Sandia National Laboratories

Jack Czyz, Brian Fernando, Jason Fitzsimons, Daniel Lawson, Aarya Patel, Grant McCord, Kyle Kraft

Analytically Extrapolating Strategies of Opponents from Play-data (AESOP)

What Is Sandia

- Sandia National Laboratories is the engineering arm of the nation's nuclear weapons enterprise working to ensure the reliability, safety, and security of the nuclear arsenal. Sandia also seeks to better understand what makes strategic deterrence effective.
- Strategic Interaction Game between Nuclear Armed Lands (SIGNAL) is an experimental wargame developed to be a part of the Project on Nuclear Gaming (PoNG).

Project Background

This year, our goal was to build a toolkit for Sandia to analyze data generated from experimental wargames, building off last year's work of:

1) Developing metrics for assessing strategic and
2) Methods for correlation play data to known behavioral models.

Experimental wargames are games that are built to collect data on strategic interaction and help Sandia study conflict escalation and the effects of new weapons and technologies.

The project works with both simulated data from games, and Sandia's data from the SIGNAL experimental wargame.

Project Methodology

1. Creating Web Server to serve as interface for toolkit

- Incorporating previous work, centered around chess for assessing strategy
- Need for a centralized metric processing pipeline, general data model.
- Create a way to selectively view and generate metrics from a central interface.

2. Develop strategic game for generating data

- Creating Python-based game, Risk World, that would allow for the collection of human and AI generated data.
- Provides data to test both analytic methods, and web server.

3. Continue to develop tools for analyzing play data

- Develop methods for clustering players using strategic metrics.

Results

1. Web Server

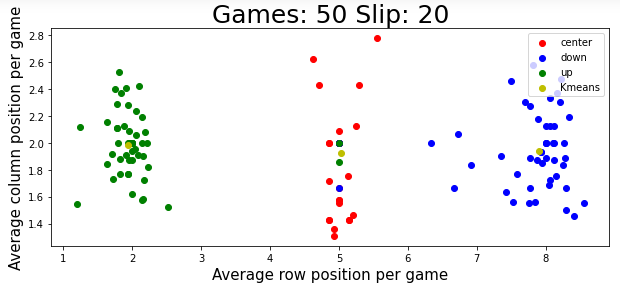
- Developed a Flask backend for the processing of metrics across many games.
- A user interface for the consumption of metrics and the upload of new data.
- MongoDB persists data and already calculated metrics.

2. Risk World

- Designed a 3x3 game to generate data for strategy analysis.
- Created multiple bots to play game with varying strategies.

3. Clustering

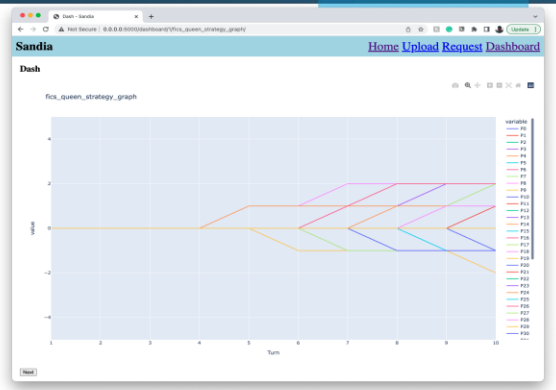
- Used K-means and DBSCAN clustering on GridWorld to study effects of noise on recognizing behavior.



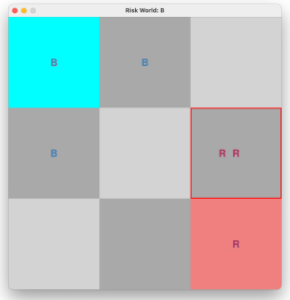
Above: **Clustering** movement trajectories from GridWorld data generated from three policies with different navigation strategies.

Future Goals

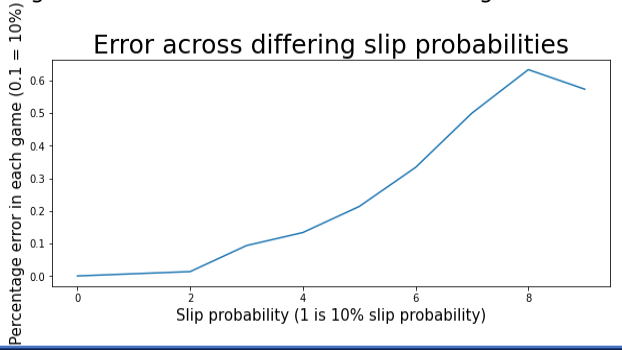
- By the end of this semester, we aim to combine work from all three tasks, integrating analytical tools, and data from Risk World and SIGNAL.
- Next year, we aim to further develop the capabilities of the toolkit and demonstrate its ability to analyze data from any experimental wargame.



Above: Screenshot from **web server**.



Left: An image from playing the **RiskWorld** game.
Right: The start screen for the **RiskWorld** game.



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