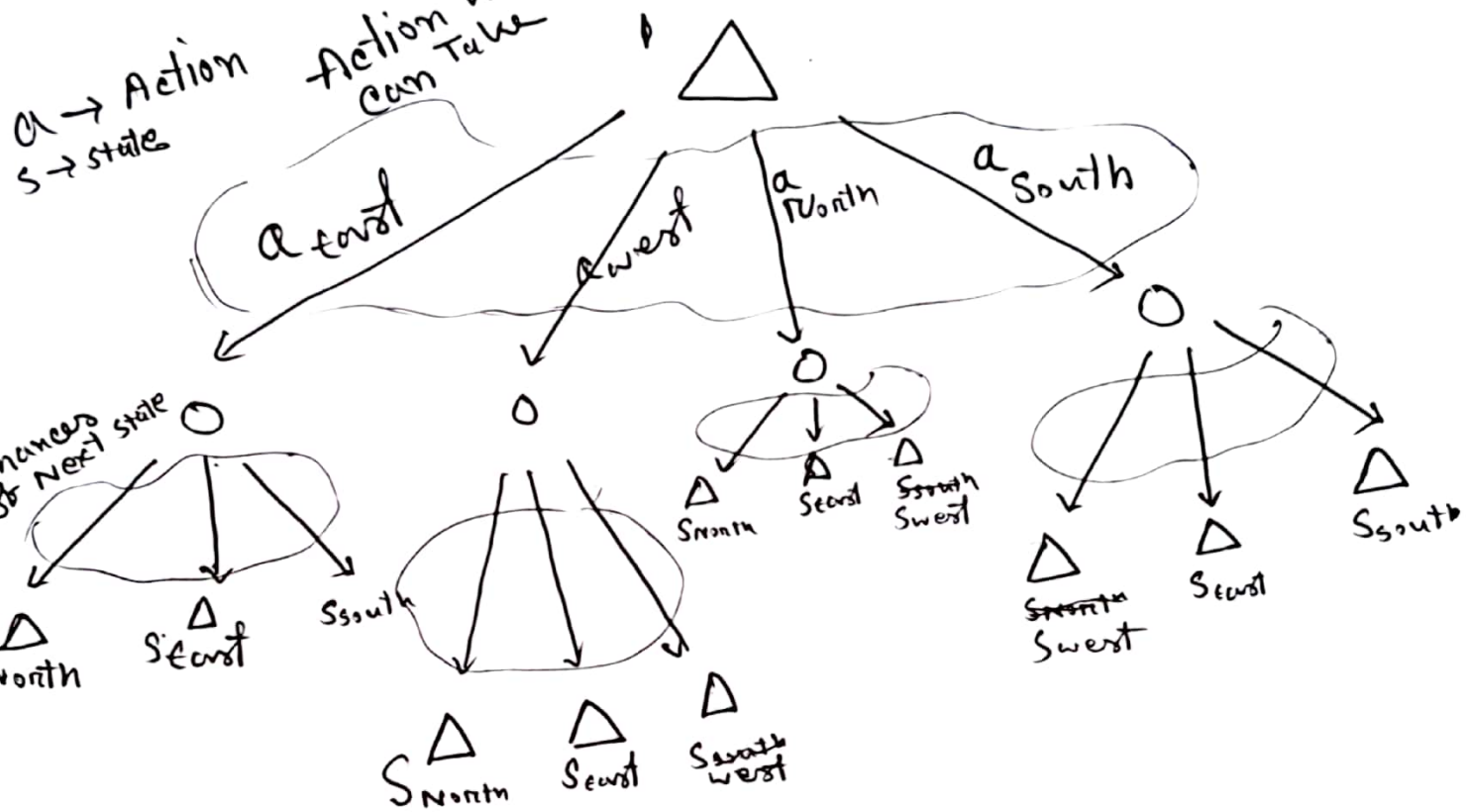
Tanvir Ahmed | SH-172-022

For Any Position On grid

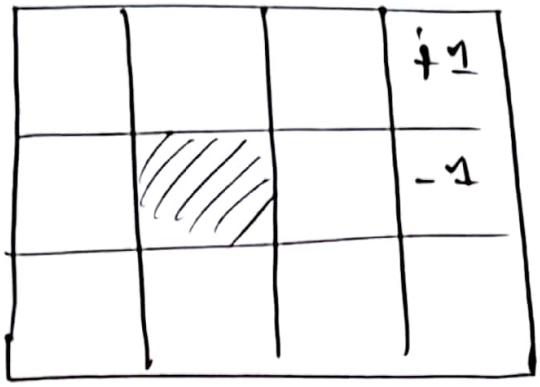
Noise = 0.2
$\gamma = 0.9$

a → Action
s → state

Action we can Take



(I'll use this template to solve ~~oth~~ ~~oth~~ all the states of grid)



