Ant Colony Optimization

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Ant Colony Optimization.

1. Initially random.
2. Leaves pheromones.
3. Ants tend to follow paths with more pheromones

ACO in TSP.

1. N cities. I distinct ants start ~~xxx~~ from any of these randomly.

2. Ants have memory:
   - → Won't visit any visited city again.
   - → Tend to choose nearer city (if rest is same)

3. P_{ij}^{k} → Probability of ant k do go to city j from city i.

$$p_{ij}^{k} = \begin{cases} \dfrac{[\tau_{ij}]^{\alpha} \cdot [\eta_{ij}]^{\beta}}{\sum_{d \in \text{allowed}_k} [\tau_{id}]^{\alpha} \cdot [\eta_{id}]^{\beta}} & j \in \text{allowed}_k \\ 0 \end{cases}$$

where τ intensity.

$$\eta_{ij} = \frac{1}{d_{ij}}$$

α, β regulate the importance.

allowed_k : cities unvisited by ant k.

Pheromone, Update rule:

$$\tau_{ij}(t+1) = \underbrace{\rho}_{\text{evaporation factor}} \cdot \tau_{ij}(t) + \Delta\tau_{ij}$$

where,

$$\Delta\tau_{ij} = \sum_{k=1}^{\text{all ants}} \Delta\tau_{ij}^{k}$$

where,

$$\Delta\tau_{ij}^{k} = \begin{cases} \dfrac{Q}{L_k} & ; \text{if ant } k \text{ has travelled on edge } ij \\ 0 & ; \text{otherwise} \end{cases}$$

when,

L_k = length of tour.

α = generally 1.

The above update is done after every ant completes an iteration (?)