Adaptive Behavior and Objectives

EES 4760/5760

Agent-Based and Individual-Based Computational Modeling

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Getting Started

Getting Started

- Download the modified Business Investor model from the class web site, under “Objectives and Adaptations” on the Download page.
  - Modified Business Investor Model

    https://ees4760.jgilligan.org/models/class_12/business-investor.nlogo

Announcements

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- Homework assigned for Wednesday, October 1 is **optional**.
  - There will be no more required homework exercises from the textbook except the exercises for your team’s team project.
  - From here on, focus on working on your team project and individual project.

Sensing

Sensing

- Options for sensing:
  - Omnisicence: `max-one-of [ expected-utility ] patches`
  - Neighbors: `max-one-of [ expected-utility ] neighbors`
  - Limited radius: `max-one-of [expected-utility ] patches in-radius 5`
  - Social network: `max-one-of [ expected-utility ] [neighbors] of   out-link-neighbors`
- Context:
  - NetLogo has **four** types of entities:
    1. Patches
    2. Turtles
    3. Links
    4. The Observer

Social Networks and Links

- Links
  - Connect turtles
  - Directed (`create-link-from`, `create-link-to`) or undirected (`create-link-with`)
  - Can have properties (color, thickness, etc.)
- Using links:
  - `my-links`, `my-in-links`, `my-out-links` report agent-sets of **links** connected to a turtle
  - `link-neighbors`, `out-link-neighbors`, `in-link-neighbors` report agent-sets of **turtles** connected to a turtle.
  - **Lots** more you can do with links (read NetLogo dictionary)

Adaptation

Adaptation and Objectives

- Making decisions:
  - Perfect rationality:
    - Pick a goal (objective function)
    - List possible actions
    - Calculate how well each will satisfy goal
    - Choose action that will best accomplish goal
  - Imperfect rationality:
    - Goal may be unclear or inconsistent
    - May not list all possible actions
    - May not calculate results of actions
    - May not act on best option
- Real-life agents may not act rationally

Bounded Rationality

- Perfect rationality and chess …
  - Evaluating all possible moves may not be possible
    - Limited time, memory, computing power
  - Cost of rationality
    - Getting, processing information
    - It may be more rational to be slightly irrational

Satisficing

- Define goal (objective function)
- Define criteria for *good enough* result
- Evaluate possible actions until the first one that is *good enough*.
  - Do that action.

Business-Investor Satisficing

- The investor can’t see the utility of any other patches
- If the utility of the current patch is greater than a certain threshold, then it’s “**good enough**”
  - If the current patch isn’t good enough:
    - Move to a random empty patch
      - neighbor, in-radius, link neighbor, etc.

More on Objective Functions

- Decisions under uncertainty
  - If you are gambling, what would you try to do?
    - Take a chance to get a very big win?
    - Try to avoid losing money?
    - Balance wins and losses finish with the most money on average?
- Behavioral economics
  - Most economists say rational people will try to get the greatest *expected* wealth
  - Actual people may be…
    - *risk seeking* (take greater chances for big wins)
    - *risk averse* (avoid taking chances)
    - *loss averse* (focus on changes instead of absolute wealth)
    - *regret averse* (try to avoid the feeling that you wish you'd made a different choice)
- Different goals may lead to very different behavior
  - Policy-makers may want to test their policies under different assumptions about people's goals and behavior

Experimenting

Experimenting

- Modified Business Investor Model:
  - You can vary the profits and risks
  - You can vary the sensing:
    - Neighboring patches
    - Patches in a radius
    - Neighbors or patches in-radius of link neighbors
  - You can vary the objective and adaptation
    - Maximize expected utility
    - Satisficing

Download Previous Experiments

- You can download a ZIP file with results from some experiments from the downloads page: Behaviorspace Experiment Results:

  https://ees4760.jgilligan.org/models/class_12/business-investor-experiments.zip