$a \in A$

$A = [\text{East}, \text{West}, \text{North}, \text{South}]$

$$V_{i+1}(s) = \max_{a \in A} \sum_{s' \in S} P(s'|s,a)\left[R(s,a,s') + \gamma V_i(s')\right]$$

V_0

0	0	0	0
0		0	0
0	0	0	0

V_1

0	0	0	+1
0		0	-1
0	0	0	0

V_1

0	0	0	+1
0		0	-1
0	0	0	0

V_2

0	0	0.72	+1
0		0	-1
0	0	0	0

3 2 1 — 1 2 3 4

$V_2(3,3)$ ⟶ ~~best action~~

$= 0.8(0 + 0.9\times1) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times0) = 0.72$ ✓

$$\max \begin{cases} a_{east} = 0.8(0 + 0.9\times1) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times0) = 0.72 \\ a_{west} = 0.8(0 + 0.9\times0) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times0) = 0 \\ a_{north} = 0.8(0 + 0.9\times0) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times1) = 0.09 \\ a_{south} = 0.8(0 + 0.9\times0) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times1) = 0.09 \end{cases}$$

$= 0.72$ Dir: East

$V_2(2,3)$

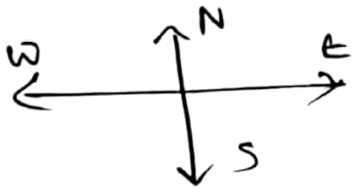
$$\max \begin{cases} a_{east} = 0 \\ a_{west} = 0 \\ a_{north} = 0 \\ a_{south} = 0 \end{cases}$$

$= 0$

$V_2(3,2)$

$$\max \begin{cases} a_{east} = 0.8(0 + 0.9\times-1) + 0 + 0 = -0.72 \\ a_{west} = 0 \\ a_{north} = 0.8(0 + 0.9\times0) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times-1) = -0.09 \\ a_{south} = 0.8(0 + 0.9\times0) + 0.1(0 + 0.9\times0) + 0.1(0 + 0.9\times-1) = -0.09 \end{cases}$$

$= 0$ Dir: West



V_2

0	0	0.72	+1
0		0	-1
0	0	0	0

→

V_3

0	0.52 →	0.78 →	+1
0		↑ 0.43	-1
0	0	0	0 ↓

3 2 1 — 1 2 3 4

$V_3(3,3)$

$= \max \begin{cases} a_{North} = 0.8(0+0.9\times0.72) + 0 + 0.1(0+0.9\times1) = 0.61 \\ a_{South} = 0+0+0.1(0+0.9\times1) = 0.09 \\ a_{East} = 0.1(0+0.9\times0.72)+0+0.8(0+0.9\times1) = 0.78 \\ a_{West} = 0+0+0.1(0+0.9\times0.72) = 0.0648 \end{cases}$

$= 0.78$ Dir: East

$V_3(2,3)$

$= \max \begin{cases} a_{North} = 0.1(0+0.9\times0.72)+0+0 = 0.07 \\ a_{West} = 0 = 0 \\ a_{South} = 0+0+0.1(0+0.9\times0.72) = 0.07 \\ a_{East} = 0.8(0+0.9\times0.72) = 0.52 \end{cases}$

$= 0.52$ Dir: East

$V_3(3,2)$

$= \max \begin{cases} a_{North} = 0.8(0+0.9\times0.72)+0.1(0+0.9\times-1)+0 = 0.43 \\ a_{South} = 0+0+0.1(0+0.9\times-1) = -0.09 \\ a_{East} = 0.1(0+0.72\times0.9)+0.8(0+0.9\times-1)+0 = -0.65 \\ a_{West} = 0+0+0.1(0+0.72\times0.9) = 0.0648 \end{cases}$

