Module 16.2: Applications of Encoder Decoder models

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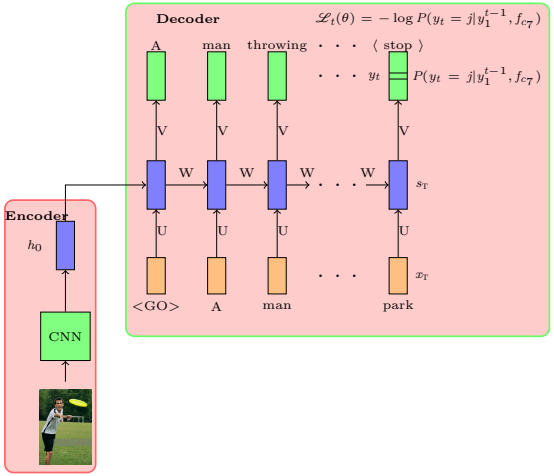

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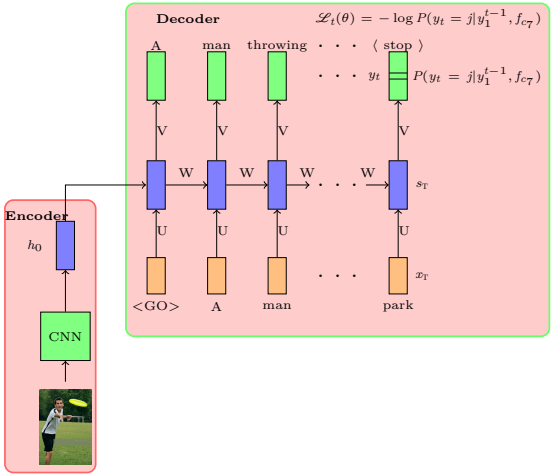

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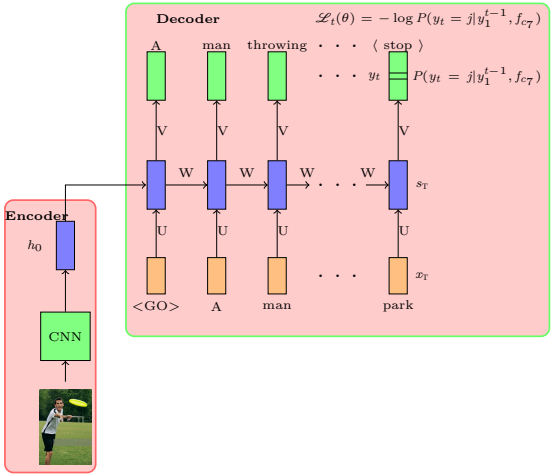

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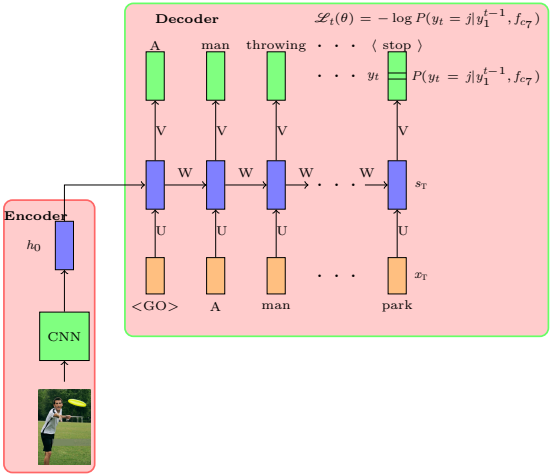

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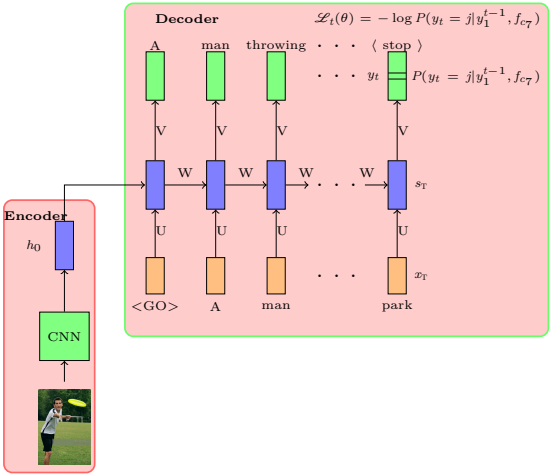

