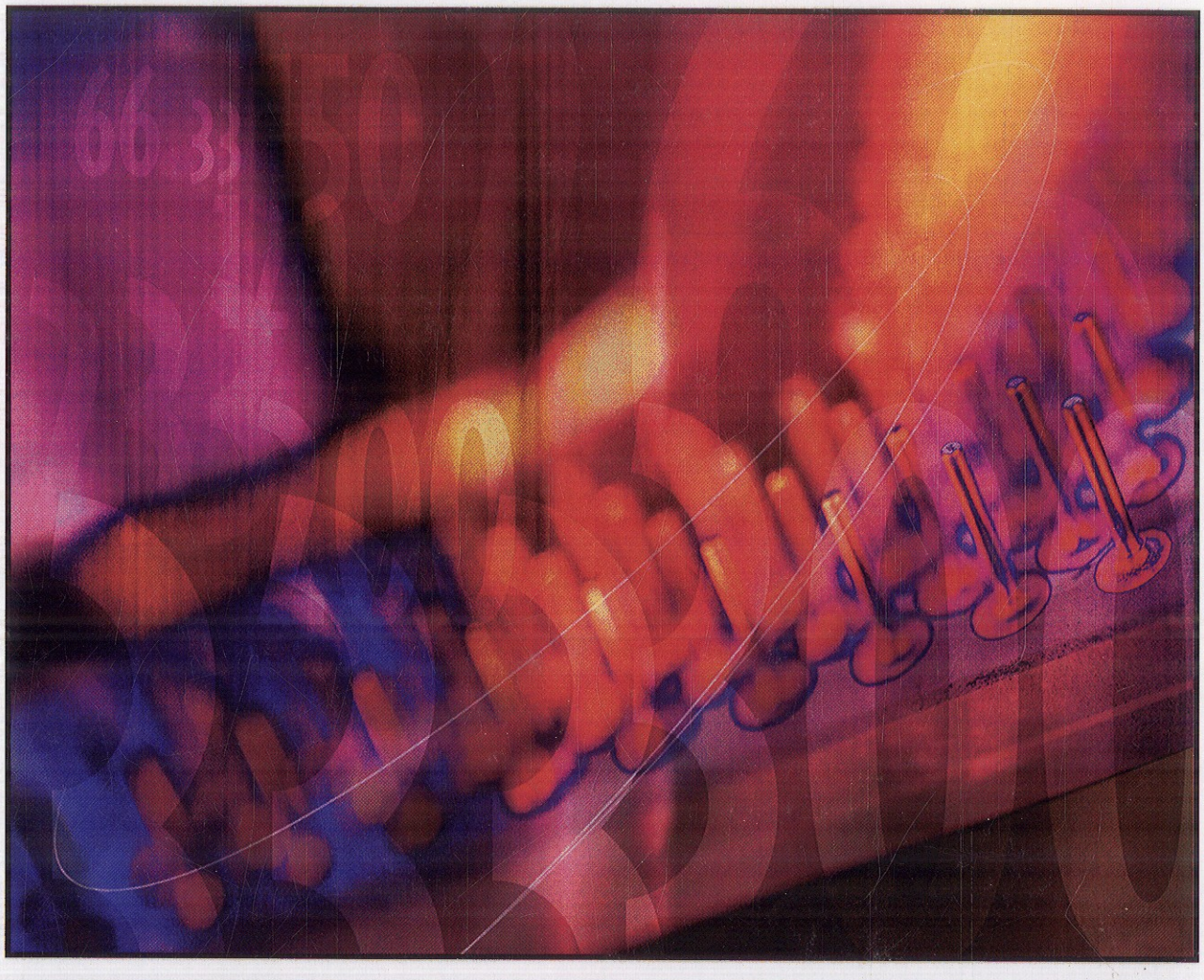
PREMIER REFERENCE SOURCE

INTELLIGENT SYSTEMS IN OPERATIONS

Methods, Models and Applications in the Supply Chain



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With the growing complexity of information technology (IT) projects, the management of these projects is proving to be a daunting task. The magnitude of this problem is underscored by the assertion that approximately 70% of IT projects fail to meet their objectives (Lewis, 2007). Computational intelligence (CI) is an area of research focused on developing intelligent systems to help with complex problems. Specifically, CI seeks to integrate techniques and methodologies to assist in problem domains in which information, data and perhaps even the problem itself are vague, approximate, and uncertain. It would seem that research aimed at leveraging the power of CI against IT project management problems is critical if IT project success rates are to be improved. This work examines the core CI technologies – fuzzy logic, neural networks, and genetic algorithms – and looks at current and potential future applications of these techniques to assist IT project managers.

Chapter 6

This chapter studies a manufacturing process of pieces. These pieces are produced with molds which are mounted on machines. The authors describe this process as an optimization problem using an integer linear programming formulation which integrates the most important features of the system, and determines the quantities of pieces to produce, including the allocation of molds to machines. The objective function is to maximize the weighted production since they seek to minimize the non-fulfilled demand. First they show that the addressed problem belongs to the NP-hard class. After observing that solving the problem in an exact way is time consuming, they propose a solution methodology based on an Iterated Local Search Algorithm. Through computational experimentation we make conclusions about the difficulty of the decisions determined in this manufacturing planning.

