

1 Recent results

Recall from last time that we were intending to use evolution algorithms to improve one of the communication parameters, q , to help the robot swarm to reach a consensus faster, and our reward was defined as

$$reward = \frac{\text{no. of robots correct}}{\text{no. of robots in swarm}}$$

However, it has been found that with a decent number of repetition, the reward seems to be not improving at all over a hundred generations, as shown in the figure below.

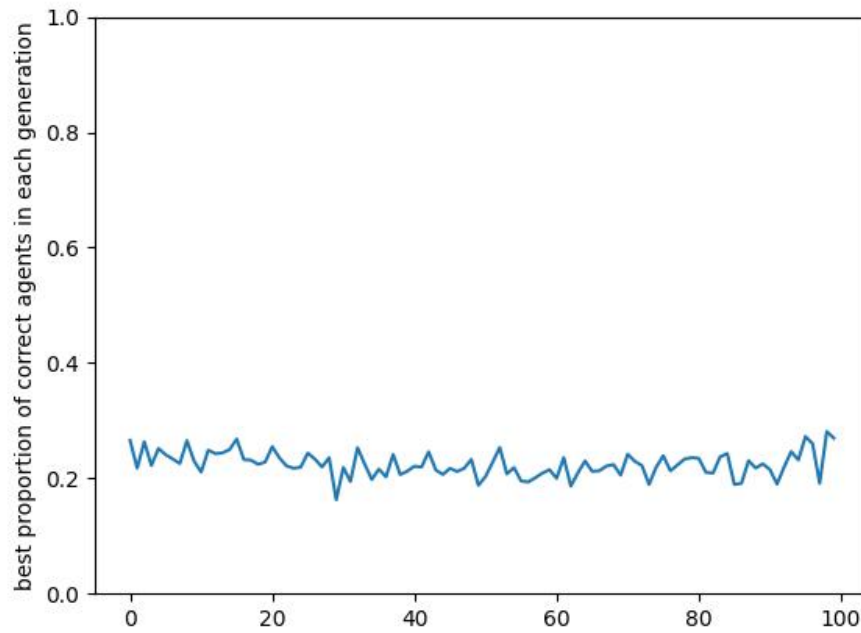
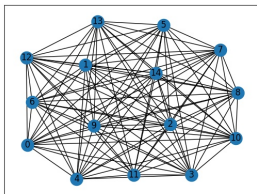
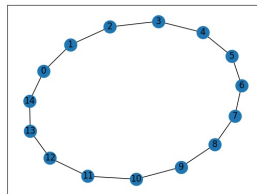


Figure 1: Average reward over 100 generations

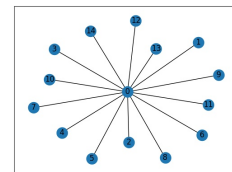
This is a sad news for us and this is the case for all graphical models that we have tried running evolution algorithm on, including a well-mixed model (fully connected graph), ring graph and star graph. This leads us to question the initial assumption that this particular



(a) well-mixed population



(b) ring graph



(c) star graph

parameter in communication has a significant impact on outcome. To see if it actually have an effect on the population fitness ie. outcome, we tried to assess the population fitness with different values of the parameter q , which is a way of quantifying some adversarial (lying) behavior, through a series of simulations.

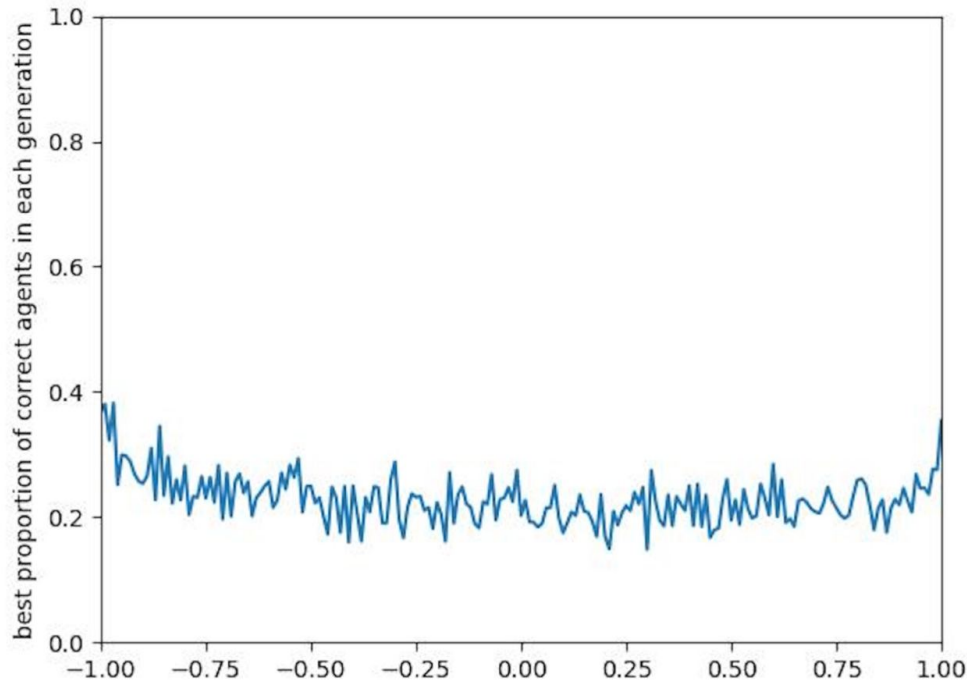


Figure 3: Fitness with different values of q

As shown in the figure above, although there is some increase in fitness as q goes to -1 and 1, as it should be, the increase is nowhere close to expected. Therefore we need to reflect on our model and show at least a proof of concept that evolution algorithm works.

2 Moving forward

We will be modifying our model slightly to look at a different parameter. We are thinking of the set up of robot swarm trying to switch from a noisy channel S1 (with a lot of noise) to a less noisy channel S2 (with significantly less noise). Although the overall "switch" is beneficial, robots with different channels are not able to communicate effectively, therefore impede the overall performance of the swarm. However, over a long period of time with multiple generations of evolution, the hope is that as more robots switch to the better communication channel S2, the overall performance of the swarm will increase. Specifically, we would be interested in looking at the effect of different network structure in helping to propagate this change in "gear".