

Monday, April 19

Lecture Day #35/42

Announcements

- Tomorrow is a mental health day, no OH
- No new HW yet

Firefly Search

- * A swarm of fireflies
- * Brightness = Quality of Solution

Each firefly will be attracted to each other brighter firefly.

Suppose firefly j is brighter than ff. i . Then, the attractiveness of j to i is:

$$A_{ij} = \beta e^{(-\gamma r_{ij}^2)}$$

r_{ij}^{-4} $e^{(-r_{ij}^2)}$ could change

where r_{ij} is the Euclidean distance between them, and β and γ are parameters that can be tuned.

Attractiveness decays with distance (in

this case, exponentially).

So, in each generation, we loop through all pairs and move the dimmer one toward the brighter one: $i \rightarrow j$

$$X_i' = X_i + \underbrace{\beta e^{(-\gamma r_{ij}^2)}}_{\text{attractiveness}} \cdot \underbrace{(x_j - x_i)}_{\substack{\text{vector that} \\ \text{points from} \\ x_i \rightarrow x_j}} + \underbrace{\alpha \cdot S \cdot L}_{\substack{\text{parameter} \\ \text{for tuning}}}$$

↑ new pos ↑ old pos ↑ vector of random +1s and -1s ↑ Levy flight

Pseudocode:

$N = \#$ of fireflies

while True:

 for i from 1 to N :

 for j from 1 to N :

 If FF_j is brighter than FF_i :
 move i toward j

Notes:

- * Maybe the attractiveness of a FF could also depend on the difference in score?
- * Unlike PSO, there is no reliance on personal best scores.

Cuckoo Search

Cuckoo birds are parasites - they lay their eggs in the nests of other birds in the hope that the other birds will take care of them.

The other birds sometimes notice and : kick out the eggs
they fly away and make
new nests

Idea: N nests. Each nest contains one egg (a random solution). Repeat the following steps:

- * pick a random nest

- * form a new solution by doing a Lévy flight
- * pick a new random nest and if the new solution is better than the egg in that nest, you replace it
- * take the worst $p\%$ of eggs in any nest, and replace each of them with a Lévy flight.

Notes: * Guarantees you'll hang onto good solutions.

- * This could work with discrete spaces. You need some version of a Lévy flight - a tweak that is usually small, but sometimes big.