

一、DE

different evolution差分演化

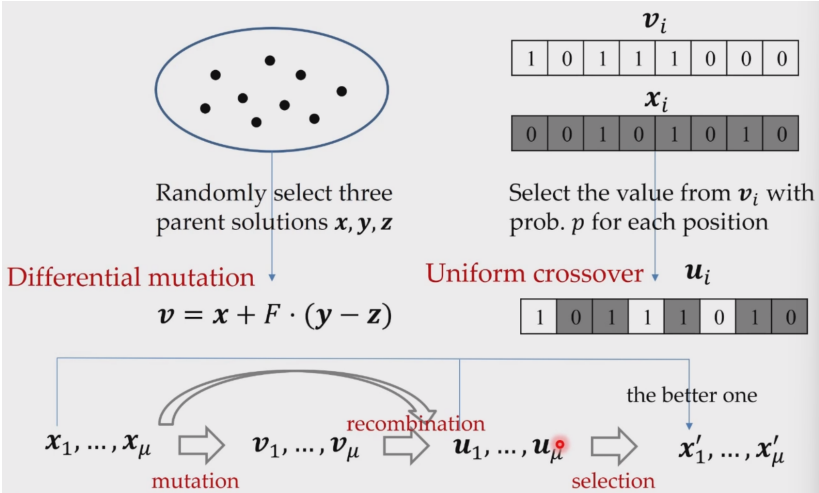
只有差分变异是创新

非线性不可微连续优化问题

Representation	Real-valued representation
Recombination	Uniform crossover
Mutation	Differential mutation
Parent selection	Uniform random selection
Survivor selection	Deterministic elitist replacement (parent vs. offspring)

差分

很粗略的用y-z



拓展

- 增加超参数

a: x的选择标准

b: 用来变异的yz数目

c: 不同crossover方法

Variants of DE: DE/a/b/c

- a is the base vector (rand or best)
- b is the number of different vectors to define perturbation vector
- c denotes the crossover scheme (“bin” is uniform crossover)

$$\text{ion vector} \left\{ \begin{array}{ll} \mathbf{y} - \mathbf{z} & \text{randomly select two} \\ (\mathbf{y} - \mathbf{z}) + (\mathbf{y}' - \mathbf{z}') & \text{randomly select four} \end{array} \right.$$

二、粒子群优化PSO

不是达尔文，鱼群鸟群

非线性优化

Representation	Real-valued representation
Recombination	None
Mutation	Adding velocity vector
Parent selection	Deterministic (each parent creates one offspring via mutation)
Survivor selection	Generational (offspring replaces parents)

- 子代解直接生存不用选择

一个解是一个位置，同时对应了扰动向量--速度v

y: 当前成员最好位置

z: 种群最好位置（社会的影响）

ES自适应变化的是步长和旋转角度，绕了一下

PSO直接变化产生子代解

- 比yi好就更新yi

三、蚁群优化ACO

Ant colony optimization

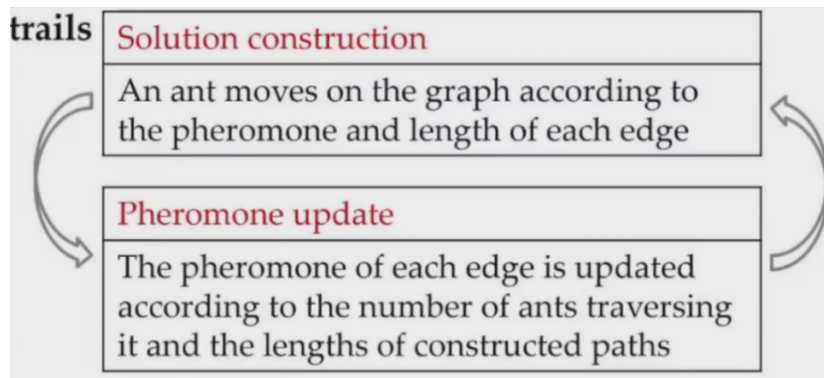
图上搜索最好路径

蚂蚁在走的路上会留下信息素，留给其他蚂蚁

转化成图搜索问题用ACO

蚂蚁的移动是path，是solution

蚂蚁在分布上构成采样



解的构造

挑选邻域中未访问过的结点移动

$$p_k(i, j) = \begin{cases} \frac{(\tau(i, j))^\alpha (\eta(i, j))^\beta}{\sum_{u \in J_k(i)} (\tau(i, u))^\alpha (\eta(i, u))^\beta}, & \text{if } j \in J_k(i) \\ 0, & \text{otherwise} \end{cases}$$

pheromone usually $1/d(i, j)$, where $d(i, j)$ is the distance between i and j

vertices which are connected to i and unvisited by the ant k

- 信息素越大，距离越近，跳转概率越大

更新信息素

再根据蚂蚁的移动重新构造解

挥发因子 ρ

After the ants construct the paths, the pheromone is updated by

$$\tau(i, j) = (1 - \rho) \cdot \tau(i, j) + \sum_{k=1}^m \Delta \tau_k(i, j)$$

evaporation factor $\Delta \tau_k(i, j) = \begin{cases} \frac{1}{C_k}, & \text{if } (i, j) \in R^k \\ 0, & \text{otherwise} \end{cases}$

length of the path constructed by the ant k

number of ants, i.e., population size

pheromone density laid on edge (i, j) by the ant k

edge set traversed by the ant k

- 蚂蚁越多，构造出的路径越短，信息素越强
- 没走过的边不发挥作用

四、EDA分布估计

Estimation of Distribution Algorithms

把之前的方法显式化，理论化

构建分布，从分布中采样，再更新分布

先选定一个概率模型，采样，再迭代