Intelligent Distributed Agent Based Architecture

By

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Abstract

This thesis presents work done on the development of a multi-agent system architecture that facilitates coordination and a novel social networks based approach to coordination. The field of multi-agent system research is undergoing tremendous expansion and it would be impossible to address all the issues related to the field. Instead, this thesis focuses on the coordination aspect of multi-agent systems.

The architecture presented here is named the INtelligent Distributed Agent Based Architecture, INDABA[1]. INDABA, as a hybrid agent architecture, combines the sub-symbolic knowledge representation layered architecture with a symbolic layer that allows for deliberative reasoning and learning. INDABA also introduces a layer that facilitates coordination in a society of agents, namely the interaction layer.

The new approach to coordination was inspired by social networks, as observed in higher mammalian societies. Two social relationships were explored, namely kinship and trust. Coordination is achieved through team selection. Using characteristics of social networks, such as learning and the ability to deal with uncertainties, the best team is selected for task execution.

The experiments conducted for the purpose of this thesis were done on three levels. Firstly, an abstract simulated environment was created where a society of a large number of agents could be observed. Secondly, experiments were done in a more realistic simulated robot environment. The last set of experiments was done in a real-world environment, with the implementation of INDABA in embodied mobile agents (robots). The experiments have confirmed the applicability of INDABA as an agent architecture, as well as the validity of the social networks coordination approach.

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[1] INDABA has also another meaning: in the Zulu language, it represents the process of cooperation, negotiation and collective problem solving.

Acknowledgements

Impossible is a word to be found only in the dictionary of fools.

- Unknown

Not everything that can be counted counts,

and not everything that counts can be counted.

- Albert Einstein

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