

HBC Notes 11/12/2021

hyperparameters
 \downarrow (0.9)
 $\text{frac} = \text{set}$

Simulated Annealing

*** K is set
 is large to start
 & gets smaller as we go

Global \rightarrow for high dimensional systems (large # variables)

I

\rightarrow minimize $f(x_1, \dots, x_N)$
 1) $\vec{x}^0 = (x_1^0, x_2^0, x_3^0, \dots, x_N^0) \leftarrow$ initial guess

2) compute cost $\rightarrow f(\vec{x}^0)$

3) modify $x_j^0 \pm$ small amount

4) compute new cost: $\Delta C = \text{new cost} - \text{old cost}$

5) if new cost $<$ orig cost, $\Delta C < 0$
 good change

II

* not get trapped in local minimum
 if $\text{rand}() < \text{"temperature effect"}$

* do random change *

end

$\downarrow e^{-\frac{\Delta C}{KT}}$

III

$T = \text{fraction} \cdot T_{\text{set}}$

$\text{frac} \cdot \text{temp} = \text{temp}$

$0001:1:1 = v$

$\begin{bmatrix} a_{11} & \dots & a_{1N} \\ \vdots & \ddots & \vdots \\ a_{N1} & \dots & a_{NN} \end{bmatrix} = A = A^T$

$1 - (v) \cdot \text{temp} = i$

(1) $v = 1$

(1+2) $v = 5b1$

$(5b1, 1b1)A + 1200 = 1200$

$(x_{11})A + 1200 = 1200$

$(x_{12})A + 1200 = 1200$

$(x_{13})A + 1200 = 1200$

$(x_{14})A + 1200 = 1200$

Simulated Annealing PseudoCode!

initialize: 1) initial guess

2) $\text{frac} \leftarrow \text{change temp by}$

3) tolerance = min temp

4) starting temp = $1e^4$

5) $K_B = 0.01$ (Boltzmann-like)

6) max iteration (for steps I and II)

hyper-parameters

$ct = 0$

7) based on initial guess, find cost (value of function)

while temp > tol

for $n = 1 : \text{max_iter}$

* random change to x_{guess} *

STORE AS VECTOR

* compute new cost *

* $\Delta C = \text{new cost} - \text{previous cost}$ *

if $\Delta C < 0$

* good change to make *

elseif $\text{rand}() < e^{-\frac{\Delta C}{K_B \text{temp}}}$

* ~~make a random change~~ *

* keep the change *

end $ct = ct + 1$ & store $\text{costVec}(ct) = \text{cost}$

end

temp = $\text{frac} \cdot \text{temp}$

end

$$A^T = A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{12} & a_{22} & a_{23} & \dots & \\ & & \ddots & & \\ & & & a_{nn} \end{bmatrix}$$

$$v = 1:1:1000$$

$$\text{cost} = 0$$

computing cost:

$$\text{cost} = 0$$

$$\text{cost} = \text{cost} + A(v_1, v_2)$$

$$\text{cost} = \text{cost} + A(v_2, v_3)$$

$$\text{cost} = \text{cost} + A(v_3, v_4)$$

for $i = 1 : \text{length}(v) - 1$

$$\text{id1} = v(i)$$

$$\text{id2} = v(i+1)$$

$$\text{cost} = \text{cost} + A(\text{id1}, \text{id2})$$

end

← b/wn as you
give → we want
1 - 999,
random change
switch w/ right
store as
NEW

- randi

- randperm (for creating v)