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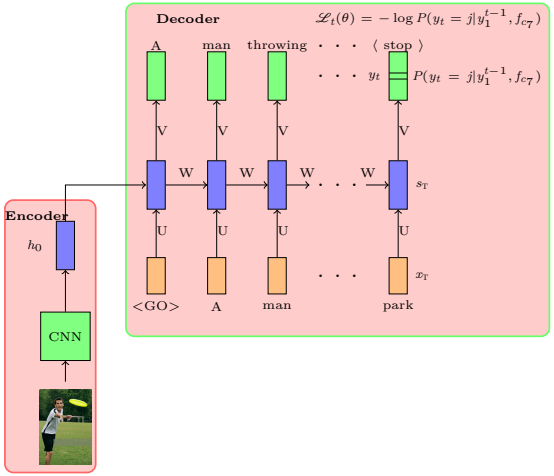

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- **Algorithm:** Gradient descent with backpropagation

o/p : The ground is wet

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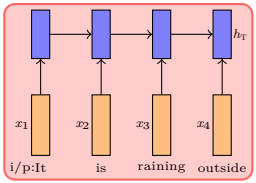

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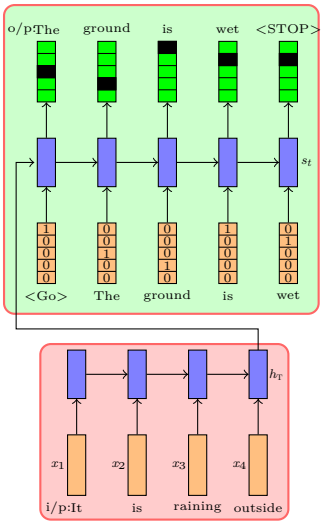

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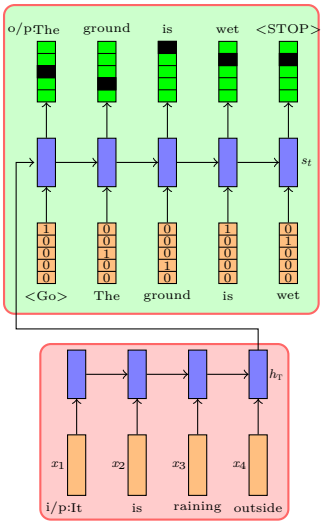

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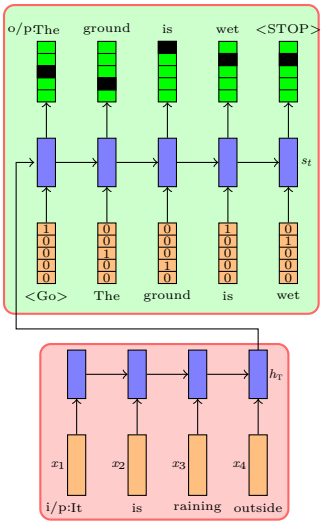

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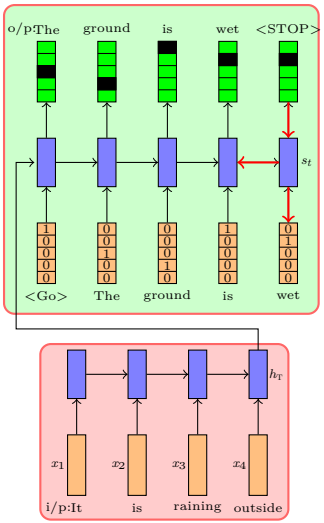

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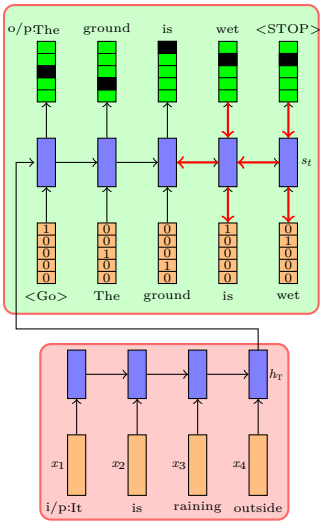

