JEDy: A Julia package for Evolutionary Dynamics

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Objectives

The objectives of this advanced project are to:

- Become familiar with standard methods for studying evolutionary dynamics computationally and analytically
- Become familiar with the Julia [1] language and its use in scientific computing
- Replicate the results of some seminal papers in the field of evolutionary dynamics using Julia
- Kickstart the development of an open-source package for studying evolutionary dynamics using Julia

Progress

So far I have been familiarising myself with the Julia language by attempting to replicate part of the results of a paper [2] which studies the iterated prisoners dilemma. In the paper, the authors use both a deterministic model of evolutionary dynamics (the replicatior-mutator equation) and a stochastic model (the Moran process) to determine the dynamics of the system. I have been focussing on the stochastic model.

I have succeeded in reproducing the behavior that is shown in the aforementioned paper for identical values of the parameters. The code that I have developed should be able to handle matrix games of arbitrary rank (ie. not just the Prisoner's Dilemma), however I have as yet been unable to test this functionality. In addition to simulating the Moran process, I have also written code to determine the transition matrix of the game between various states, and as such I am able to calculate fixation probabilites and stationary distributions for arbitrary simple matrix games.

References

[1] Jeff Bezanson, Stefan Karpinski, Viral B. Shah, Alan Edelman, *Julia: A Fast Dynamic Language for Technical Computing*. eprint arXiv:1209.5145, September 2012.

[2] Lorens A. Imhof, Drew Fudenberg, Martin A. Nowak and Robert M. May, *Evolutionary Cycles of Cooperation and Defection*. PNAS, Vol. 102, No. 31, 2005.