Influence of Reputation on Resistance against Bad Agents in the Iterated Prisoner's Dilemma

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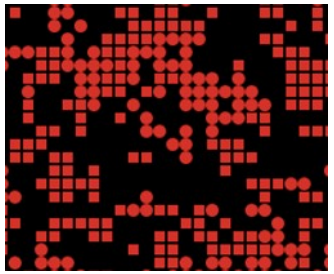
Introduction

	B cooperates	B defects
A cooperates	3 3	5 0
A defects	0 5	1 1

- In the prisoner's dilemma cooperation is better for the group, defection however is better for the individual
- Agents have no memory
- How does reputation influence the resistance to bad agents?



Spatial configuration

- Agents are spawned on a grid
- Each round agents will decide to cooperate or defect
- The result of the game impacts the chance to procreate

Reputation

- Agents can look up reputation of other agents
- The reputation of each agent is the percentage that agent cooperated
- Each agent can then decide to cooperate or defect

Bad agents

- Agents that always defect when opponent is not of the same group
- When groups are used ␣ bad agents cooperate with own group, defect with other groups
- When no groups are used ␣ bad agents never cooperate
- Three different configurations are used, in which the number of bad agents differs

Configuration	p_{bad}
k_0	0
k_1	0.05
k_2	0.10

Solo reputation

- Each agent has an own reputation, and a threshold for cooperation
- Expected is that reputation increases resistance and improves cooperation
- This is indeed the case in the configurations with bad agents: reputation makes for less bad agents and more cooperation

	pop	*bad*	*good*	*coop*
k_0	1765	0	1765	100.0%
k_0 rep	1760	0	1760	100.0%
δ	-0.3%	0.0%	-0.3%	0.0%
k_1	1753	22	1732	98.9%
k_1 rep	1757	8	1749	99.5%
δ	0.2%	-63.6%	1.0%	0.6%
k_2	1775	26	1749	98.5%
k_2 rep	1759	12	1747	99.2%
δ	-0.9%	-56.2%	-0.1%	0.8%

Group reputation

- The reputation is determined by the average reputation of a group, and each agent has a threshold for cooperation for each group
- Expected is that reputation increases resistance and improves cooperation
- The resistance to bad agents has improved by introducing reputation
- The cooperation with agents of other groups has improved, however the cooperation with agents of the same group has gone down

	pop	*bad*	*good*	$coop_s$	$coop_d$
k_0	1780	0	1780	100.0%	100.0%
k_0 rep	1781	0	1781	99.6%	97.9%
δ	0.1%	0.0%	0.1%	-0.4%	-2.1%
k_1	1707	1346	361	100.0%	28.0%
k_1 rep	1688	846	842	97.3%	43.4%
δ	-1.1%	-37.1%	133.3%	-2.7%	55.1%
k_2	1674	1445	229	100.0%	19.3%
k_2 rep	1686	1241	445	97.9%	25.1%
δ	0.7%	-14.2%	94.6%	-2.1%	30.2%

Results

- On average over all experiments the population and the cooperation percentage do not differ very much when using reputation
- There are a lot more good agents when reputation is used, and the population of bad agents decreases
- Therefore, using reputation improves the resistance to bad agents

δ *pop*	δ *bad*	δ *good*	δ *coop*
-1.4%	-27.5%	45.2%	1.3%

References

B. Baranski *et al.*, "The Impact of Group Reputation in Multiagent Environments," *2006 IEEE International Conference on Evolutionary Computation*, 2006, pp. 1224-1231, doi: 10.1109/CEC.2006.1688449.
Nadathur, S., Nadathur, S., & Profile, V. M. C. (2021, 18 mei). *Extortion in Prisoner's Dilemma*. Blank on the map. http://blankonthemap.blogspot.com/2012/09/optimal-strategies-in-iterated.html

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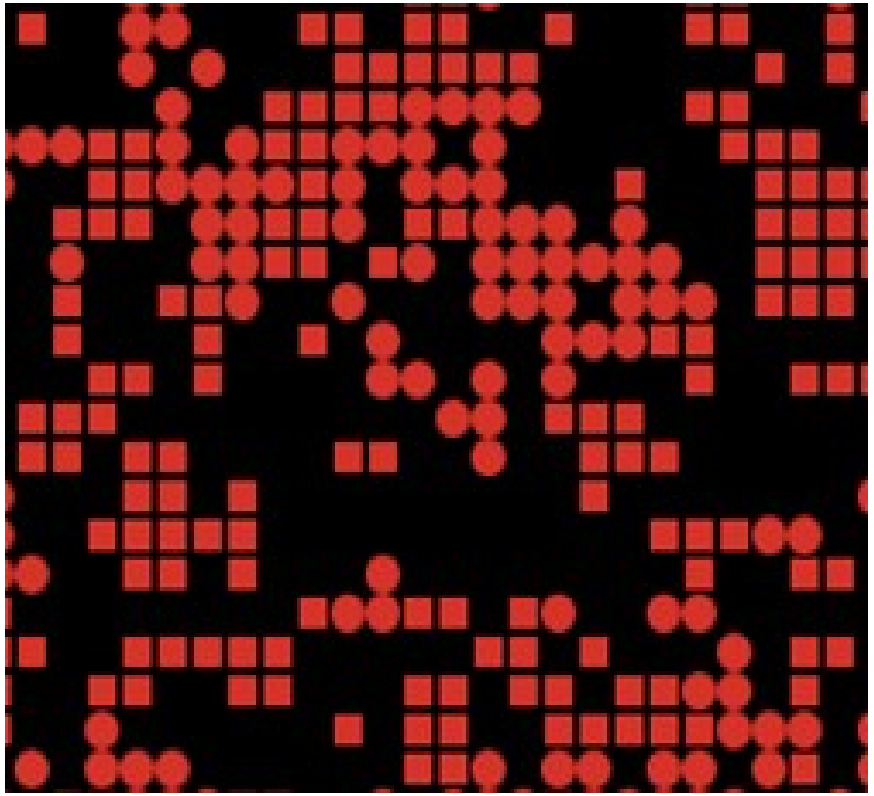

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