Agents in Simulation Models, using a Swarm-like Agent Protocol in Python (SLAPP)

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Abstract. We discuss how to build agent based simulation models employing a generalized modular structure. We propose also a straightforward protocol, coming from the Swarm heritage, to code this kind of models, using Python. A concrete application to an Interbank Actual Payment System, aimed to simulate liquidity crisis, is also shown. Finally, we introduce the possibility of linking directly the Swarm-like Agent Protocol in Python (SLAPP) framework to the R statistical environment and to the Calc OpenOffice application.

Keywords: Agent Based Simulation, Swarm protocol, Python.

1 Introduction to the ERA (Environment, Rules, Agents) and CTs (Cross Targets) schemes

We propose here a scheme are useful to build agent based simulation models. The ERA framework (Fig. 1) is related to the structure of the models. We introduce also a straightforward protocol, coming from the Swarm heritage, to code this kind of models using Python.

The main goal is a didactic one: to expose undergraduate and graduate students to the construction of agent based simulation models using a simple low level language, in order to avoid any black box effect; but we have also a second goal, that of promoting openness of this kind of models, to make replication simpler or simplify direct use and re-use.

1.1 The ERA scheme

The building process of agent based simulation models needs some degree of standardization, mainly when we go from simple models to complex results. The main value of the Environment-Rules-Agents (ERA) scheme, introduced in Gilbert and Terna [1] and shown in Fig. 1, is that it keeps both the environment, which models the context by means of rules and general data, and the agents, with their private data, at different conceptual levels.

With the aim of simplifying the code design, agent behavior is determined by external objects, named Rule Masters, that can be interpreted as abstract

representations of the cognition of the agent. Production systems, classifier systems, neural networks and genetic algorithms are all candidates for the implementation of Rule Masters. We also need to employ meta-rules, i.e., rules used to modify rules (for example, the training side of a neural network). The Rule Master objects are therefore linked to Rule Maker objects, whose role is to modify the rules mastering agent behavior.

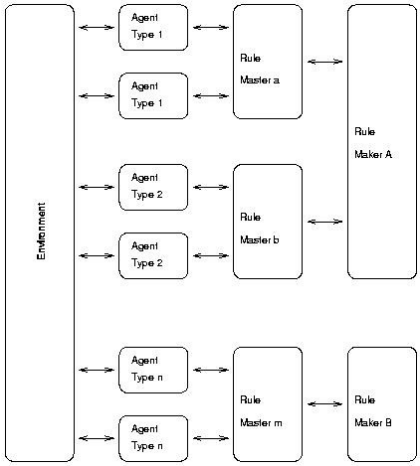

Fig. 1. The Environment, Agents and Rules (ERA) scheme.

Although this code structure appears to be complex, there is a benefit when we have to modify a simulation. The rigidity of the structure then becomes a source of invaluable clarity.

2 Using the scheme in SLAPP

To develop this kind of models, our proposal is that of using SLAPP, that you can find at http://eco83.econ.unito.it/terna/slapp. Links to R environment and to OpenOffice programs are respectively at http://rpy.sourceforge.net/ and http://udk.openoffice.org/python/python-bridge.html.

The basic code is the proof that we can implement a rigorous protocol like that of Swarm (http://www.swarm.org) with a simple coding system, consistently with the goals exposed in the premise. On the web site a complex application, with an AI experiment about the world of artificial Chameleons, may also be found. The Interbank Actual Payment System application is currently under development and can be requested to the author as a code under development.

References

1. Gilbert N., Terna P.: How to build and use agent-based models in social science. Mind & Society, 1 (2000) 57-72.