Modeling and simulation of complex systems

Project 4: Evacuation

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Question

How to better manage the pedestrian evacuation of a population on a beach in a tsunami context?

- flooding will not be modeled by itself
- just **the behavior of residents** in the face of the threat.

Modeling and Simulation

Situation

- People will only evacuate if they have been informed of the imminent risk of flooding.
  - We assume that only **10% of the population is informed at the beginning of the simulation**.
  - A person observing someone evacuating (at a distance of less than 10m) will have a probability of 0.1 of evacuating in turn.
- **Not all residents know where to evacuate** and only 10% will go directly to the shelter.
- People have multiple modalities of evacuation: they can evacuate by car, by bike, or on foot.

Modeling and Simulation

Situation - My extension

- **The knowledge of the evacuation shelter can be transfered across people**.
  - The knowledge of the evacuation shelter can be shared with 2 people at 10% probability when they meet each other on the road while evacuating.
  - When the knowledge is shared, 2 people have 10% probability to change their evacuation to the closest shelter they're heading to.

Modeling and Simulation

Strategies to aware of flooding

Different strategies of aware of flooding to the 10% of the population:

- random.
- furthest from the shelter.
- closest to the shelter.

Find the most effective of these strategies in terms of:

- number of evacuees.
- evacuation time.
- time for the total evacuation/time spent on the roads.

Modeling and Simulation

Parameters

- initial population.
- the alert time before the flooding.

GIS Data

GIS data of the city of Hanoi, Vietnam.

Implementation (GAMA)

Extensions

- **Extensions 0**: GIS map, population, evacuation shelter, roads, flooding simulation, etc.
- **Extensions 1**: The evacuating behavior of the population.
- **Extensions 2**: Multimobility of population (car, bike, foot).
- **My Extensions**: The knowledge of the evacuation shelter can be transfered across people.
- **Extensions 3**: Experiment and analyze the effectiveness of different strategies of aware of flooding.

Implementation: Extensions 0

The Map

Implementation: Extensions 0

Species

- **People**: the inhabitants of the city.
- **Evacuation Shelter**: the shelter for evacuation.
- **Road**: the road for evacuation.
- **Building**: the building in the city.
- **Flooding**: the flooding area.

Implementation: Extensions 0

Species - Flooding

Implementation: Extensions 1

Species - People behavior

Implementation: Extensions 2

Multimobility of population

Implementation: My Extensions

Transfer knowledge of evacuation shelter

Implementation: Extensions 3

Trategies: Random

Implementation: Extensions 3

Trategies: Furthest

Implementation: Extensions 3

Trategies: Closet

Experiment

Comparison

Experiment

Batch exploration

Q & A