

selectivity. The restriction of selectivity is mainly compelled by the specific characteristics of large-scale multi-agent systems. In such settings, it is reasonable to assume that the overhearing resources will be essentially limited, thus allowing the overhearing agent to overhear only a subset of inter-agent communications. Most

previous investigations on overhearing ignore the limitation of selectivity, assuming that all relevant inter-agent communications can be overheard. In contrast, our work provides an empirical study of selective overhearing committed by both centralized and distributed teams of collaborative overhearing agents.

Cognitively Inspired Decision Making for Software Agents: Integrated Mechanisms for Action Selection, Expectation, Automatization and Non-Routine Problem Solving

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Abstract

Despite impressive advances in the past decades, autonomous agents living in dynamic and unpredictable environments are typically equipped with simple decision-making mechanisms in their sense-decide-act routines. These agents deal mostly with one goal at a time. This research aspires to model, design and/or implement a sophisticated decision-making mechanism that selects the agent's next action with different levels of awareness: automatized skills, consciously mediated routine solutions and consciously deliberated non-routine solutions. Such a decision-making mechanism is presented in a 'conscious' software agent framework called IDA that implements Baars' Global Workspace Theory of consciousness. IDA integrates many computational and conceptual mechanisms, among which this research deals with its action selection, expectation, automatization and non-routine problem-solving modules.

The overarching continual task of an agent's intelligence is for the service of choosing, at each moment in time, the appropriate action in response to exogenous and endogenous stimuli. IDA's action selection mechanism (ASM) can interleave and prioritize actions of different and competing

goal hierarchies. The ASM system is implemented as a domain-independent and reusable framework for behavior networks and is tested as a controller to a khepera robot operating in a real-world domain.

We humans have the amazing ability to learn a procedural task (e.g. walking) so well that we do not need to think about the task consciously in order to accomplish it. This ability is what we call automatization. Once a task has been automatized, there is no need for attention to be paid to its execution unless the expected result does not occur. At failure of expectation, deautomatization process temporarily disables the automatization effects and 'conscious' control plays a role to deal with the failure situation. We implement the automatization and deautomatization cognitive functions as a self-organizing system in the IDA framework.

Non-routine problem solving is the ability to devise unexpected, and often clever, solutions to problems that have never been encountered before. We will present a detailed design and specification of a non-routine problem-solving mechanism as a special goal context hierarchy that guides a deliberative solution search process, which we will discuss in IDA's cognitive cycle.

Autonomy vs. Conformity: An Institutional Perspective on Norms and Protocols

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Abstract

The research presented in this thesis is part of the ToKeN project ANITA (Administrative Normative Information Transaction Agents). In this domain, the main challenges concern both the shortage of information (not being able to find legally relevant data that should be available) as well as the abundance of information (e.g., violating privacy rights). Although the agents decide autonomously whether to share information based on (local) norms, a global frame was needed for the enforcement of (global) norms given by laws and regulations of the domain. In most software and agent methodologies, such regulations are seen only as extra requirements in the analysis phase, and are thus hard-coded into the software or agents themselves. If, however the regulations change, all design steps have to be checked and all code verified to ensure

compliance to the new regulations. The alternative is to have an explicit representation of the norms, for example, by the introduction of an electronic institution, but this approach requires some form of enforcement to ensure the compliance instead. The introduction of an electronic institution in highly regulated domains such as the ANITA scenario requires us to solve issues related to the abstractness of human regulations, the lack of operational information and the implementation of norm enforcement from an institutional perspective. In this thesis, we solve these problems by the introduction of a framework for making the connections between the norms and the practice explicit. To ensure that none of the norms derived from law are violated, an enforcement mechanism is presented based on monitoring and punishing rather than

restricting the agents to specific procedures (that are known to be norm compliant). Such a mechanism of active

norm enforcement ensures a good balance between autonomy and conformity in an institution.

Self-Organizing Neural Networks in the Characterization of Interstitial Lung Diseases in Chest Radiographs

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Abstract

The technological development provides an improvement in the quality of life due to easiness, speed and flexibility in the access to the information. In the biomedical area, the technology is admitted as an important allied, allowing the fast development of methods and techniques that assist the professional in the health care. Recent advances in the computerized analysis of medical images contribute for the precocious diagnosis of a series of diseases. In this work, a methodology for the development of a computational system for characterization of patterns in pulmonary images, based on techniques of artificial neural networks is presented. In the study, has searched for the verification the use of self-organizing neural networks as a feature extraction and dimensionality reduction tool of chest radiographs, willing to characterize

interstitial lung disease. For the dimensionality reduction and feature extraction, an algorithm based on Self-Organizing Maps was implemented, with some variations, getting a reduction of about three million pixels that it composes an image, for 240 elements. For the pattern classification, a Multilayer Perceptron was used, validated with the leave-one-out methodology.

With a database containing 79 samples of linear pattern, 37 samples of nodular pattern, 30 samples of mixed pattern, and 72 samples of normal pattern, the classifier provided an average result of 89.5% of right classification, with 100% of right classification for linear pattern, 67.5% for nodular pattern, 63.3% for mixed pattern, and 100% for normal pattern. The results prove the validity of the methodology.

Specifying and Analyzing Institutions in Multi-Agent Systems using Answer Set Programming

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Abstract

It is recognized that normative systems, and in particular electronic institutions and contracts are a potentially powerful means for making agent interactions in multi-agent systems effective and efficient. However, correctly specifying the behaviour of such systems is a difficult problem. Designers are faced with two concurrent, complex tasks: first, they must specify the relationships (over time) between agents' actions and their effects, and secondly they must also consider how agents' actions are to be regulated through the definition of agents' permissions and obligations. Such systems are typically complex, and given this complexity it may be difficult for a designer to determine whether their original objectives have been captured by the specification of the system. In this dissertation, we seek to address some of the problems associated with institutional specification. In order to do

this, we present a model for specifying institutions based on the notion of socially constructed reality that accounts not only for how the action and events, which constitute the institution, are described, but also how they are regulated.

Institutions may be used in a number of ways, and may account for concepts at varying levels of abstraction. Recognizing this, we also investigate how several institutions, each accounting for a particular aspect of a society may be composed and how the relationships between these institutions may be expressed. Given this model, we then demonstrate how, using the answer set programming paradigm institutional specifications based on our model may be checked for the absence or presence of certain (un)desirable properties.

Diagnosing Coordination Faults in Multi-Agent Systems

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