Evolutionary Game Theory

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Here is our super nice abstract with the solution which will bring peace to the world

Explanation of problem

why is it important to such things modelling of nature for forecasting, understanding, estimating get old paradigm of the behaviour in HD right - paradigm shift to the new paradigm that HD players could act in a way not known until now

super important for theoretical ecology

$$A = \begin{bmatrix} A_{11} & A_{21} \\ A_{21} & A_{22} \end{bmatrix} \tag{1}$$

Looking at evolutionary game structures, the pay-off is crucial to determine each players fitness and the fitness of a whole group.

Spatial structure added to the game results in a population, where its individuals occupy patches on a spatial lattice (here two dimensional). Each tick (update) will be done by letting individuals play against their nearest neighbours. The resulting pay-offs will be used to decide upon the focal patch's future occupant. It could be an offspring of the last occupant resisting the invasion or from a neighbour spreading its strategy. The lattice is updated and the evolutionary process takes place with every update.

Prisoners Dilemma

Explanation of PD in general: The cooperators get exploited by defectors, subsequently defectors are naturally selected. The cost to the donor of fitness(pay-off?) is always higher than zero, but generally lower the benefit to the receiver of the pay-off (b ¿ c ¿ 0). The defectors pay-off is the highest pay-off b if the other player is cooperating. The lowest pay-off, namely only the cost, has then (-c) the cooperator which is defected in the unilateral cooperation. Finally it is best to defect regardless of other players decision. Mutual defections result then in pay-off zero for both players, not reducing the fitness but also not increasing it (see 1). Here, the defector strategy is the ESS.

Table 1: *Prisoner's Dilemma*

	C	D
Payoff to C	$b-c$	$-c$
Payoff to D	b	0

Spatial PD: Spatial structure in Prisoners Dilemma is a potent promoter of cooperation. Cooperators stay on forming large compact clusters thus reducing the exploitation by defectors.

Snowdrift game

In general:
At the snowdrift game we have the difference to Prisoners Dilemma. The players can share the benefit

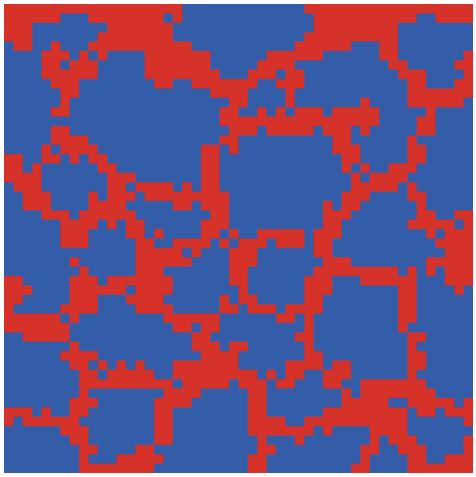

Figure 1
Clustering

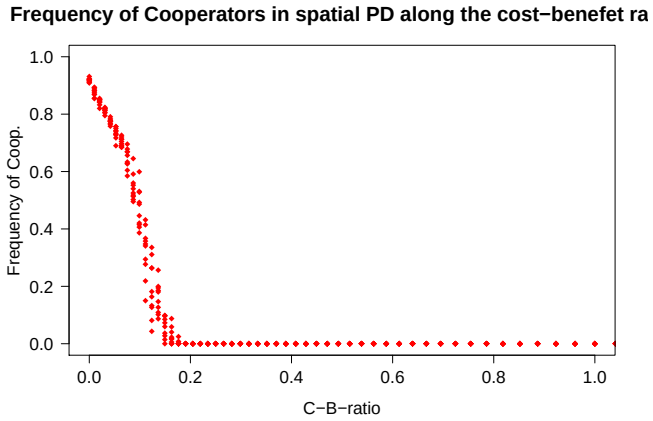

Figure 2
Frequency of cooperators against c-b-ratio

and the cost, depending on their strategies. Another feature in this game is, that if one defects, the pay-off could be less than the sucker's pay-off of the unilateral cooperator. Still defecting if the other player cooperates is, according to the matrix, the best response choice. As one can see in table 2, the pay-off matrix is slightly different than the one of Prisoners Dilemma in table 1. If $2b > c > b > 0$, meaning that if costs are high, these pay-off structures change the game to a PD and affect the reverse pay-off structure. If $b > c > 0$, the best action depends on co-players action resulting in a mixed strategy population, where rare strategies can invade, either defector or cooperator with an ESS at cooperator proportion is $1 - c/(2b - c)$.

Spatial structure in snowdrift: In comparison to the spatial structure of the Prisoner's Dilemma's resulting cooperation lattice, the cooperators form only small filament-like clusters in the snowdrift game. The defectors have via the isolated cooperators struc-

Table 2: *Snowdrift game*

	C	D
Payoff to C	$b - c/2$	$b - c$
Payoff to D	b	0

ture the advantage to exploit fitness and break in those fragile clusters.

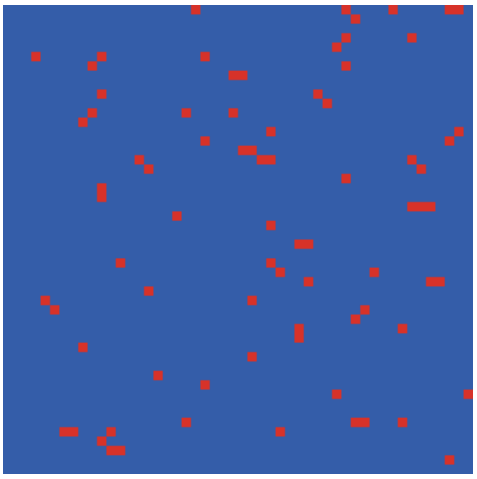

Figure 3
Clustering

task 1

First explanation of spatial modelling structure

Last explanation of experiments

task 2

different plots like in the paper from hauert with the frequency of coop against cb ratio explanation of differences explanation of HD special case

task 3

discussion

maybe discuss difference to the hauert paper? differ our results with their results?

where can we give in more time, where are options to prolong this topic? relation to nature, where is the importance here ?

bibiography: this paper should be enough though :D

References