Part 3 Extra Solutions

November 25, 2022 9:27 AM

Example 1.

$$V(A11) = -2 + \gamma \times -1 + \gamma^2 \times -1 + \gamma^3 \times -1 + \gamma^4 \times 0$$

$$= -2.875$$

$$V(A01) = -1 + \gamma \times -1 + \gamma^2 \times -1 + \gamma^3 \times 0$$

$$= -1.75$$

$$V(B01) = \frac{(-1 + \gamma \times -1 + \gamma^2 \times 0) + (-1 + \gamma \times 0)}{2}$$

$$= -1.25$$

$$V(B00) = 0$$

$$V(B11) = -2 + \gamma \times -1 + \gamma^2 \times -1 + \gamma^3 \times -1 + \gamma^4 \times 0$$

$$= -2.875$$ A

$$V(B10) = \frac{(-1 + \gamma \times -1 + \gamma^2 \times -1 + \gamma^3 \times 0) + (-1 + \gamma \times -1 + \gamma^2 \times 0)}{2}$$

$$= -1.625$$

$$V(A10) = -1 + \gamma \times 0$$

$$= -1$$

$$V(A00) = 0$$

Example 2.

$$P(B01 \mid B01, \text{Clean}) = 0.5$$

$$P(B00 \mid B01, \text{Clean}) = 0.5$$

$$V(A11) \leftarrow r(A11) + \gamma \left[P(A01 \mid A11, \text{Clean})\, V(A01) \right]$$

$$\leftarrow -2 + 0.5\,(1 \times -1)$$

$$\leftarrow -2.5$$

$$V(A01) \leftarrow r(A01) + \gamma \left[P(B01 \mid A01, \text{Right})\, V(B01) \right]$$

$$\leftarrow -1 \times 0.5(1 \times -1)$$

$$\leftarrow -1.5$$

$$V(B01) \leftarrow r(B01) + \gamma\left[P(B01 \mid B01, Clean)V(B01) + P(B00 \mid B01, Clean)V(B00)\right]$$

$$\leftarrow -1 + 0.5(0.5 \times -1 + 0.5 \times 0)$$

$$\leftarrow -1.25$$

$$V(B01) \leftarrow r(B01) + \gamma\left[P(B01 \mid B01, Clean)V(B01) + P(B00 \mid B01, Clean)V(B00)\right]$$

$$\leftarrow -1 + 0.5(0.5 \times -1.25 + 0.5 \times 0)$$

$$\leftarrow -1.3125$$

$$V(B00) \leftarrow r(B00)$$

$$\leftarrow 0$$

$$V(B11) \leftarrow r(B11) + \gamma\left[P(B10 \mid B11, Clean)\, V(B10)\right]$$

$$\leftarrow -2 \times 0.5(1 \times -1)$$

$$\leftarrow -2.5$$

$$V(B10) \leftarrow r(B10) + \gamma\left(P(B10 \mid B10, Clean)\, V(B10)\right]$$

$$\leftarrow -1 + 0.5(1 \times -1)$$

$$\leftarrow -1.5$$

$$V(B10) \leftarrow r(B10) + \gamma\left(P(A10 \mid B10, Left)\, V(A10)\right]$$

$$\leftarrow -1 + 0.5(1 \times -1)$$

$$\leftarrow -1.5$$

$$V(A10) \leftarrow r(A10) + \gamma\left(P(A00 \mid A10, Clean)\, V(A00)\right)$$

$$\leftarrow -1 + \gamma(1 \times 0)$$

$$\leftarrow -1$$

$$V(A00) \leftarrow r(A00)$$

$$\leftarrow 0$$

We have performed one iteration.

