Simulation Analysis for Social Systems

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What is a social system ?

It's our life style.

Rescue System

Refugee Navigation
- So many refugees
- Immediate response

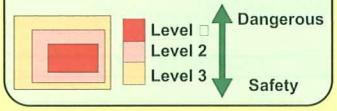
⇨ Limit of Capacity

Objective

Grasp dangerous regions from global viewpoints to reduce computational cost

Virtual Map

How to classify regions?



Probabilistic Class

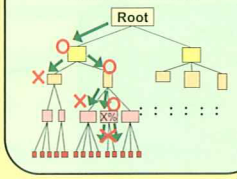
The regions are classified by some danger levels on the basis of escape probability.

Indexing Structure

The regions are indexed by RNR-Tree. RNR-Tree is extended from R-Tree.

Nodes represent square regions. Hierarchy represents danger levels.

How to index?



Transport System

Transport vehicles are social agents.
They want to get more rewards from customers.

Reward

Risk | Assured Reward | Expected Reward

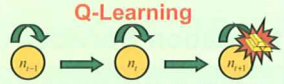
How many people waiting?

I'm waiting.

I'm going to ...

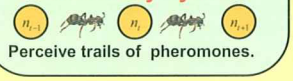
How to estimate the reward?

Q-Learning



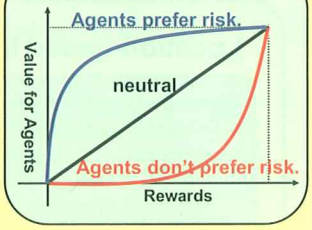
Estimate sum of expected reward.

Ant Colony System



Perceive trails of pheromones.

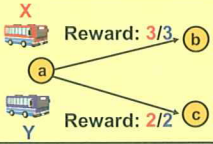
How to control the risk?



Transport vehicles select routes sometime cooperatively, sometime competitively.

Strategy

Cooperative Competitive | Synchro Alternate



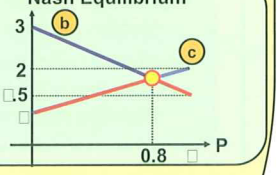
If vehicle X select (b) with P%,

What is the best strategy for vehicle Y?

Payoff Matrix

X \ Y	b	c
b	(1.5, 1.5)	(3, 2)
c	(2, 3)	(1, 1)

Nash Equilibrium



Vehicle Y can select better way than vehicle X.
However, after the battle between vehicles X and Y,
The strategies of the two reach to Nash Equilibrium.

Geographic Information System

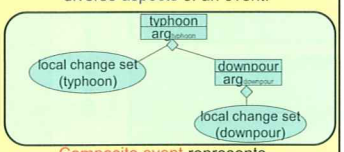
Traditional GIS
- Focus on version history of geographic objects
- Manage only local changes

Objective

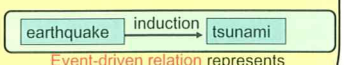
Needs to manage and represent processes of geographic changes as global changes

Event Model
- Event: a thing that causes local changes
- Is-a relation -> Conceptual hierarchy
- Part-of relation -> Composite event
- Causal relation -> Event-driven relation

Conceptual hierarchy represents diverse aspects of an event.



Composite event represents structured hierarchy of events.



Event-driven relation represents causal affection between events.

Prototype System
- Observation
  - Spatial aspects
  - Quantitative aspects

Processes of geographic changes can be observed by tracing three relation in our model

After 10 years later ...

Your life will be better.

Thanks to members of SI and GIS group