Exploring Modeling Within the Iterated Prisoners Dilemma

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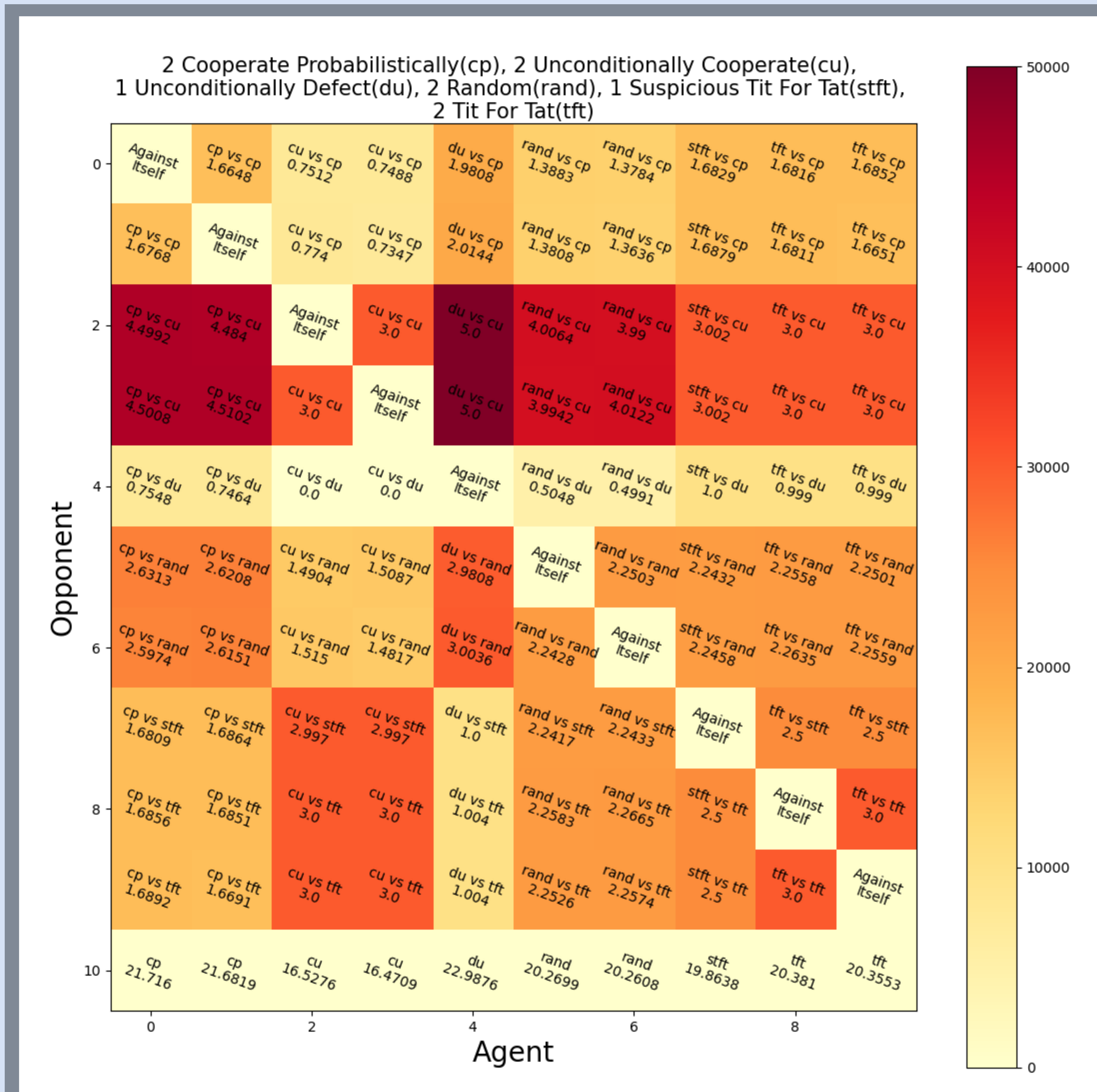
Check out the code:
(github.com/sebastianwied/GameTheory)



What is the Iterated Prisoners Dilemma?

The Prisoners Dilemma is a classic mathematical ‘game’ in the field of Game Theory, in which two perfectly rational ‘agents’ interact with each other, without communication and under a predefined set of rules, receiving points based on the combination of their moves.

The Iterated Prisoners Dilemma arose through a project at the University of Michigan run by Dr. Robert Axelrod, in which he conducted a round robin tournament between submitted strategies and tracked their behavior after matches in which 200 interactions take place. Tit for Tat, one of the simplest strategies submitted, won both tournaments Dr. Axelrod ran.

See the Stanford Encyclopedia of Philosophy’s entry, my main reference:
https://plato.stanford.edu/entries/prisoner-dilemma/

What’s Happening Here?

What you are seeing here are the results of an Iterated Prisoners Dilemma tournament. Each cell is a matchup between two agents, with a number below indicating their score against their opponent. A higher score indicates more ‘value’ generated in this interaction. This graph is somewhat anti-symmetric across the diagonal, representing the opposing values gained by the two strategies from this interaction. If a certain cell gained lots of value, its corresponding diagonal cell will have gained very little value.

What is This Research?

This project arose through conversations with my philosophy of math professor Tim Doyle as a way for me to explore my interest in computer simulations and math through a fascinating, incredibly deep framework.

Rather than identifying a problem and working towards an explanation or deeper understanding, this research is rooted in a technical idea—exploring the iterated prisoners dilemma as a tool for simulating systems. Right now, I am exploring how the iterated prisoners dilemma responds to changes in the mechanics of the tournament.

Once we have a tournament that exhibits interesting behavior, we will look for a problem to apply it to. However, this is not the primary goal right now — the primary goal is for me to explore the field of evolutionary game theory.

What’s Next?

Before any problem to model is identified, I plan to explore the following mechanical changes:

- Geographic structures
  - How does the shape of the world change the dynamics? A simple grid, a torus, a sphere? How about a social network?
- Strategy Evolution
  - Do individual agents change their strategy in response to whats happening around them? How do they decide to change their strategy?
- How does changing the payoff matrix (the amount of points you get) change the dynamics?
  - Where does cooperation win? Where does competition win?
- How do all of these interplay together? What combinations yield interesting emergent behavior?