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Example 3.

$$V(A11) \leftarrow V(A11) + \alpha\left(r(A11) + \gamma V(A01) - V(A11)\right)$$
$$\leftarrow -1 + 0.5\left(-2 + 0.5 \times -1 - (-1)\right)$$
$$\leftarrow -1.75$$

$$V(A01) \leftarrow V(A01) + \alpha\left(r(A01) + \gamma V(B01) - V(A01)\right)$$
$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times -1 - (-1)\right)$$
$$\leftarrow -1.25$$

$$V(B01) \leftarrow V(B01) + \alpha\left(r(B01) + \gamma V(B01) - V(B01)\right)$$
$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times -1 - (-1)\right)$$
$$\leftarrow -1.25$$

$$V(B01) \leftarrow V(B01) + \alpha\left(r(B01) + \gamma V(B00) - V(B01)\right)$$
$$\leftarrow -1.25 + 0.5\left(-1 + 0.5 \times 0 - (-1.25)\right)$$
$$\leftarrow -1.125$$

$$V(B00) \leftarrow 0$$

$$V(B11) \leftarrow V(B11) + \alpha\left(r(B11) + \gamma V(B10) - V(B11)\right)$$
$$\leftarrow -1 + 0.5\left(-2 + 0.5 \times -1 - (-1)\right)$$
$$\leftarrow -1.75$$

$$V(B10) \leftarrow V(B10) + \alpha\left(r(B10) + \gamma V(B10) - V(B10)\right)$$
$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times -1 - (-1)\right)$$
$$\leftarrow -1.25$$

$$V(B10) \leftarrow V(B10) + \alpha\left(r(B10) + \gamma V(A10) - V(B10)\right)$$
$$\leftarrow -1.25 + 0.5\left(-1 + 0.5 \times -1 - (-1.25)\right)$$
$$\leftarrow -1.375$$

$$V(A10) \leftarrow V(A10) + \alpha\left(r(A10) + \gamma V(A00) - V(A10)\right)$$
$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times 0 - (-1)\right)$$

$\leftarrow -1$

$V(A00) \leftarrow 0$

We have performed one iteration.

Example 4.

$$Q(A11,C) \leftarrow Q(A11,C) + \alpha\left(r(A11) + \gamma \max_{a'} Q(A01,a') - Q(A11,C)\right)$$

$$\leftarrow -1 + 0.5\left(-2 + 0.5(-1) - (-1)\right)$$

$$\leftarrow -1.75$$

$$Q(A01,R) \leftarrow Q(A01,R) + \alpha\left(r(A01) + \gamma \max_{a'} Q(B01,a') - Q(A01,R)\right)$$

$$\leftarrow -1 + 0.5\left(-1 + 0.5(-1) - (-1)\right)$$

$$\leftarrow -1.25$$

$$Q(B01,C) \leftarrow Q(B01,C) + \alpha\left(r(B01) + \gamma \max_{a'} Q(B01,a') - Q(B01,C)\right)$$

$$\leftarrow -1 + 0.5\left(-1 + 0.5(-1) - (-1)\right)$$

$$\leftarrow -1.25$$

$$Q(B01,C) \leftarrow Q(B01,C) + \alpha\left(r(B01) + \gamma \max_{a'} Q(B00,a') - Q(B01,C)\right)$$

$$\leftarrow -1.25 + 0.5\left(-1 + 0.5 \times 0 - (-1.25)\right)$$

$$\leftarrow -1.125$$

$$Q(B11,C) \leftarrow Q(B11,C) + \alpha\left(r(B11) + \gamma \max_{a'} Q(B10,a') - Q(B11,C)\right)$$

$$\leftarrow -1 + 0.5 \times \left(-2 + 0.5 \times -1 - (-1)\right)$$

$$\leftarrow -1.75$$

$$Q(B10,C) \leftarrow Q(B10,C) + \alpha\left(r(B10) + \gamma \max_{a'} Q(B10,a') - Q(B10,C)\right)$$

$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times -1 - (-1)\right)$$

$$\leftarrow -1.25$$

$$Q(B10,L) \leftarrow Q(B10,L) + \alpha\left(r(B10) + \gamma \max_{a'} Q(A10,a') - Q(B10,L)\right)$$

$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times -1 - (-1)\right)$$

$$\leftarrow -1.25$$

$\leftarrow -1.25$

$$Q(A10, C) \leftarrow Q(A10, C) + \alpha\left(r(A10) + \gamma \max_{a'} Q(A00, a') - Q(A10, C)\right)$$

$$\leftarrow -1 + 0.5\left(-1 + 0.5 \times 0 - (-1)\right)$$

$$\leftarrow -1$$

We have performed one iteration.

