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Yuki Miyamoto[1]*, Taishun Kusaka[1], Yuki Okado[1], Toshinari Sakai[1], Akira Hasegawa[1], Haruki Uehara[1], Nobuhiro Ito[1], and Kazunori Iwata[2]

[1]Department of Information Science, Aichi Institute of Technology, Japan
[2]Department of Business Administration, Aichi University, Japan

Abstract

We aim to distribute agents properly over tasks and to reduce the number of inactive agents this year. We introduce various clustering modules and a path planning module to achieve this purpose. The results of preliminary experiments showed that our team could achieve better scores than the last year in almost scenarios used in RoboCup 2019.

In this abstract, we describe especially effective two modules: the clustering that we call *highways* and the path planning using the *highways*.

Highways Clustering Module Agents are required to omit any unnecessary *steps* when they move to their destinations. *Police Forces* should remove *blockades* that interrupt the movements as soon as possible. However, they take many *steps* to remove all *blockades* in a scenario with many *blockades*. Therefore, it is essential to reduce the number of roads from which *blockades* must be removed and to share this information with the *Police Forces*.

This module provides the prior roads as *highways* for path selection and *blockades* removal. The *highways* are derived beforehand in the precomputation by gathering the roads included in the shortest paths among some areas dispersed on the entire map. The areas are determined with the k-means++ clusters [1].

Passable Path Planning Module This module searches for a path that avoids impassable roads with the A* algorithm [2]. A *highway* determined by the highways module can be regarded as a passable road because its *blockades* are removed preferentially. Therefore this module selects a path on the *highways* with priority.

The cost function used in the A* algorithm is the Euclidean distance between two roads. The cost is reduced to prioritize if the roads are *highways*, in contrast, increased to deprioritize if the roads are determined as impassable by a perception.

This module is also utilized on our *Road Detector* of *Police Forces* to disperse them into the entire map. The cost function of them is not the same as other

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* Corresponding author.

agents because they can remove *blockades*. Each *Police Force* especially prioritizes the roads that are included in the highways and its assigned cluster.

Our team with the above two modules can achieve higher scores than the last year. As a result, we conclude our approach with developed modules is effective.

References

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