International Journal of Innovative
Computing, Information and Control
Volume **7**, Number **6**, June **2011**

 ISSN 1349-4198
pp. 3121–3132

A SWARM-BASED ROUGH SET APPROACH FOR FMRI DATA ANALYSIS

Hongbo Liu[1,2,3,4,*], Ajith Abraham[3], Weishi Zhang[1] and Seán Mcloone[4]

[1]School of Information
Dalian Maritime University
No. 1, Linghai Road, Dalian 116026, P. R. China
teesiv@dlmu.edu.cn
*Corresponding author: lhb@dlmu.edu.cn

[2]School of Computer
Dalian University of Technology
No. 2, Linggong Road, Ganjingzi District, Dalian 116023, P. R. China
lhb@dlut.edu.cn

[3]Machine Intelligence Research Labs – MIR Labs
Auburn, Washington 98071, USA
ajith.abraham@ieee.org

[4]Department of Electronic Engineering
National University of Ireland Maynooth
Maynooth, Co. Kildare, Ireland
sean.mcloone@eeng.nuim.ie

Received April 2010; revised August 2010

Abstract. *The functional Magnetic Resonance Imaging (fMRI) is one of the most important tools for exploring the operation of the brain as it allows the spatially localized characteristics of brain activity to be observed. However, fMRI studies generate huge volumes of data and the signals of interest have low signal to noise ratio making its analysis a very challenging problem. There is a growing need for new methods that can efficiently and objectively extract the useful information from fMRI data and translate it into intelligible knowledge. In this paper, we introduce a swarm-based rough set approach to fMRI data analysis. Our approach is based on exploiting the power of particle swarm optimization to discover the feature combinations in an efficient manner by observing the change in positive region as the particles proceed through the search space. The approach supports multi-knowledge extraction. We evaluate the performance of the algorithm using benchmark and fMRI datasets. The results demonstrate its potential value for cognition research.*

Keywords: Particle swarm, Swarm intelligence, Multi-knowledge, fMRI

1. **Introduction.** The field of neuroinformatics is concerned with the collection, organization and analysis of neuroscience data and the development of computational models and analytical tools for the exploration of this data. Standing at the intersection between neuroscience and information science, neuroinformatics plays a vital role in the integration and analysis of increasingly fine grain experimental data and in improving existing theories about nervous system and brain function [1].

Functional Magnetic Resonance Imaging (fMRI) is one of the most important tools for the generation of Neuroinformatics data. It provides a high resolution volumetric mapping of the haemodynamic response of the brain which can be correlated with neural activity, thereby allowing the spatially localized characteristics of brain activity to be observed.