# RoboCup Rescue 2020 ONLINE TDP Agent Simulation AIT-Rescue (Japan)

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## Abstract

It turns into a more important problem to rescue civilians than before in no fire scenario. In other words, we need to assign the proper number of platoon agents to every damaged civilian, in proper order.

In no fire scenario, fire brigades can rescue civilians as they do not need to extinguish. Therefore, fire brigades must effectively search and rescue civilians by cooperating with ambulance teams. In searching and rescuing civilians, it is important to decide which area they should search from, as the first step. However, it isn't easy to decide the search order by available information in the simulation's precomputing process.

To address this problem, we developed a voice-based search module for ambulance teams and fire brigades. Our such agents can use search for civilians in proper order. As a result, they could rescue many civilians.

Our ambulance teams are assigned to proper areas, buildings' list, by a clustering module based on k-means++ [1]. Ambulance teams detect civilians to be rescued from the buildings according to their own hearing range. Platoon agents can not detect the direction of a civilian's voice but whether the civilian is in their own hearing range. When a platoon agent detects the same voice, the agent can derive a rough position of the civilian by intersecting hearing range circles drawn based on the positions at which the agent has heard the voice. The procedure is described as follows. First, it regards all buildings within the hearing range as a candidate building list for a civilian to be rescued when an ambulance team hears a voice crying for help. Secondly, the candidate building list is gradually re-fined if the ambulance team hears the same civilian's voice at different steps. In other words, the candidates get gradually narrowed down by continuing to integrate all of the agents' candidate lists every step. Note that these lists do not include buildings with zero collapse value. This method realizes that ambulance teams search for the buildings with the highest possibility where damaged civilians are.

Although fire brigades also search for civilians in the same as ambulance teams, fire Brigades cannot use *Load* and *Unload* command. Therefore, a fire

brigade searches for the other civilians when he is no longer to rescue any civilian. Namely, a fire brigade leaves the building when the buriedness of damaged civilians in the building reaches zero. A fire brigade notifies the ambulance team at this time.

We confirmed that our module is valid and effctive through some experiments. There we can expect our agent achive good rescue activety by our method.

## References

1. Arthur, D., Vassilvitskii, S.: k-means++: the advantages of careful seeding. In: SODA '07 (2007)