Human Swarm – Model Description

Skanda Vaidyanath

Institute of Creative Technologies

05/24/2019

The Agent and the Operator

- Single spokesperson (agent) controlling (initially) N drones.
- Single Operator to interrupt in required situations.

Events and Rewards

- Clock Tick -1
- Civilian group saved +5000
- Civilian group dies -500,000
- Timeout (fire encroaches entire town) -1,000,000

Actions and Rewards

- RESCUE GROUP +20-1
- WARN -3
- NEGOTIATE -10
- INTERRUPT OPERATOR -150-3
- NAVIGATE TO ‘SAFE ZONE’ +35-5
- END CONTACT (at ‘safe zone’ indicating the civilian group has been saved) +5000-1

Negative rewards indicate the number of time units (how do we incorporate this ?)

State Variables

1) Fire Information from all drones. Eg: each drone gives a probability distribution of the time it takes for the fire to reach its current location. We will use the mean of the distribution and discretize it into a LOW RISK, MEDIUM RISK or HIGH RISK scenario depending on the value of the mean

2) Global Timer counting down from T

3) Number of active drones (there is a possibility that drones go down with the house and civilians)

State Variables (contd.)

4) Number of searching drones. Indicates the number of active drones that are not in contact with any group of civilians.

5) Operator Available ? 0 for Operator busy. 1 for Operator available.

6) Number of Operator contacts attempted (successful and unsuccessful)

7) Number of WARNings issued

8) Number of drone NEGOTIATIONs carried out

State Variables (contd.)

9) Number of operator negotiations carried out

10) Number of groups of civilians saved

11) Number of groups of civilians dead

12) Number of groups to be saved

State Variables (contd.)

The following are drone-specific variables. Each drone (regardless of whether it is active or inactive) has a copy. If a drone is inactive, all the fields are 0.

13) Searching ? 0 for no, 1 for yes.

14) Has the drone sighted a civilian group ? 0 for no, 1 for yes.

15) In contact with civilian group ? 0 for no, 1 for yes.

16) Drone issuing a warning ? 0 for no, 1 for yes.

State Variables (contd.)

17) Drone negotiating ? 0 for no, 1 for yes.

18) Drone contacting operator ? 0 for no, 1 for yes.

19) Operator negotiating through drone ? 0 for yes, 1 for no.

20) Drone navigating to safe zone ? 0 for no, 1 for yes.

21) Drone at safe zone ? 0 for no, 1 for yes.

22) Location information (x,y) after splitting the town map into grids to discretize

State Variables (contd.)

We may not have access to this information or we will need to find replacements of some sort for this information.

We may/may not have access to this information but it also may/may not be very useful. They may help in identifying the population demographic, for example, "generally stubborn" since we will deal with a variety of populations, but this is something to think about.

All drones start off in the searching phase by default. They have respective location coordinates and all other fields are 0.

We do not know the time it takes for the operator to complete a negotiation through a given drone.

Actions

Each action can be carried out by each drone individually. So each action is prefixed with "DRONE i DO…" where 'i' is a valid drone number for a drone that is active.

1) RESCUE GROUP: Having sighted a civilian group, get in contact and initiate rescue sequence. This takes 1 time unit.
2) WARN: Issue a warning to the civilian group for a period of 3 time units
3) NEGOTIATE: Commence robotic negotiation for a period of 10 time units.
4) INTERRUPT OPERATOR: Provided the operator is available. If operator is busy, this action does nothing. At this point, a drone may keep trying the same action or try a different action (according to policy). This takes 3 time units.

Actions (contd.)

5) NAVIGATE TO ‘SAFE ZONE’: Once the civilian group is convinced, the drone navigates the group to the ‘safe zone’. This takes 5 time units.

6) END CONTACT: When drone is at ‘safe zone’. Indicates that the civilian group has been saved. Communicate this information to the spokesperson as well. And go back to searching i.e. set searching=1 for this drone. This takes 1 time unit.

To keep things simple, ‘actions’ such as “DRONES 1-3 WARN” will have to be carried out in 3 separate actions.