

Chapter 3.7

Hybrid Intelligent Diagnosis Approach Based on Neural Pattern Recognition and Fuzzy Decision-Making

Amine Chohra

Paris-East University, France

Nadia Kanaoui

Paris-East University, France

Véronique Amarger

Paris-East University, France

Kurosh Madani

Paris-East University, France

ABSTRACT

Fault diagnosis is a complex and fuzzy cognitive process, and soft computing methods and technologies based on Neural Networks (NN) and Fuzzy Logic (FL), have shown great potential in the development of Decision Support Systems (DSS). Dealing with expert (human) knowledge consideration, Computer Aided Diagnosis (CAD) dilemma is one of the most interesting, but also one of the most difficult problems. Among dif-

ficulties contributing to challenging nature of this problem, one can mention the need of fine pattern recognition (classification) and decision-making. This Chapter deals with classification and decision-making based on Artificial Intelligence using multiple model approaches under soft computing implying modular Neural Networks (NN) and Fuzzy Logic (FL) for biomedical and industrial applications. The aim of this Chapter is absolutely not to replace specialized human but to suggest decision support tools: hybrid intelligent diagnosis systems with a satisfactory

DOI: 10.4018/978-1-60960-818-7.ch3.7

reliability degree for CAD. In this Chapter, a methodology is given in order to design hybrid intelligent diagnosis systems for a large field of biomedical and industrial applications. For this purpose, first, a survey on diagnosis tasks in such applications is presented. Second, fault diagnosis systems are presented. Third, the main steps of hybrid intelligent diagnosis systems are developed, for each step emphasizing problems and suggesting solutions able to ensure the design of hybrid intelligent diagnosis systems with a satisfactory reliability degree. In fact, the main steps discussed are knowledge representation, classification, classifier issued information fusion, and decision-making. Then, the suggested approach is developed for a CAD in biomedicine, from Auditory Brainstem Response (ABR) test, and the prototype design and experimental results are presented. Finally, a discussion is given with regard to the reliability and large application field of the suggested approach.

INTRODUCTION

In this Chapter, the main objective is to give a methodology to design hybrid intelligent diagnosis systems for a large field of biomedical and industrial applications. From a description and analysis on diagnosis tasks and diagnosis systems in such applications, a global diagnosis system is deduced. In this global diagnosis system one can consider, in case of diagnosis of the same fault class set, the information or knowledge (from one or several sources) is represented in different knowledge representations, and independently classified (in parallel), then the decision-making of their results gives the final results (fault class set and suitable remedies or a reliability rate of the possible identified fault class).

The suggested methodology consists to develop the main steps of the global diagnosis system, for each step emphasizing problems and suggesting solutions able to ensure the design of hybrid

intelligent diagnosis systems with a satisfactory reliability degree. Indeed, the main steps developed are knowledge representation (how to take advantage from image knowledge representations: global and subdivided images) from biomedical or industrial signals, classification (double neural classification: the redundancy aspect acts to the reliability benefit of overall system), classifier issued information fusion combining modular Neural Networks (NN), and decision-making using Fuzzy Systems (FS). In fact, the double classification, suggested in a hybrid intelligent diagnosis approach, is exploited in Primary Fuzzy System (PFS) to ensure a satisfactory reliability. Afterwards, this reliability is reinforced using a Confidence Parameter (*CP*) with primary diagnosis result, exploited in Final Fuzzy System (FFS), in order to generate the appropriate diagnosis with a Confidence Index (*CI*).

For this purpose, first, a survey on diagnosis tasks in biomedical and industrial applications is presented. Second, fault diagnosis systems are presented. Third, the main steps of hybrid intelligent diagnosis systems are developed, for each step emphasizing problems and suggesting solutions able to ensure the design of hybrid intelligent diagnosis systems with a satisfactory reliability degree. In fact, the main steps discussed are knowledge representation, classification, classifier issued information fusion, and decision-making. Then, the suggested approach is developed for a Computer Aided Diagnosis (CAD) in biomedicine, from Auditory Brainstem Response (ABR) test, and the prototype design and experimental results are presented.

In fact, four Hybrid Intelligent Diagnosis Systems (HIDS) based on image representation for computer aided auditory diagnosis (in a biomedicine application: auditory diagnosis based on auditory brainstem response test), based on neural classifications (modular neural networks) and fuzzy decision-making systems has been suggested:

21 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/hybrid-intelligent-diagnosis-approach-based/56157

Related Content

A View on Fuzzy Minimal Open Sets and Fuzzy Maximal Open Sets

Hamid Reza Moradi (2015). *International Journal of Software Science and Computational Intelligence* (pp. 62-73).

www.irma-international.org/article/a-view-on-fuzzy-minimal-open-sets-and-fuzzy-maximal-open-sets/140953

Use of BIM and GIS in Maintenance and Operation of Urban Infrastructure

P. Selvakumar (2026). *Building Information Modeling and Geographic Information Systems for Next-Generation Spatial Intelligence* (pp. 209-236).

www.irma-international.org/chapter/use-of-bim-and-gis-in-maintenance-and-operation-of-urban-infrastructure/396400

A Statistical Framework for the Prediction of Fault-Proneness

Yan Ma, Lan Guo and Bojan Cukic (2007). *Advances in Machine Learning Applications in Software Engineering* (pp. 237-263).

www.irma-international.org/chapter/statistical-framework-prediction-fault-proneness/4863

Feature Based Rule Learner in Noisy Environment Using Neighbourhood Rough Set Model

Yang Liu, Luyang Jiao, Guohua Bai and Boqin Feng (2012). *Breakthroughs in Software Science and Computational Intelligence* (pp. 46-64).

www.irma-international.org/chapter/feature-based-rule-learner-noisy/64602

On Localities of Knowledge Inconsistency

Du Zhang (2011). *International Journal of Software Science and Computational Intelligence* (pp. 61-77).

www.irma-international.org/article/localities-knowledge-inconsistency/53163