State Estimation and Data Assimilation for an Agent-Based Model using a Probabilistic Framework *

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Abstract. XXXXX NICK TO WRITE ABSTRACT

Keywords: Agent-based modelling · Probabilistic programming · Uncertainty · Data assimilation · State estimation · Bayesian inference

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1 Introduction and Objectives

- Aim: Experiment with probabilistic modelling and probabilistic programming as a means of performing state estimation and data assimilation on a agent-based model.
- Method: Apply the framework to an ABM with decreasing amounts of information about the truth:
  1. Full information about all agents (with a bit of noise)
  2. Information about only some agents (i.e. we're tracking a few individuals)
  3. Only aggregate information (This will be future work).

Luke is this realistic by Feb 22?

Note that this is not calibration - it's state estimation through data assimilation

2 Background

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

Outline what probabilistic programming is, and what Keanu is.

3 An Example Agent-Based Model: *StationSim*

NM: Briefly outline station sim to show that it has some of the normal characteristics of an ABM (one paragraph).

4 Data Assimilation Framework

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.

5 Results

5.1 Full Knowledge of the System

Experiments when the probabilistic model has full knowledge of the system

5.2 Knowledge of Only Some Agents

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

6 Conclusions

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Link to ABMUS Workshop Themes

This paper contributes to the challenge set out in the workshop theme by developing methods that support "trusted models that can be used by industry and governments to enhance decision-making, and that can incorporate real (and real-time) data sets in a meaningful way". Without a reliable means of incorporating real-time data into urban models, their use in forecasting will always be limited to providing likely outcomes based on historical data.

(This is just to make the referencing work initially - can be deleted later [1]).

References

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