Example 5.

$f_1(s, a)$ = # of dirty squares

$f_2(s, a)$ = distance to nearest dirty square

Example 6.

Representation

$$S = S_1 S_2 S_3 \cdots S_n$$

where $S_i = 1$ if item is in knapsack

$S_i = 0$ if item is not in knapsack

Fitness function:

$$f(s) = \sum_{i=1}^{n} v_i \ (\text{if } s_i = 1) \quad \text{if } \sum_{i=1}^{n} w_i \ (\text{if } s_i = 1) \leq W$$

$$= 0 \quad \text{otherwise}$$

Genetic operator:

$$g(x, y) = x_1 \cdots x_j y_{j+1} \cdots y_n \quad \text{for random } 1 \leq j \leq n$$

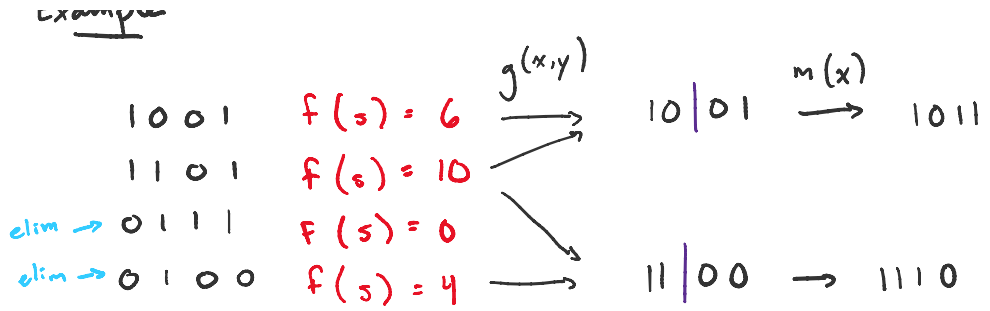
Mutation operator:

$$m(x) = x_1 \cdots x_{j-1} z x_{j+1} \cdots x_n \quad \text{for random } 1 \leq j \leq n$$

$z \in \{0, 1\}$ chosen randomly

Example

$g(x,y)$ $\quad$ $m(x)$



Example 7.

Compute P("hee")

$= P("e" | "he")\, P("e" | "h")\, P("h")$

$= P("e" | "e")\, P("e" | "h")\, P("h")$

$= \frac{count("ee")}{count("e")} \quad \frac{count("he")}{count("h")} \quad \frac{count("h")}{count}$

$= \frac{2}{6} \quad \frac{2}{2} \quad \frac{2}{15}$

$= \frac{2}{45}$

Example 8.

Vocabulary:

[i, scream, you, we, all, for, ice, cream, cold]

Occurrence vectors:

D1: [1, 1, 1, 0, 0, 0, 0, 0, 0]

D2: [0, 1, 0, 1, 1, 1, 1, 1, 0]

D3: [0, 0, 0, 0, 0, 0, 1, 1, 1]

Count vectors:

D1: [1, 2, 1, 0, 0, 0, 0, 0, 0]

D2: [0, 1, 0, 1, 1, 1, 1, 1 0]

D3: [0, 0, 0, 0, 0, 0, 2, 1, 1]

Term Frequency vectors:

D1: [1/4, 1/2, 1/4, 0, 0, 0, 0, 0, 0]
D2: [0, 1/6, 0, 1/6, 1/6, 1/6, 1/6, 1/6, 0]
D3: [0, 0, 0, 0, 0, 0, 1/2, 1/4, 1/4]

IDF:

[0.48, 0.18, 0.48, 0.48, 0.48, 0.48, 0.18, 0.18, 0.48]

TF - IDF vectors

D1: [0.12, 0.09, 0.12, 0, 0, 0, 0, 0, 0]
D2: [0, 0.03, 0, 0.08, 0.08, 0.08, 0.03, 0.03, 0]
D3: [0, 0, 0, 0, 0, 0, 0.09, 0.045, 0.12]