



UMEÅ UNIVERSITET

DYNAMIC CONTEXT- SENSITIVE DELIBERATION FOR SOCIAL SIMULATIONS

Balancing Scalability and Realism

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Akademisk avhandling

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Abstract

There exists a realism and scalability trade-off in modelling agent-based simulations. As an example, one could create a simpler model with a simpler behavioural model that allows to simulate many agents. However, this simple model can miss important details of the real world. Incorporating these aspects of the real world can increase realism, however, it can come at the cost of scalability. If more aspects of the real world are incorporated into the model, the behavioural model should be tied to these aspects. However, an interdependent behavioural system that considers all information at each time step is usually poorly scalable in terms of deliberative aspects. This poor scalability hinders the expansion of other desirable properties in the model, such as aspects of life and the number of agents.

We propose a context-sensitive deliberation framework that could help increase the scalability of the deliberation without losing behavioural realism. The framework is inspired by Kahneman's concept of thinking fast and thinking slow. On the one hand, it will be capable of fast deliberation that is efficient (scalability). On the other hand, it can sometimes perform slower deliberation that can solve complex situations (behavioural realism). Rather than switching between these two modes, the framework slides, gradually incorporating more information into the deliberation. This is the complexity by need principle. The framework needs to be aware of the context to determine what kind of information to use and what kind of information to deliberate on.

Whether context-sensitive deliberation can increase scalability while retaining realism will be evaluated with a use-case simulation, the Agent-Based Social Simulation of the Coronavirus Crisis (ASSOCC). Context-sensitive deliberation is implemented in the ASSOCC framework. The Original ASSOCC framework is then compared with the context-sensitive ASSOCC variant. The results show that deliberation is no longer the bottleneck, since context-sensitive deliberation achieved a roughly 16-17 times speed-up over the original ASSOCC deliberation model. This speed-up was retained with higher agent numbers, and it can be expected that if deliberation contains more aspects, context-sensitive deliberation will be capable of an even greater speed-up. The behavioural and infection curves were similar between the two models, thus the realism of the model is retained. In conclusion, the work shows that context-sensitive deliberation can increase scalability and retain realism in agent-based simulations.

Keywords

Context-sensitive deliberation, scalability, realism, behaviour, agent-based simulation

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