An open reproducible framework for the study of the iterated prisoner's dilemma

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1 Introduction

As stated in [4]: "*few works in social science have had the general impact of [Axelrod's study of the evolution of cooperation]*". In 1980, Axelrod wrote two papers: [1, 2] which described a computer tournament that has been at the origin of a majority of game theoretic work [3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22]. As described in [**Bendor2015**] this work has not only had mathematical impact but has also led to insights in biology (for example in [21], a real tournament where Blu Jays are the participants is described) and in particular to the study of evolution.

The tournament is based on an iterated game (see [16] or similar for details) where two players repeatedly play the normal form game of (1) in full knowledge of each others playing history to date. An excellent description of the *one shot* game is given in [10] which is paraphrased below:

Two players must choose between *Cooperate* (C) and *Defect* (D):

- If both choose C, they receive a payoff of R (**R**eward);
- If both choose D, they receive a payoff of P (**P**punishment);
- If one chooses C and the other D, the defector receives a payoff of T (**T**emptation) and the cooperator a payoff of S (**S**ucker).

$$\begin{pmatrix} R, R & S, T \\ S, S & P, P \end{pmatrix} \quad \text{such that } T > R > P > S \text{ and } 2R > T + S \tag{1}$$

The game of (1) is called the Prisoner's Dilemma. Numerical values of $(R, S, T, P) = (3, 0, 5, 1)$ are often used in the literature. Axelrod's tournaments (and further implementations of these) are sometimes referred to as Iterated Prisoner's Dilemma tournaments, an overview of published tournaments is given in Table 1.

Year	Reference	Number of Strategies	Type	Source Code
1979	[1]	13	Standard	Not immediately available
1979	[2]	64	Standard	Not immediately available
1991	[4]	13	Noisy	Not immediately available
2002	[21]	16	Wildlife	Not applicable

Table 1: An overview of published tournaments

- Review of the tournament itself; Original paper by Axelrod and Hamilton [**1981-Axelrod-Hamilton**]. Some recent discussion of memory one strategies [**press2012iterated**, **stewart2012extortion**].

- Discussion about open reproducible science (there are some reference around) (Python, git, github etc. . .)
- Overview of the library (what it can do, what has been done with it)
- Point at Sections 2 and 3.

2 Reproducing previous tournaments

3 New strategies, tournaments and implications

4 Conclusion

References

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