

An Implementation of Rescue Agents with Genetic Algorithm

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I. INTRODUCTION

When a large-scale disaster happened, support by computer systems will be helpful because the rescue plan has to be built dealing with vast amounts of information instantly. To realize such a system, we implemented a disaster simulator, and tried to acquire effective rescue strategies[2]. In some studies[1], the strategies for such domain have been described with if-then rules. It is easy to understand them, but hard to coordinate because they need a lot of rules. Consequently, we take an approach, that each agent decides the next target by neural network which calculates the priority of each disaster area from the damage pattern of its surroundings.

II. CHARACTERISTIC OF THE PROBLEM SPACE

In an environment of disaster simulation, supervised learning can not be applied because the optimal rescue strategy for a particular disaster is not known beforehand. Therefore, the strategy has to be improved based on simulation results only. Also, methods like gradient descent procedure are unsuitable for this problem because the problem space has rough shape (see Fig.1). For these reasons, we adopted a genetic algorithm (GA) in which the weight of each link of the neural network is considered as a gene.

In this case, because the purpose is disaster mitigation, effective solution must be acquired stably. Then, maintaining the diversity of the population becomes important. On the other hand, the simulation number of times must be kept low because it needs high computational cost. To maintain the diversity of the population, methods like MGG[4] are useful, but they need a lot of trials. Therefore, we adopted elite strategy of high mutation probability.

III. RESULTS OF LEARNING

In the experiment, we tried to improve the fire fighter's strategy, with simulation of spread of fire on the RoboCup Rescue Simulation System and its 1/100 map. Thinking about a scenario that a fire broke out in the center of the map, and started fire-fighting in 30 minutes, the strategy is evaluated by the damage in 100 minutes. We use GA whose population size = 10 and the number of elite = 4. In every epoch, all genes are evaluated by simulation, and four elites are selected. Then, six new genes are created by crossover of every two combination of the elite. And, one weight in every new gene mutates in 50% of probability, and changes $\pm 50\%$.

The learning curve is shown in Fig.2 (each vertical line shows the range of the score of the generation). The acquired strategy is effective to some extent, but it is still inferior to a hand coded one (which holds the damage to 19). However, this approach using neural network acquires a strategy which has similar efficiency to the hand coded strategy when we apply a random-walk search[3], whose search range was rather narrow. Accordingly, the efficiency of the strategy which is acquired by GA might be improved more, if focussing on some promising points, and searching them deeper.

IV. SUMMARY

This paper introduced our approach acquiring an effective rescue strategy automatically with GA. In this experiment, the acquired strategy is inferior to a hand coded one, but depending on the search method, it still has possibility to become more effective.

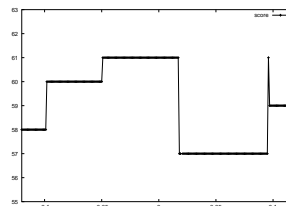


Fig. 1. A cross section of the problem space

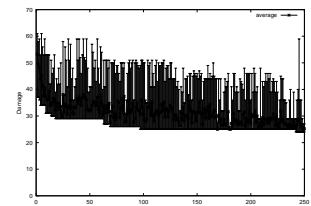


Fig. 2. Typical learning curve of the experiment

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