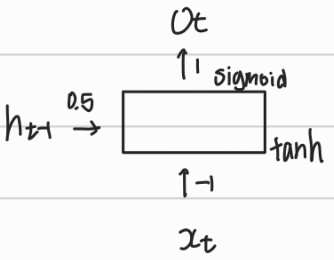
2020314482 인공지능융합전공 황선우

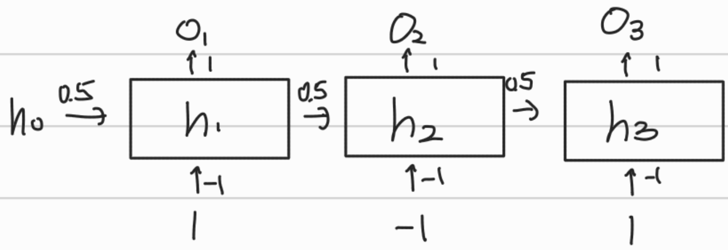
homework #10

*ipynb파일참조

1.



a. Synched many to many




```
#synched many to many
X = [1,-1,1]
h = torch.FloatTensor([0])
for i,x in enumerate(X):
  h = tanh(0.5*h + (-1)*x)
  o = sigmoid(h)
  print(f"o{i+1} = {o}")
```

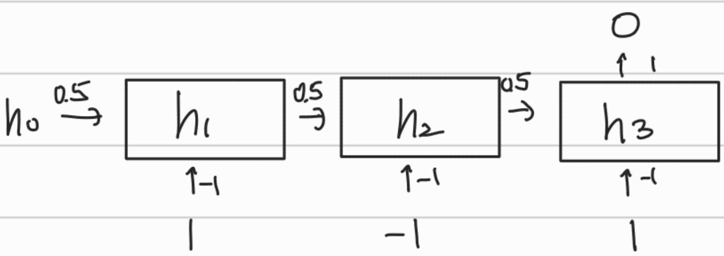
```
o1 = tensor([0.3183])
o2 = tensor([0.6343])
o3 = tensor([0.3498])
```

$O_1 = 0.3183$

$O_2 = 0.6343$

$O_3 = 0.3498$

b. many to one

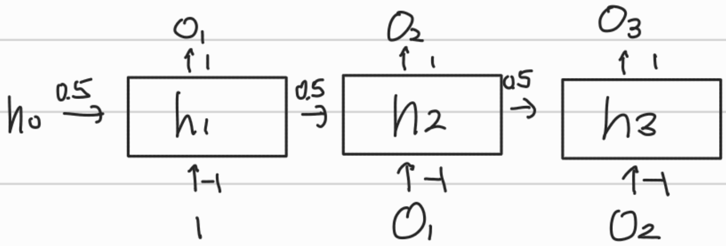



```
#many to one
X = [1,-1,1]
h = torch.FloatTensor([0])
for i,x in enumerate(X):
  h = tanh(0.5*h + (-1)*x)
  if i == len(X)-1:
    print(f"o = {sigmoid(h)}")
```

```
o = tensor([0.3498])
```

$O = 0.3498$

c. one to many




```
#one to many
X = 1
h = torch.FloatTensor([0])
for i in range(3):
  h = tanh(0.5*h + (-1)*X)
  X = sigmoid(h)
  print(f"o{i+1} = {X}")
```

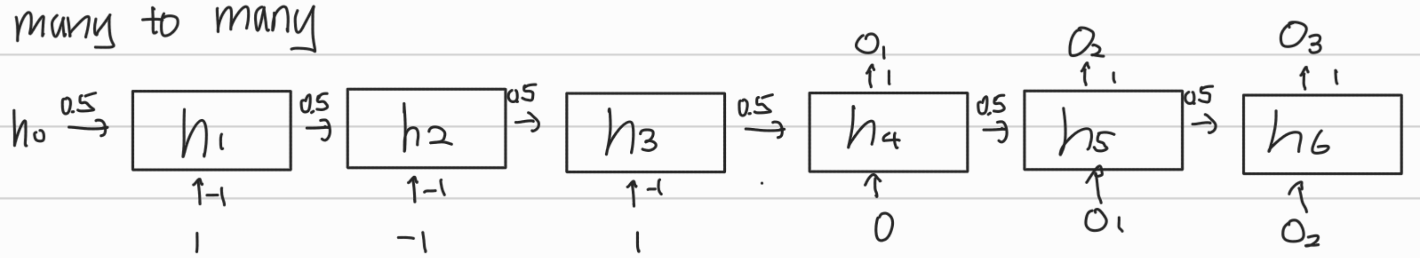
```
o1 = tensor([0.3183])
o2 = tensor([0.3535])
o3 = tensor([0.3600])
```

