Recurrent Neural Network□RNN□

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1. □□□□□□□□□x_t□□□□□□□□□□□h_{t-1}
2. □□□□□□□□□□□□□h_t□□□□□□□□□□□
3. □□□□□□□□h_t□□
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Long Short-term Memory(LSTM)

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1. □□□□ (Cell State)□
   - □□□□□□□□□□□□□
   - □□□C_t
2. □□□□□□□
   - **□□□ (Forget Gate)**□□□□□□□□□□□□□□□
   - **□□□ (Input Gate)**□□□□□□□□□□□□□□□
   - **□□□ (Output Gate)**□□□□□□□□□□□□□□□
3. □□□□ (Hidden State)□
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   - □□□h_t

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$\odot$□□□□□□□□□□□□□□□□□□

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1. □□□□□

$$ f_t = \sigma(W_f \cdot [h_{t-1},x_t] + b_i) $$

□□□

- W_f□□□□□□□□□□□□□□□b_f□□□
- f_t□□□□□□□□□□□□□□□□□□C_t□□□□

2. □□□□□

$$ i_t = \sigma(W_i\cdot [h_{t-1,x_t}] + b_i) \ \tilde{C_t} = tanh(W_C\cdot [h_{t -1},x_t]+ b_C) $$

□□□

- $W_i□W_C$□□□□□□□□□□□□
- $\tilde{C_t}$□□□□□
- i_t□□□□□□□□□□□$\tilde{C_t}$□□□□□C_t□□□

3. □□□□□□

$$ C_t = f_t \odot C_{t-1} + i_t \odot \tilde{C_t} $$

- f_t□□□□□□□□□□□□□□□□□□□

4. □□□□□

$$ o_t = \sigma(W_o\cdot [h_{t-1,x_t}] + b_o) $$

□□□

- W_o□□□□□□□

5. □□□□□□□□□□□□□□

$$ h_t = o_t \odot tanh(C_t) $$

□□□

- o_t□□□□□□□□C_t□□□□□

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□□

LSTM (□□□□□□□□) □□□□□□□□□RNN□□□□□□□□□LSTM□□□□□□□□□□□□□□□□□□□

1. □□□□ **(Cell State)** - LSTM□□□□□□□□□□□□"□□□□"□□□
2. □□□□- LSTM□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
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4. □□□□□□□ - LSTM□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

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GRU□□□□□□□□□

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1. □□□□**update gate**□

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[illegible] $$ z_t = \sigma(W_z \cdot [h_{t-1},x_t]) $$

- W_z[illegible]
- z_t[illegible]1[illegible]
- z_t[illegible]0[illegible]

2. [illegible]**reset gate**[illegible]

[illegible]h_{t-1} $$ r_t = \sigma(W_r \cdot [h_{t-1},x_t]) $$

- W_r[illegible]
- r_t[illegible]0[illegible]h_{t-1}[illegible]

[illegible]

1. [illegible]

[illegible]h_{t-1}[illegible]h_t[illegible] $$ z_t = \sigma(W_z \cdot [h_{t-1},x_t]) $$

2. [illegible]

[illegible] $$ r_t = \sigma(W_r \cdot [h_{t-1},x_t]) $$

3. [illegible]

[illegible] x_t [illegible] $h_{t−1}$[illegible]r_t[illegible] $$ \tilde{h_t} = tanh(W\cdot [r_t \odot h_{t-1},x_t]) $$

4. [illegible]

[illegible] z_t[illegible] h_{t-1} [illegible]$\tilde{h_t}$ [illegible] $$ h_t = (1 - z_t) \odot h_{t-1} + z_t \odot \tilde{h_t} $$

Slot Filling[illegible]

[illegible]

1. [illegible]"[illegible]"[illegible]"[illegible]"[illegible]"[illegible]"[illegible]"[illegible]"[illegible]
2. [illegible]
    - [illegible]

[illegible]

[illegible]

1. [illegible]1[illegible]
2. [illegible]
3. [illegible]ReLU[illegible]1[illegible]

[illegible]

1. [illegible]1[illegible]
2. [illegible]RNN[illegible]sigmoid[illegible]tanh[illegible]0[illegible]
3. [illegible]

Connectionist Temporal Classification[illegible]

CTC[illegible]

[illegible]

[illegible]“hello”[illegible]CTC [illegible]

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CTC Loss □□□□“□□□□”□□□ loss □□□□□□