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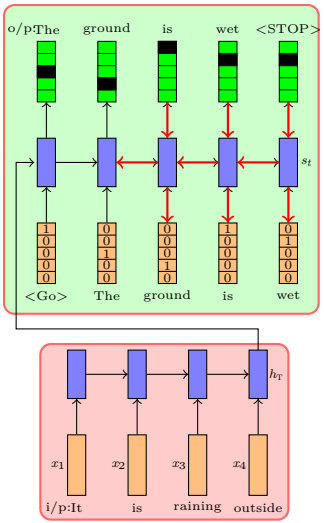

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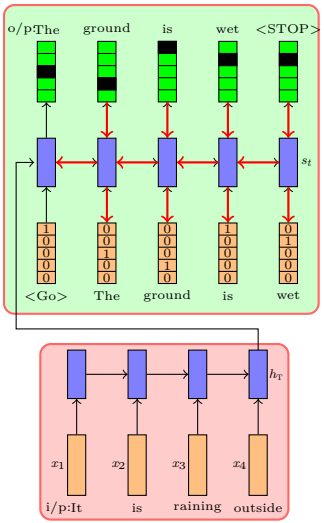

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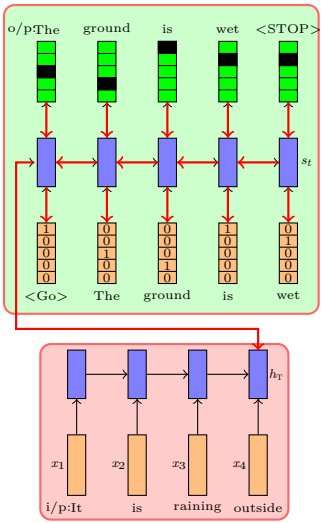

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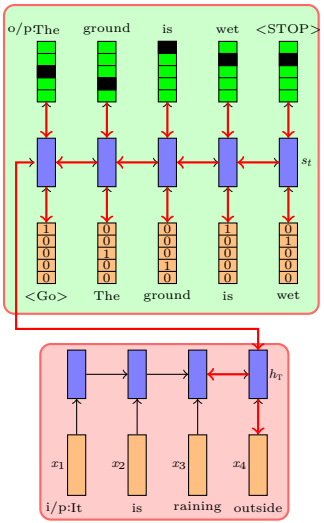

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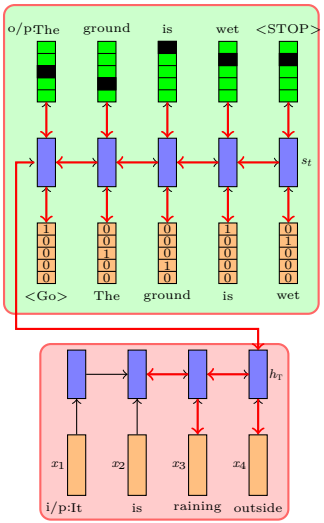

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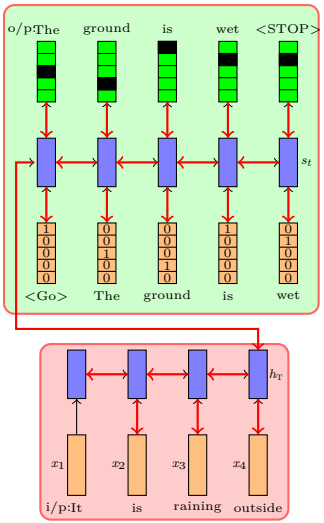

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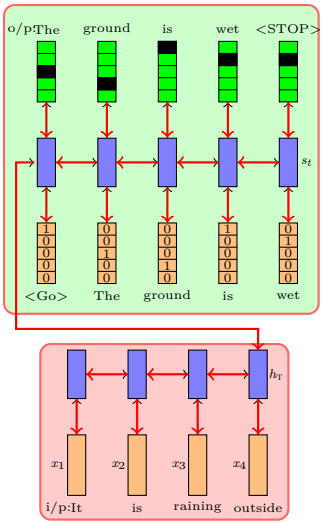

