Final Project Proposal Guide

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Outline

- Problem Statement
- Agent Design Strategy
- Desired Emergent Behavior
- Hypotheses
- Experiments

Problem Statement

- What is the problem?
  - For example: I want to build a game where there are 4 wolves chasing a rabbit. (**No**)
  - For example: To understand how agents can form a team to effectively traverse a vast terrain in order to complete a joint task together. (**Yes**)
- Why is the problem important to solve?
  - Because it is interesting/cool (**No**)
  - Because it is challenging for agents to carry out effective teamwork given minimal communication and coordination due to scalability, time constraint, and incomplete information (**Yes**)
- Additional (but not required): What is missing from the state-of-the-art?

Agent Design Strategy

- How many types of agents?
- For each agent type
  - What does it sense (from the environment, including other agents)?
  - How does it reason or make decision?
  - What actions does it perform (that will change the environment)?
- For environment
  - Of the five key properties (incomplete, stochastic, dynamic, non-episodic, real-time) which ones are made available?
  - What are the designs to manifest those properties in the environment?
  - How do agents interact with the environment

Desired Emergent Behavior

- This is your understanding of the desired “stable” system-wide behavior after convergence
- This is not what the agents do derived directly after they each carry out their actions.
- This is what emerges AFTER agents interact with each other and with the environment through their actions
- For example: The wolves (predator agents) will trap the rabbit (prey agent) effectively.
  - Has to define what you mean by “effective"

Hypotheses

- A hypothesis should not be trivial
  - That is, a hypothesis' validity should not already be known prior to experiments and investigations
  - In your proposal, state why you think the hypothesis might or might not be validated
- A hypothesis should be specific enough for it to be tested
  - For example: When wolves communicate more, it is easier for them to trap the rabbit, given that all other factors remain the same. (**Yes**)
  - For example: When wolves communicate, they will trap the rabbit. (**So-so**)
  - For example: When wolves communicate, they will attempt to trap the rabbit. (**No**)
- Ideas for writing a hypothesis:
  - Think about your predicted outcome
  - And then think about factors that *might* prevent that outcome from becoming true

Experiments

- For each hypothesis, devise an experiment
- For each experiment
  - Consider the number of factors (and their values) that you will manipulate
  - How many possible combinations?
    - If there are three factors, each factor has three possible values, then there are 3x3 = 9 combinations.
  - How many runs?
    - If 100 simulation runs per combination, then 9x100 = 900 simulation runs
  - Make sure that it ties back to the hypothesis
    - For example: Communicate more → (1) baseline = no communication, (2) low comm = at most once every 3 ticks; (3) high comm = at most once every 2 ticks; (4) constant comm = once every tick
    - The above will allow you to plot graphs and observe trends/differences better