$= 0.43$ Dir: North

$v_3(3,1) =$

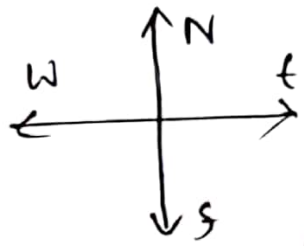
$$\max \begin{cases} a_{North} = 0+0+0 = 0 \\ a_{east} = 0+0+0 = 0 \\ a_{south} = 0+0+0 = 0 \\ a_{north} = 0+0+0 = 0 \end{cases}$$

$= 0$ Dir: None

$v_3(4,1)$

$$= \max \begin{cases} a_{north} = 0+0+0.8(0+0.0\times -1) = -0.72 \\ a_{south} = 0+0+0 = 0 \\ a_{east} = 0+0+0.1(0+0.9\times -1) = -0.09 \\ a_{west} = 0+0+0.1(0+0.9\times -1) = -0.09 \end{cases}$$

$= 0$ Dir: South



V_3

0	0.52	0.78	+1
0		0.43	-1
0	0	0	0

V_4

0.37 →	0.65 →	0.83 →	+1
0		0.51 ↑	-1
0	0	0.31 ↑	0 ↓

3 2 1 — 1 2 3 4

$V_4(3,3)$

$= \max \begin{cases} a_{north} = 0.2\times0.9\times0.78 + 0.1\times0.9\times1 + 0.1\times0.9\times0.52 = 0.7 \\ a_{south} = 0.8\times0.9\times0.43 + 0.1\times0.9\times1 + 0.1\times0.9\times0.52 = 0.45 \\ a_{east} = 0.8\times0.9\times0.78 + 0.8\times0.9\times1 + 0.1\times0.9\times0.43 = 0.83 \\ a_{west} = 0.8\times0.9\times0.52 + 0.1\times0.9\times0.78 + 0.1\times0.9\times0.43 = 0.48 \end{cases}$

≥ 0.83 Dir: East

$V_4(2,3) = \max \begin{cases} a_{north} = 0.2\times0.9\times0.52 + 0.1\times0.9\times0.78 + 0 = 0.44 \\ a_{south} = \cancel{0.1\times0.9\times0.52 + 0.1\times0.9\times0.52} \quad 0.2\times0.9\times0.52 + 0.1\times0.9\times0.78 = 0.44 \\ a_{east} = \cancel{0 + 0.2\times0.9\times0.52} \quad 0.8\times0.9\times0.78 + 0.1\times0.9\times0.52 + 0.1\times0.9\times0.52 = 0.65 \\ a_{west} = 0 + 0.1\times0.9\times0.52 + 0.1\times0.9\times0.52 \end{cases}$

≥ 0.09

≥ 0.65 Dir: East

$V_4(1,3) = \max \begin{cases} a_{north} = 0.1\times0.9\times0.52 = 0.05 \\ a_{south} = 0.1\times0.9\times0.52 = 0.05 \\ a_{east} = 0.8\times0.9\times0.52 = 0.37 \\ a_{west} = 0 \end{cases}$

$= 0.37$ Dir: East

$V_4(3,2) =$

$$\max \begin{cases} a_{North} = 0.78 \times 0.9 \times 0.8 + 0.1 \times 0.9 \times 0.13 + 0.1 \times 0.9 \times -1 = 0.51 \\ a_{South} = -0.05 \\ a_{West} = 0.33 \\ a_{East} = -0.65 \end{cases}$$

$= 0.51$ Dir: North

$V_4(3,1) =$

$$\max \begin{cases} a_{North} = 0.2 \times 0.9 \times 0.13 = 0.31 \\ a_{South} = 0 \\ a_{East} = 0.1 \times 0.9 \times 0.13 = 0.04 \\ a_{West} = 0.04 \end{cases}$$

$= 0.31$ Dir: North

$V_4(2,1) =$

$$\max \begin{cases} a_{North} = 0 \\ a_{South} = 0 \\ a_{East} = 0 \\ a_{West} = 0 \end{cases}$$

$= 0$ Dir: None

$V_4(4,1) =$

$$\max \begin{cases} a_{North} = 0.8 \times 0.9 \times -1 = -0.72 \\ a_{South} = 0 \\ a_{West} = 0.1 \times 0.9 \times 1 = -0.09 \\ a_{East} = 0.1 \times 0.9 \times -1 = -0.09 \end{cases}$$

$= 0$ Dir: South