Exploiting Evolutionary Modeling to Prevail in Iterated Prisoner’s Dilemma Tournaments

Marco Gaudesi, Elio Piccolo
Alberto Tonda, Giovanni Squillero
## Iterated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th>Player B</th>
<th>Defection</th>
<th>Cooperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defection</td>
<td>(P: 1, P: 1)</td>
<td>(T: 5, S: 0)</td>
</tr>
<tr>
<td>Cooperation</td>
<td>(S: 0, T: 5)</td>
<td>(R: 3, R: 3)</td>
</tr>
</tbody>
</table>
“A problem of indisputable difficulty in its field”
“A problem of indisputable difficulty in its field”
Proposed Approach

TAGES
Proposed Approach
Evolutionary Algorithm
Brute force approach (try all possibilities)
Etruscan Mythology

- Laran (2011)
  - First prototype based on FSM
- Turan (2014)
  - First prototype based on ND-FSM
- Tages (2016)

What if the opponent is not an FSM?
Etruscan Mythology

- **Turan**: Only strong players can be good models

The player behaves differently from the real opponent

The player is a loser
Etruscan Mythology

- **Turan**: Only strong players can be good models
- **Laran**: Models don’t need to be exact to be useful
Etruscan Mythology

- **Turan:** Only strong players can be good models
- **Laran:** Models don’t need to be exact to be useful
- **Laran:** Lose a match, win the tournament
average over 100,000 random tournaments for each tournament size

40 opponents (all the usual suspects + others)
Why we deserve the prize?

Tages victories in tournaments of different sizes

Tages overcomes both human-written and evolved opponents in tournaments

average over 100,000 random tournaments for each tournament size

40 opponents (all the usual suspects + others)
Why we deserve the prize?

Tages victories in tournaments of different sizes

Tages is intelligent (it foresees opponent’s moves and behaves accordingly)

average over 100,000 random tournaments for each tournament size

40 opponents (all the usual suspects + others)
Thanks

- HPC@POLITO (computational resources)
- Andrea Mussano (Laran)
- Denny De Vito (presentation)
- Arnold Schwarzenegger (presentation)