**Automating Agent-Based Model Construction using IRL**

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**Abstract**

**Agent Based Modeling (ABM)**

ABM… how system level properties emerge from the adaptive behavior of agents (Railsback 2001) as well as how the system affects individuals.

**Agent Based Model (ABM) Construction Method**

1. Run Inverse Reinforcement Learning (IRL) algorithm to extract agents’ behavioral policies (rewards functions behind their behavior) from a dataset.
2. With a Machine Learning (ML) clustering algorithm, classify the behavioral policies. Alternatively, feature expectations of agents’ behaviors are classified first, and then IRL can be run to obtain classified behavioral policies.
3. Construct ABM with the learned behavioral policies.
4. Incorporate any analysis measures and intervention ideas into the model.

**Synthetic Data**

Using NetLogo, 20 sets of data have been generated for 700 people’s behaviors with regard to conversation and movement. Basically, 700 people are located in a public space, and they talk with others and move continuously. They are distinguished by their innate characteristic with 2 levels. This characteristic can be considered as ethnicity (Black/White), religion (Hindu/Muslim), or any other traits with 2 levels. There are 3 types of people and each person can take one of 4 actions at a time.

* kinds of people: unbiased people, biased people, racists
* possible actions:

1. start a conversation with a nearby person
2. continue a conversation for another tick
3. move short distance with random direction
4. move long distance with random direction

Time in this data is discretized in ticks (time scale in NetLogo). A proximity radius is defined to identify nearby people and distance. Short distance is defined as a length slightly less than the proximity radius and long distance as a length slightly more than the radius.

The three types of people have their own behavioral patterns as follows:

* Unbiased people: Speak to anyone for random duration (2 – 5 ticks), Move either short or long distance randomly
* Biased people: Speak to people with same characteristic for 5 ticks and people with different characteristic for 2 ticks, Move short distance after meeting with a same character and long distance after meeting with a different character.
* Racists: Speak for 1 tick with a same character and 5 ticks with a different character, Move short distance always.

REFERENCES

Railsback, S.F., 2001. Concepts from complex adaptive systems as a framework for individual-based modelling. Ecol. Model. 139, 47–62.