GameNetViz

1  2
40,80 80,40
80,40 40,80

Probability

1  2

Jason Hartford
Neil Newman
CPSC547
What?

Behavioural Game Theory aims to predict the behaviour of **people** as they interact strategically.

<table>
<thead>
<tr>
<th></th>
<th>Neil</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Up</td>
<td>10, 15</td>
<td>0, 19</td>
</tr>
<tr>
<td>Down</td>
<td>15, 5</td>
<td>14, 3</td>
</tr>
</tbody>
</table>

Jason
How might you reason about this game?

This is known as the “Max max payoff” feature.
Assume Neil plays right or left with some probability
Respond by choosing the action that makes you best off, given your assumption.
But Neil may think of that and change his action...

Neil

Left

Right

Prob of Action

0.0

1.0

Jason

Up

14, 15

0, 19

Down

3, 5

10, 3

Prob of Action

1.0

0.0
Abstractly...

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![Graph showing probability of action](image-url)
Data

Experimental Data

Data from 9 behavioural economics experiments on human subjects

128 unique games with 12 071 plays

Model Data

Set of numbers that parameterise the model

Output at each intermediate stage of computation.
Model...

- Many parameters
- Difficult to visualise intermediate computation
- Difficult to identify design flaws / poor optimization fits
Our Solution
GameNetViz

Computation Direction

Player 1 Actions
1 2 3

Player 2 Actions
1 2 3

max max payoff
max min payoff
max efficiency
min unfairness
min max regret
Common Colours

- The same colour corresponds to the same action throughout the viz
Payoff Matrix Viz

- Allows for quick summary of a game
- Very easy to spot mismatched payoffs

- Detailed information, for when subtle differences matter
Hand-crafted Features

- From previous work, we know about features that players seem to like
- When hovering over a hand-crafted feature, the row(s) corresponding to that feature light up
- In this image, player 1 can achieve the highest payoff by picking action 4 (if player 2 picks action 2)
- Non-hovered features are grayed out, to avoid distraction
Features

- Each feature outputs a different probability distribution of playing each action
- Clicking on the stacked bar charts splits them into grouped bar charts, so that you can compare an action’s distribution across different features
Action Response Layers

Tool tip

- AR layers are weighted sums of the feature units, as well as previous AR layers
- Hovering over an AR unit produces a tool-tip showing a breakdown of how it is composed, before the non-linearity is applied.
- The sharpness parameter of the non-linearity function for that AR layer is also displayed
Level distribution

- The output is a weighted sum of all the AR units. The weight associated with each AR is encoded as a bar above the AR.
Output vs Actual Play

- Compare the model’s predicted distribution of play against observed play (from experiments with human players)
Game Selector

- Games can be ordered by size, or by a derived difference between the model’s prediction and observed play
- Choosing a game from the selector will render data for that game
DEMO
Critique & Future Work

- The blob payoff matrix encoding is invariant to scaling, so two scaled games look the same. But humans have a non-linear response to payoffs, and maybe we can find an encoding that matches this.
- Hidden layer encoding not offering any insights, could be better
- Handle larger games (e.g. 100 x 100)
- Show even more data! (Parameters, optimization)
Applause