$O_1 = 0.3183$

$O_2 = 0.3535$

$O_3 = 0.3600$

d. many to many




```python
#many to many
X = [1,-1,1]
s = 0
h = torch.FloatTensor([0])
for x in X:
  h = tanh(0.5*h + (-1)*x)

x = s
for i in range(3):
  h = tanh(0.5*h + (-1)*x)
  x = sigmoid(h)
  print(f"o{i+1} = {x}")
```

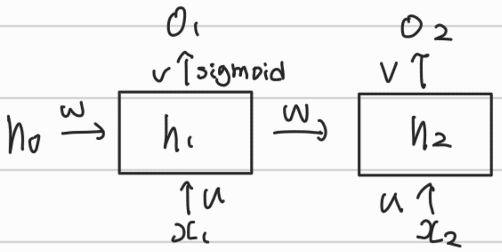
```
o1 = tensor([0.4255])
o2 = tensor([0.3730])
o3 = tensor([0.3636])
```

$O_1 = 0.4255$

$O_2 = 0.3730$

$O_3 = 0.3636$

2.



$$MSE = \frac{1}{2}\sum_{i=1}^{2}(t_i - O_i)^2$$

$(x_1, t_1), (x_2, t_2)$

$$h_1 = \tanh(h_0 \times w + x_1 \times u)$$
$$O_1 = \text{sigmoid}(h_1 \times V)$$
$$h_2 = \tanh(h_1 \times W + x_2 \times u)$$
$$O_2 = \text{Sigmoid}(h_2 \times V)$$

$$\frac{\partial E}{\partial w} = \sum_{i=1}^{2} \frac{\partial E}{\partial h_i}\frac{\partial h_i}{\partial w} = \frac{\partial E}{\partial h_1}\cdot\frac{\partial h_1}{\partial w} + \frac{\partial E}{\partial h_2}\cdot\frac{\partial h_2}{\partial w}$$

$$= \left(\frac{\partial E}{\partial O_1}\cdot\frac{\partial O_1}{\partial h_1} + \frac{\partial E}{\partial h_2}\frac{\partial h_2}{\partial h_1}\right)\cdot\frac{\partial h_1}{\partial w} + \frac{\partial E}{\partial h_2}\cdot\frac{\partial h_2}{\partial w}$$

$$= \left(\frac{\partial E}{\partial O_1}\cdot\frac{\partial O_1}{\partial h_1} + \frac{\partial E}{\partial O_2}\cdot\frac{\partial O_2}{\partial h_2}\cdot\frac{\partial h_2}{\partial h_1}\right)\cdot\frac{\partial h_1}{\partial w} + \frac{\partial E}{\partial O_2}\cdot\frac{\partial O_2}{\partial h_2}\cdot\frac{\partial h_2}{\partial w}$$

$$= (O_1 - t_1)\cdot V\cdot O_1(1-O_1)\cdot h_0\cdot(1-h_1)(1+h_1) +$$
$$(O_2 - t_2)\cdot V\cdot O_2(1-O_2)\cdot\left(w\cdot(1-h_2)(1+h_2)\cdot h_0(1-h_1)(1+h_1) + h_1(1-h_2)(1+h_2)\right)$$

$$= (O_1 - t_1)\cdot V\cdot O_1(1-O_1)\cdot h_0\cdot(1-h_1)(1+h_1) +$$
$$(O_2 - t_2)\cdot V\cdot O_2(1-O_2)\cdot(1-h_2)(1+h_2)\left(W\cdot h_0(1-h_1)(1+h_1) + h_1\right)$$

3.

$$m_1 = \begin{bmatrix} -1 & 2 \end{bmatrix} \times \begin{bmatrix} 1 \\ 1 \end{bmatrix} = 1 \qquad s_1 = \frac{\exp(m_1)}{\sum_{j=1}^{3} \exp(m_j)} = 0.4683$$

$$m_2 = \begin{bmatrix} 1 & 0 \end{bmatrix} \times \begin{bmatrix} 1 \\ 1 \end{bmatrix} = 1 \qquad s_2 = \frac{\exp(m_2)}{\sum_{j=1}^{3} \exp(m_j)} = 0.4683$$

$$m_3 = \begin{bmatrix} 0 & -1 \end{bmatrix} \times \begin{bmatrix} 1 \\ 1 \end{bmatrix} = -1 \qquad s_3 = \frac{\exp(m_3)}{\sum_{j=1}^{3} \exp(m_j)} = 0.0634$$

$$z = x_1 \times s_1 + x_2 \times s_2 + x_3 \times s_3 = (0, 0.8732)$$