Towards a DSL for BDI MultiAgent Systems using Python

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Multi-Agent Systems (MAS) are systems where multiple intelligent agents are connected to solve complex problems where a single agent or system solution is infeasible. MAS has proven helpful in many domains. Given the complexity of such systems, several languages and frameworks (e.g., JaCaMo, Jade) have been proposed to facilitate their development.

One of the existing paradigms to develop MAS is the Belief, Desire, and Intention (BDI), which offers a rich foundation to represent knowledge and reasoning in agents. A BDI agent is composed of beliefs, or the things it believes are true about its environment and itself; desires, which can be thought of as goals the agent has; and intentions, which are the actions the agent will execute to achieve its goals. The environment is a non-autonomous entity where the agent will act.

Although numerous tools exist, it is still hard to embed reinforcement learning algorithms into agents, given the lack of support on those platforms. The *Python* programming language has a rich ecosystem of libraries of this kind. But, as far as we know, there is no native support for creating general-purpose BDI agents using *Python*, although there are some approaches to program agents using frameworks like Spade, PADE, and Profeta.

Given the gap in this area, we have developed (in previous work) the so-called Multi-Agent System library in PYthon (MASPY). This library offers all the necessary items to model a BDI-MAS. It provides three extendable main base classes to model any application. The Agent class aggregates all the elements needed to build an agent. The environment-based class allows the modelling of any environment. The Communication class allows the agents to communicate between themselves using Knowledge Query and Manipulation Language. While unnecessary to the functioning of MASPY, the Handler class offers a few utility functions to facilitate the management of the system.

Our next goal is to develop a Domain-Specific Language (DSL) for the MASPY library. We will write this DSL in *Python*, where we will define the corresponding rules for both the lexer and parser of the DSL, capturing the necessary abstraction enclosed with BDI concepts to represent the knowledge and reasoning of agents in a high-level programming language, such as those based on the `AgentSpeak` language. With this, we intend to have available a programming language to (natively) program BDI multi-agents for general-purpose scenarios, capable of endowing such agents with reinforcement learning techniques.

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