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APPROACHING SIMULATION TO MODELERS: A USER INTERFACE FOR LARGE-SCALE DEMOGRAPHIC SIMULATION

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ABSTRACT

Agent-based modeling is one of the promising modeling tools that can be used in the study of population dynamics. Two of the main obstacles hindering the use of agent-based simulation in practice are its scalability when the analysis requires large-scale models as in policy research, and its ease-of-use especially for users with no programming experience. While there has been a significant work on the scalability issue, ease-of-use aspect has not been addressed in the same intensity. This poster presents a graphical user interface designed for a simulation tool which allows modelers with no programming background to specify agent-based demographic models and run them on parallel environments. The interface eases the definition of models to describe individual and group dynamics processes with both qualitative and quantitative data. The main advantage is to allow users to transparently run the models on high performance computing infrastructures.

1 INTRODUCTION

Agent-based modeling (ABM) is a useful approach to deep on the understanding of population dynamics through simulation. The main reason is that the object of study in these disciplines, human society present or past, is difficult to analyze through classical analytical techniques due to the unpredictable and changing (dynamic) nature. ABM has already been applied to demographic simulation at a small scenario scale (Billari, Ongaro, and Prskawetz, 2003). However, complex policy models that include biological factors (such as health-related factors), cognitive factors (such as learning) or social factors (such as social network) may require a significant amount of computing power. Parallel simulation techniques might pay an important role in the future of social simulation, supporting the management of large simulations.

To approach agent-based techniques to modelers interested in population projections, we developed a tool (called Yades) which simulates the demographic evolution and interactions of individuals in a society (Onggo 2008). It provides the placeholders for different demographic processes such as fertility, mortality, change in economic status, change in marital status, and migration with two different type of agents: family unit and regions. Yades has three components: a web user interface, a demographic

simulation library and the simulation code generator. The web user interface is designed so that modelers can build their demographic ABMs for a set of group dynamics processes. The simulation code generator can produce the corresponding C++ code that is linked to the demographic simulation library which uses a scalable parallel discrete-event simulation engine. The generated code is ready for compilation using a target C++ compiler. The overall framework is shown in Figure 1.

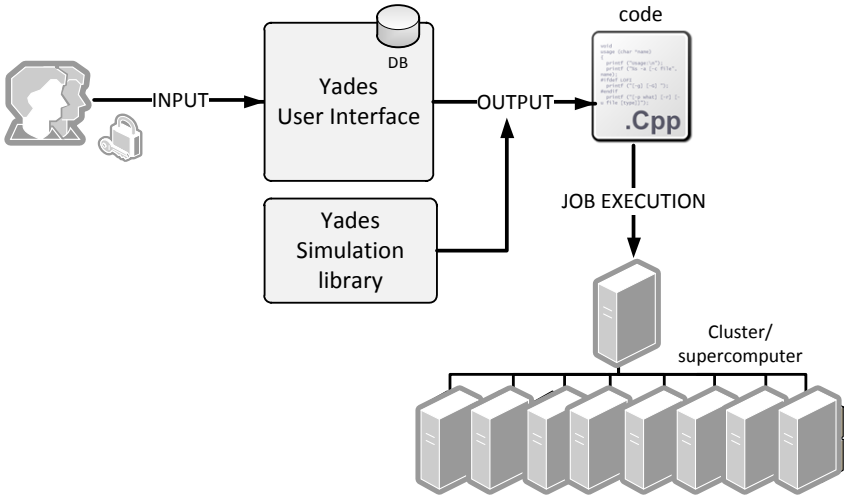

Figure 1: Yades modeling and simulation framework

We present the design of the web interface, which is accessible at http://yades.fib.upc.edu. We have followed a participatory design with the anthropologist who co-authors this paper. As a result, the interface provides four types of interfaces to allow modelers specify the behavior of individuals: state-transition diagram, multiple regression, logic rules, and standard theoretical distributions. The development of a graphical user interface is useful for social scientists and modelers to exploit the potential power offered by parallel computers transparently, especially because most of them are not familiar with programming and parallel computer environment.

We believe the two of the main issues in the wider adoption of parallel simulation are scalability and ease-of-use. This tool tackles the scalability problem in large scale and complex agent-based models by running the models on top of a parallel discrete-event simulation engine (Onggo, Montañola-Sales, and Casanovas-Garcia 2010). The ease-of-use issue is tackled by providing an interface that allows modelers to describe personal behavior, such as fertility and change in marital status. We believe that this will allow users to concentrate on understanding the modeling process rather than in the simulation library it is being used. We believe this will help to remove a major barrier on using simulation although we are aware technical knowledge is necessary to execute scenarios in High Performance Computing facilities.

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