

Chapter 11¹

KNOWLEDGE ACQUISITION AND UNCERTAINTY IN FAULT DIAGNOSIS: A ROUGH SETS PERSPECTIVE

Lian-Yin Zhai*, Li-Pheng Khoo*, and Sai-Cheong Fok**

* *School of Mechanical and Production Engineering, Nanyang Technological University,
50 Nanyang Avenue, Singapore 639798*
Email: mlyzhai@ntu.edu.sg, mlpkhoo@ntu.edu.sg
Web: <http://www.ntu.edu.sg/mpe/Admin/Divisions/mechatronics&design/staff.asp>

** *Faculty of Engineering & Surveying, University of Southern Queensland,
Toowoomba, Qld 4350, Australia*
Email: foksai@usq.edu.au
Web: <http://www.usq.edu.au/users/foksai/>

Abstract: The ability to acquire knowledge from empirical data or the environment is an important requirement in better understanding many natural and artificial organisms. This ability relies heavily on the quality of the raw information available about the target system. In reality, these raw information/data may contain uncertainty and fuzziness, that is, it may be imprecise or incomplete. A number of techniques, such as the Dempster-Shafer theory of belief functions and fuzzy set theory, have been developed to handle knowledge acquisition in environments that exhibit uncertainty and fuzziness. However, the advent of the rough set theory in the early 80's provides a novel and promising way of dealing with vagueness and uncertainty. This chapter will address the issue systematically by covering a broad area including knowledge acquisition / extraction, uncertainty in general, and techniques for handling uncertainty. The basic notions of rough set theory as well as some recent applications are also included. Two simple case studies related to fault diagnosis in manufacturing systems are used to illustrate the concepts presented in this chapter.

Key Words: Rough Sets, Rule Induction, Knowledge Acquisition, Fuzzy Reasoning, Fault Diagnosis.

¹ Triantaphyllou, E. and G. Felici (Eds.), **Data Mining and Knowledge Discovery Approaches Based on Rule Induction Techniques**, Massive Computing Series, Springer, Heidelberg, Germany, pp. 359-394, 2006.