

Agent Based Modelling for Social Research

Introduction

Hello, and welcome wherever you are. I am here Jakub Bijack, a professor of statistical demography at the University of Southampton. And it's my great pleasure to introduce the online materials for a short course Agent Based Modelling for Social Research.

In this course, our research team would like to share a novel approach from building, validating and analysing agent based simulation models, which were developed as a part of a four year programme based on agent based population studies funded by the European Research Council. In this course, we focus on applications in social sciences, but the approach is interdisciplinary and involves five different ingredients.

The first obvious one is an agent based model, a computer simulation of processes involving what we call agents. And these agents are conscious beings who are capable of making decisions, taking actions and interacting with one another and with the environment. These agents can be people, but also groups or institutions.

The second ingredient is a programming language and environment. Some modellers prefer using general purpose languages, which are more flexible, but require more experience with programming. Others such as using domain specific languages, which have simple syntax, but are largely limited to applications in a specific domain. In this course, we'll discuss the pros and cons of both approaches, and also examine the best practice in documenting the model construction.

The third ingredient involves data. In social applications, the data is inevitably patchy and it will come in many guises. Qualitative, quantitative micro, macro describing processes are contextual and so. It is a truism to say that the modeller needs to know what the data actually measure. Besides, as we discussed further in the course, we need to examine the different quality aspects of the data to know the limits.

The fourth ingredient is linked to decisions. If the agent's behaviour is to be realistic, their decisions need to be plausible. Here we show how advances in cognitive and experimental psychology can help us build models, which are more closely aligned to actual human behaviour.

The final fifth ingredient is an analytical framework to put everything together. In this course, we demonstrate methods of Bayesian statistics and especially the so called uncertainty quantification, to analyse and calibrate agent based models. This approach also helps bring all the other ingredients together. The basic idea is to build a statistical model of the agent based model or simulation, which

is called an emulator or a meta model, and to analyse his properties. Here we show a few examples of how to do it in practice.

So welcome to this course. I hope you'll enjoy it and I also hope you'll find the content inspiring for your own work on agent based models of social reality.