

Overview

This data set should be viewed in context with the comparison of algorithms described in Table 1 (additional details can be found in Supplementary Note 3) of the following paper:

J. W. Crandall, M. Oudah, Tennom, F. Ishowo-Oloko, S. Abdallah, J. F. Bonnefon, M. Cebrian, A. Shariff, M. A. Goodrich, and I. Rahwan, Cooperating with Machines, *Nature Communications*, Vol. 9, Article No. 233, 2018

Note that these logs are from a distinct run of the simulation from the one used to produce the summarized results in the paper, though they contain logs for the same pairings of algorithms (from the same code) in the same games. Thus, there are likely to be small differences in these results and those presented in that paper due to the stochastic behaviors of some of the algorithms. In the interest of space, this data set contains only results for 1000-round games (instead of up to the 50,000-round games reported in the paper).

Should you find any issues with the data set, please contact Jacob Crandall at crandall@cs.byu.edu.

Files Included

1. *ActionLog.zip*: contains a log of 1000-round repeated games for each tuple (game, computer_agent1, computer agent2).
2. *Games.zip*: contains the description of each matrix games in the set of games included in these simulations

Interpreting the log files

Each repeated game played between two algorithms is logged in a .csv file that can be viewed inside the folder ActionLog (once ActionLog.zip is extracted). The filename of each log file specifies the matrix game being played and the two algorithms playing the repeated game. The filename of the logged results is specified as follows:

[gamename]_[agent1]_[agent2]_0.csv

where [gamename] is the filename of the game described in the supplied “games” folder, and [agent1] and [agent2] are one of 25 algorithms. As an example, the log file “cg_pow2_1_br1_br2_0.csv” logs the results of the interaction between the algorithm named “br1” (player 0, the row player) and the algorithm named “br2” (player 1, the column player) in the game “cg_pow2_1.txt”.

Each .csv file contains a header row and then a sequence of 1000 rows, one corresponding to each round of the 1000 rounds of the repeated game. The first column (a0) specifies the action played by player 0 in the round, the second column (a1) species the action of player 1 in the

round, the third column (p0) specifies the payoff received by player 0 in the round, and the fourth column (p1) specifies payoff received by player 1 in the round.

Game Files

The matrix games are given in the “games” folder (once “games.zip” is extracted). The first three lines of the each file specify the number of players in the game, the number of actions available to player 0, and the number of actions available to player 1, respectively. For these games, all of these values are 2, since the games are two-player, two-action matrix games.

The fourth line in the game file specifies the payoffs obtained by the players when player 0 plays action 0 and player 1 plays action 0, with the payoff to player 0 listed first, and the payoff to player 1 listed second. The fifth line of the file specifies the payoffs obtained by the players when player 0 plays action 1 and player 1 plays action 0, the sixth line gives the payoffs obtained by the players when player 0 plays action 0 and player 1 plays action 1, and the seventh line specifies the payoffs obtained by the players when both players play action 1.

As an example, the game “cg_pow2_1.txt” has the following text:

```
2
2
2
1.000000  1.000000
0.000000  0.200000
0.200000  0.533333
0.533333  0.000000
```

which specifies the following bi-matrix game:

| | | Player 1 (Col) | |
|----------------|----------|----------------|------------|
| | | Action 0 | Action 1 |
| Player 0 (Row) | Action 0 | 1.00, 1.00 | 0.00, 0.20 |
| | Action 1 | 0.20, 0.53 | 0.53, 0.00 |

where the payoffs to the row player (player 0) are given first in each cell, followed by the payoff to the column player (player 1).

Algorithms

The data set contains games played by 25 different algorithms in total, the same set of algorithms listed in Table 1 of the paper “Cooperating with Machines” cited at the beginning of this document. Descriptions of each of these algorithms can be found in Supplementary Note 3 of

that paper. The below table equates the codes used to the name the algorithms in the code/ filenames to the naming of the algorithms in Table 1 of the paper.

| Algorithm name in paper | Algorithm name in code |
|-------------------------|------------------------|
| S++ | S++ |
| Manipulator | manipulator-bully |
| Bully | bully |
| S++/simple | S_simp |
| S | S |
| Fict. play | fp |
| MBRL-1 | br1 |
| EEE | eeew |
| MBRL-2 | br2 |
| Mem-1 | memory1 |
| M-Qubed | mqubed |
| Mem-2 | memory2 |
| Manip-Gf | manipulator-gf |
| WoLF-PHC | wolf |
| QL | qlearn |
| gTFT | godfather |
| EEE/simple | eeew_simp |
| Exp3 | exp3w |
| CJAL | cjal |
| WSLS | pavlov |
| GIGA-WoLF | gigawolf |
| WMA | wma |
| Stoch. FP | sfp |
| Exp3/simple | exp3w_simp |
| Random | random |