

## SYS 6582 Reinforcement Learning (Spring 2017)

### Project Proposal

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#### Objectives:

Our objectives are twofold: an increased understanding of Inverse Reinforcement Learning (IRL) and verification of understanding by application of IRL to Agent Based Model construction.

#### Motivation:

The critical observation of Agent-Based Modeling (ABM) is that simple rules for individuals can result in interesting emergent behavior at the aggregate level. The problem is that we first need these simple rules to build an ABM, which often requires deep insight about an agent's behaviors. If we can extract the behavioral rules (i.e., reward functions) of individuals from data by Inverse Reinforcement Learning (IRL), it could be a meaningful contribution to automation of ABM construction, which is one of the current hot topics in ABM research.

#### Project Detail:

The result of this project will seek to simulate human segregation behavior with ABM. The rules of each individual agent will be extracted from synthetic data using IRL algorithm then classified by their reward functions. We expect that the extracted and classified reward functions can provide a newly constructed ABM with rich but concise rules for agents. Rules which are often hard to get from observation alone. The steps of this project then are as follows:

- 1) Data - generate synthetic data of segregation model with heterogeneous agents
- 2) IRL - learn rewards functions (weights of features) from observed trajectories
- 3) ML - classify observed agents by rewards functions
- 4) ABM - present aggregated behavior of heterogeneous agents with learned policy

#### Academic Rigor:

The current “state-of-the-art” in IRL research combines ideas from fields such as Reinforcement Learning, Dynamic Programming, Linear Programming and Quadratic Programming. Therefore, in order to successfully use IRL algorithms for new problems, an understanding of all these fields will be required to overcome unanticipated challenges between now and completion.

References:

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Nouri, E., Georgila, K., & Traum, D. R. (2012). A Cultural Decision-Making Model for Negotiation based on Inverse Reinforcement Learning. CogSci.