Calibration and State Estimation of an Agent-Based Model using a Probabilistic Framework *

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Abstract

XX ABSTRACT
XX KEYWORDS

Contents

1 Introduction

- Aim: Experiment with probabilistic modelling and probabilistic programming as a means of performing state estimation and data assimilation on a agent-based model.

- Method:
  - Illustrate the data assimilation algorithm on a simple system (i.e. simple model).
  - Apply the framework to an ABM with decreasing amounts of information about the truth:
    * Full information about all agents (with a bit of noise)
    * Information about only some agents (i.e. we're tracking a few individuals)
    * Only aggregate information

2 Background

2.1 Data Assimilation and Probabilistic Programming

How this work fits in to the wider data assimilation schema (is it 'nudging'? and how it compares to traditional data assimilation. Basically a brief literature review.

Outline what probabilistic programming is, and what Keanu is.

2.2 An Example Agent-Based Model: *StationSim*

Briefly outline station sim to show that it has some of the normal characteristics of an ABM.

2.3 A Framework for Data Assimilation

Explain the basic framework here, e.g. number of iterations, number of windows, calculating the posterior for the state, etc. We apply the same framework to the simple model and station sim.

3 Probabilistic Data Assimilation with a Trivial Model

Outline the Simple Model (just the for loop), show how the state is represented probabilistically, and then show how Keanu can be used to do state estimation / data assimilation (*which of these terms is correct? we need to be careful to use precise language!*).

4 Probabilistic Data Assimilation with StationSim

4.1 Full Knowledge of the System

Experiments when the probabilistic model has full knowledge of the system

4.2 Partial Knowledge of Some Agents

Experiments when we only give the probabilistic model access to partial information in the state vector (i.e. only a few agents)

4.3   Aggregate Knowledge of the System

Experiments when the probabilistic model only has information about the density in some different parts of the system

5   Conclusions

Just to test referencing: (Epstein and Axtell, 1996)

References

Epstein, J. and R. Axtell (1996). *Growing Artificial Societies: Social Science from the Bottom Up.* Brookings Institution Press.