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Introduction

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KIMAS aims for unified approaches to knowledge intensive multi-agent systems that emerge in all domains of business, engineering, and modeling of the human mind. This involves a variety of disciplines including: intelligent decision support, signal processing and financial prediction, robotics and infobot design, text understanding and generation, artificial life, computational linguistics, data mining, and collaborative systems. A need to integrate data, knowledge, information, and wisdom unifies these diverse fields. Knowledge can be in the form of precise laws of physics, inborn brain structures, or uncertain intuitions of scientists. The ubiquitous requirement to combine data and knowledge for producing refined knowledge challenges us across disciplines. Common algorithmic characteristics include an integrated operation of sensing, information extraction, knowledge construction, and action. Some researchers arrive at this structure motivated by practical needs and mathematical analysis. Others are inspired by studies of the mind and brain. Herein, we have a collection of high quality articles spanning several aspects of the theory and practice of knowledge intensive multiagent systems that complement contemporary artificial intelligence, soft computing, and multiagent systems.

REVIEW OF PAPERS

The first paper authored by our colleagues at U of Waterloo describes a rich trust management system for a vehicular ad-hoc network (VANET). Their design takes a multifaceted trust approach, in that the system allows for experience-based trust, role-based trust, majority opinion, and priority-based trust with each of these allowed to be weighted differently depending on the need at the time. There are several issues therein that are not addressed. The paper is primarily focused on purposely malicious nodes propagating mal-information. Alhough this is a possibility; in general, it is a much higher probability that it will be a non-malicious node propagating misleading information due to technical issues; e.g., a malfunctioning sensor. No consideration is given should an authoritative node start to propagate erroneous data. As they use authoritative nodes to counteract malicious nodes, by possibly giving the authoritative nodes higher priority, this could pose a very serious problem.

Our second paper describes a technique for tracking humans with a camera network using face recognition. Through a series of agent platforms, where each platform is integrated with a video camera, mobile agents can jump from platform to platform looking for a particular person. The video camera footage is a real time data set that the agent analyzes for its target’s facial features. The authors describe a generator algorithm to efficiently find this face in a parallel computing environment. Each camera in the network is considered to be a node. According to the authors, the goal of the generator is to find neighboring nodes so that when a human crosses into another camera’s range, the human can easily be tracked by the agent by jumping to that camera’s agent platform. In the paper, the authors describe a series of problems that must be overcome. The layout of the network is dynamic from one setting to another, but the camera installation points, once set, are to be considered static. The authors give suggestions that cameras should be placed at natural choke points, such as a doorway or an end of a hallway. Since cameras cannot know the layout of the network, defining the path an agent should take to go from one camera system to another is considered to be difficult, so using a matrix to distinguish neighbors is the solution explore.

Considering collective opinions is the theme of our third paper by Professor Vadim Stefanuk. He models agents as finite or probabilistic automata or entities from control theory. He argues that stable collective opinion may be reached via a simple local interaction of expedient agents by way of local exchange of individual opinions.

In fourth paper, Dr. Rik Warren of ARFL addresses the difficulties and nuances of doing research on a culture and group dynamics using human subjects and the unique capabilities and residual difficulties of using agent-based modeling. He conducts an experiment on team performance using multi-cultural groups. In order to investigate the performance of mixed- versus homogeneous-culture military teams; NATO conducted a large five-nation computer-game based search-task experiment. The search task required planning, resource allocation, situation awareness, communications and coordination for good performance. Cultural diversity can have both positive and negative effects on the performance of multinational teams. He hypothesizes that cultural diversity promotes better strategy and richer ideas arising from the interaction of the team as a whole during the planning phase. Also, that potentially positive effect from good planning can be partially countered in the execution phase since cultural diversity can lead to poorer communications and misunderstandings. The purpose of Warren's study is to use agent-based modeling to better understand the reasons behind the results of the NATO experiment. Several aspects of the simulation study that are noteworthy are the two-factor model, the team-diversity index, and cultural research in general.

The Simulation: The simulation attempted to mimic certain aspects of the NATO task, in particular using a search task requiring calls for help to team members. It provides for a more realistic complex world.

The Two-Factor Model: The two-factor model is consistent with the simulation results. Under certain circumstances, team cultural diversity can produce superior performance in complex tasks which require separate phases for developing strategy and task execution. Also under different circumstances, team diversity can hinder performance.

The Team-Diversity Index: The team-diversity index has not been fully studied.

Culture Research & Agent-Based Simulation: Warren summarizes that research on culture and inter-cultural relations is extremely difficult to conduct and filled with unavoidable confounds which make interpretation of results difficult.

In our fifth paper, our colleagues at 21st Century report on a framework that captures the cultural characteristics inherently within the machine learning ARTMAP algorithm, naturally bringing out the characteristics which influence each facet of the cultural response prediction. We have begun implementation of our framework and have included some preliminary analyses of Inference Engine 1 using Grid and Group as initial Cultural Traits based on data availability, breadth of variables used in these calculations, and the relationship with existing Individualist/Collectivist measures.

Deloach and Miller take on modeling goals in complex, adaptive systems in our sixth paper. Their strategy that is dubbed GMoDS provides end-to-end modeling and execution and allows systems to adapt to changes in the environment and problem, a significant advantage for complex, adaptive systems. The GMoDS specification model includes the notions of goals, goal decomposition, events, precedence, and goal instantiation. The GMoDS instance model captures the dynamics of the system state while maintaining the structure of the specification model. The execution model, which has been used in several multiagent and cooperative robotic systems, implements these models in an efficient manner.

Our seventh and final paper is on multimode social networks. This paper presents a mathematical methodology for manipulating multi-mode networks. Wegman details three mode networks and presents a generalized multi-mode model for networks. In network theory, a network may be represented by a matrix or graph. Wegman applies his ten-mode network to understand the patrimonial/tribal society in Afghanistan and allows for disambiguating subtle relationships among sectors within that social system.