subject in the field of aerospace, especially for turbine. Failure mode and effect analysis (FMEA) model provides an effective tool to solve this problem. However, the

基于模糊元胞自动机的城市规划

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摘 要：城市空间系统是一个复杂的动态系统，在城市发展中其土地使用情况在不断发生变化，正确预测不同类型土地的变化趋势有很强的现实意义。元胞自动机（Cellular Automata, CA）能够用较简单的规则模拟出复杂的土地演变情况，被广泛应用于城市规划问题中。经典的 CA 模型存在着不确定信息处理能力弱或对数据要求过高的不足，对此我们提出一种新的模糊元胞自动机(Fuzzy Cellular Automata, FCA)模型，将元胞的状态归属模糊化，允许元胞以不同的概率归属于若干个状态，可以有效解决这些问题。我们将新模型应用于规划西安市雁塔区的土地使用，预测结果体现了新模型较经典模型的优越性。

关键词：元胞自动机；模糊元胞自动机；城市规划

中图分类号： TU984

Urban planning based on a new Fuzzy Cellular Automata model

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1）Northwestern Polytechnical University, Xi'an 710072

Abstract: Urban spatial system is a complex dynamic system. During the development of the city, the land use keeps changing continually. Hence, it is meaningful to predict the variation trend of different kinds of lands correctly. Cellular Automata (CA) model can model the complex evolution of land with some relatively simple rules. Due to it, CA model is widely applied in urban planning programs. However, some shortcomings exist in the classical CA model like its ability of handling uncertain information is weak or it holds a high demand for data. To address them, a new Fuzzy Cellular Automata (FCA) is proposed. The state of cell is fuzzified,

项目成果

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