Chapter 7

In this chapter, the authors present an intelligent simulation system for supply chain event management for the purpose of designing and re-engineering the supply chain. The simulation framework mainly composes of component layer, process layer, intelligent execution layer, and output layer. The functional design of the layers is discussed with comments on the contribution of the simulation. Implementation issues are further addressed and an illustrative case study is reported.

Chapter 8

The present chapter discusses the application of intelligent decision-support systems – mathematical programming-based in particular – to operations management within the mining industry. The underlying production and distribution planning and scheduling problems have often been addressed individually, in disregard of upstream and downstream operations. A supply chain approach to mining operations, however, requires an integrated perspective which takes into account mine, railway and port operations, as well as domestic and international supply stations served by appropriate logistics channels. Three main topics are discussed here: recent operations research developments in the mining industry; integrated approaches towards the development of decision-support systems to address a global mining supply chain; and possible solution approaches to the integrated problems. The main thread is oriented to mathematical programming approaches, but relevant applications of simulation and artificial intelligence techniques are also discussed.

Chapter 9

The development of Information and Communication Technologies (ICT) allowed the enterprises to adopt an e-marketplace approach to Business to Business (B2B) applications. In particular, these kind of applications are demonstrating their capacity to provide real added value to manufacturing industries by allowing their global performance to increase. The implementation of the e-marketplace by firms is not considered an easy job because of the lack of automation: the human participation is still in all stages of the B2B process. The chapter proposes a three value added services: workflow design, Multi Agent System and negotiation approach. In particular, two negotiation, an auction and single round approaches with three customer behaviors are proposed. A simulation environment is developed in order to test the proposed approaches. The simulations have been conducted in several scenarios in order to highlight what is the best approach to perform.

Chapter 10

Computer vision is nowadays a key factor in many manufacturing processes. Among all possible applications like quality control, assembly verification and component tracking, the robot guidance for pick and place operations can assume an important role in increasing the automation level of production lines. While 3D vision systems are now emerging as valid solutions in bin-picking applications, where objects are randomly placed inside a box, 2D vision systems are widely and successfully adopted when objects are placed on a conveyor belt and the robot manipulator can grasp the object by exploiting only the 2D information. On the other hand, there are many real-world applications where the 3rd dimension is required by the picking system. For example, the objects can differ in their height or they can be manually placed in front of the camera without any constraint on the distance between the object and the camera itself. Although a 3D vision system could represent a possible solution, 3D systems are more

complex, more expensive and less compact than 2D vision systems. This chapter describes a monocular system useful for picking applications. It can estimate the 3D position of a single marker attached to the target object assuming that the orientation of the object is approximately known.

Service-oriented computing is becoming increasingly popular. It allows designing flexible and adaptable software systems that can be easily adopted on demand by software customers. Those benefits are from primary importance in the context of supply chain management; that is why this paper proposes to apply ProDAOSS, a process for developing adaptable and open service systems to an industrial case study in outbound logistics. ProDAOSS is conceived as a plug-in for I-Tropos - a broader development methodology - so that it covers the whole software development life cycle. At analysis level, flexible business processes are generically modelled with different complementary views. First of all, an aggregate services view of the whole applicative package is offered; then services are split using an agent ontology - through the i* framework - to represent it as an organization of agents. A dynamic view completes the documentation by offering the service realization paths. At design stage, the service center architecture proposes a reference architectural pattern for services realization in an adaptable and open manner. The chapter finally presents the implemented platform for a particular service – manage transport – so that the reader can realize how the developments have been achieved.

Selected Readings

This article describes an application that illustrates the role of data mining technology in identifying hidden causal knoledge from health and medical data repositories. Across the health care and medical enterprises, a wide variety of data is being generated at a rapid rate. Current information technologies tends to focus on a more statical side of causal knowledge and do not address the dynamic causal knowledge. This article shows that the dynamic causal relation data can be captured for treatment, payment, operations purposes and administrative directed insights. Accessing this currently unrealized knowledge potential would enable the delivery of actionable knowledge to medical practitioners, healthcare system managers, policy planners and even patients to make a significant difference in overall healthcare.

Deliberate exploitation of natural resources and excessive use of environmentally abhorrent materials have resulted in environmental disruptions threatening the life support systems. A human centric approach of development has already damaged nature to a large extent. This has attracted the attention of environmental specialists and policy makers. It has also led to discussions at various national and international conventions. The objective of protecting natural resources cannot be achieved without the involvement of professionals from multidisciplinary areas. This chapter recommends a model for the creation of knowledge-based systems for natural resources management. Further, it describes making use of unique capabilities of remote sensing satellites for conserving natural resources and managing natural disasters. It is exclusively for the people who are not familiar with the technology and who are given the task of framing policies.

Chapter 16

In recent years, product ontology has been proposed for solving integration problems in product-related information systems such as e-commerce and supply chain management applications. A product ontology provides consensual definitions of concepts and inter-relationships being relevant in a product domain of interest. Adopting such an ontology requires means for assessing their suitability and selecting the "right" product ontology. In this article, the authors (1) propose a metrics suite for product ontology evaluation based on semiotic theory, and (2) demonstrate the feasibility and usefulness of the metrics suite using a supply chain model. The contribution of our research is the comprehensive metrics suite that takes into account the various quality dimensions of product ontology.