Off-line Synthesis of Evolutionarily Stable Normative Systems

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Within the area of multi-agent systems, normative systems are a widely used framework for the coordination of interdependent activities. A crucial problem associated with normative systems is that of synthesising norms that will effectively accomplish a coordination task and that the agents will comply with. Many works in the literature focus on the on-line synthesis of a single, evolutionarily stable norm (convention) whose compliance forms a rational choice for the agents and that effectively coordinates them in one particular coordination situation that needs to be identified and modelled as a game in advance. In this work, we introduce a framework for the automatic off-line synthesis of evolutionarily stable normative systems that coordinate the agents in multiple interdependent coordination situations that cannot be easily identified in advance nor resolved separately. Our framework roots in evolutionary game theory. It considers multi-agent systems in which the potential conflict situations can be automatically enumerated by employing MAS simulations along with basic domain information. Our framework simulates an evolutionary process whereby successful norms prosper and spread within the agent population, while unsuccessful norms are discarded. The outputs of such a natural selection process are sets of codependent norms that, together, effectively coordinate the agents in multiple interdependent situations and are evolutionarily stable. We empirically show the effectiveness of our approach through empirical evaluation in a simulated traffic domain.

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