

A self-learning case and rule-based reasoning algorithm for intelligent technology evaluation and selection

Liam Evans¹, Niels Lohse¹, Phil Webb²,

¹ Faculty of Engineering, University of Nottingham, Nottingham
England, NG7 2RD, United Kingdom

² Department of Systems Engineering and Human Factors, School of Engineering,
Cranfield University, Cranfield, England, MK43 0AL, United Kingdom

¹ epxl1@nottingham.ac.uk

Abstract. This research programme proposes to fulfill the existing gap in knowledge by providing an experience-oriented decision algorithm to solve technology selection problems based on cases and expert's experience. The approach adopts historical case-based data to extract rules through the ID3 rule induction algorithm. The decision model integrates a rule induction approach in a rule-based knowledge system and database management system to support automated knowledge mining and usage

The adoption of a pair-wise comparison algorithm within the similarity index assists in relating the importance of the criteria within the knowledge-bases reasoner. A series of historical and new solutions are presented in a scoring index based on the requirements of a new case.

Keywords: case-based, rule-based reasoning, expert system, technology selection, experience-oriented problems, self-learning.

Extended Abstract

Each year, manufacturing organizations spend millions of pounds investing in new technologies to improve their approach to the manufacture and subsequent working of their products. The recent challenging climate has formed intense pressure on organizations to remain competitive by reducing the overall cost and development of new and existing products.

State-of-the-art manufacturing technologies improve operational efficiency and can be attractive to companies wishing to attain higher profitability margins from existing products and processes. Although the ultimate selections of these technologies will not necessary have a beneficial effect on an organization, if conducted appropriately, organizations can invest wisely. With much focus on developing advanced technologies, the market becomes saturated with capable solutions. This leads to a progressively more difficult process of identifying the optimal manufacturing process due to the number of complex technologies that exist.

It has been recognized that organizations do not have standard procedures for the appropriate evaluation and selection of alternative technologies, which can have a detrimental impact on the success of an organization. The know-how policies in the acquaintance of manufacturing technologies can significantly impact the eventual capability and performance of the system. Current practices rely upon experience, knowledge and intuition by senior management, and managers cannot consider all relevant criteria due to the level of information processing and lack of rationale.

This research programme proposes to fulfill the existing gap in knowledge by providing an experience-oriented decision algorithm to solve problems based on cases or expert's experience. A rule induction-based knowledge system will automatically extract rule-based knowledge from previous cases. The decision model integrates a rule induction approach in rule-based knowledge system and database management system to support automated knowledge mining and usage. The use of a pair-wise comparison algorithm within the similarity index assists in relating the importance of the criteria within the decision.

The research provides a novel integrated decision model to the problem of manufacturing technology selection. The retainment and reuse of knowledge to sustain future decision-making practices ensures a quality and reliable approach to the area is ensued.