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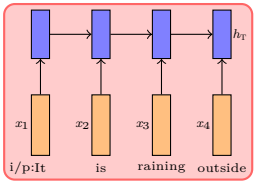

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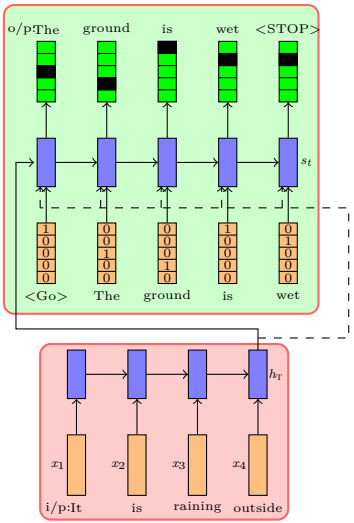

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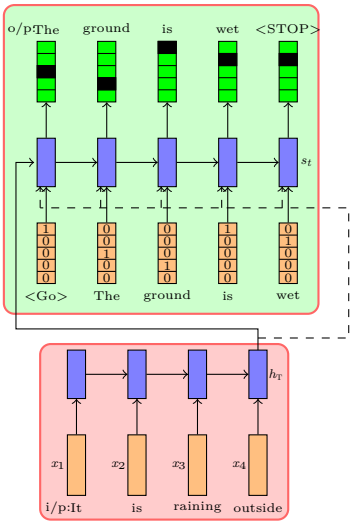
o/p : The ground is wet



i/p : It is raining outside

- **Task:** Textual entailment
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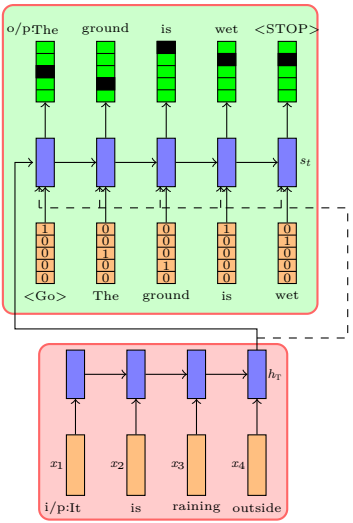

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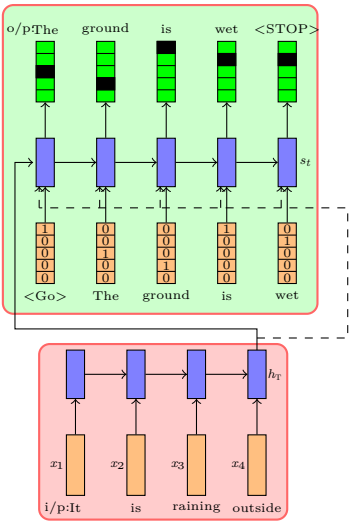

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o/p : Mein ghar ja raha hoon

- **Task:** Machine translation

i/p : I am going home

o/p : Mein ghar ja raha hoon

- **Task:** Machine translation
- **Data:** $\{x_i = source_i,\ y_i = target_i\}_{i=1}^{N}$

i/p : I am going home

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i/p : I am going home

o/p : Mein ghar ja raha hoon

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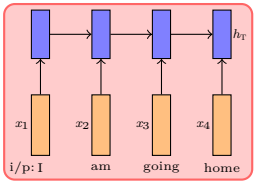
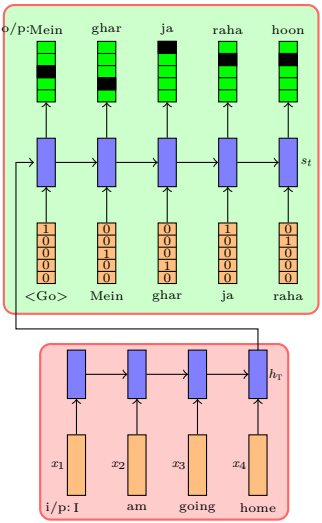


i/p : I am going home

o/p : Mein ghar ja raha hoon



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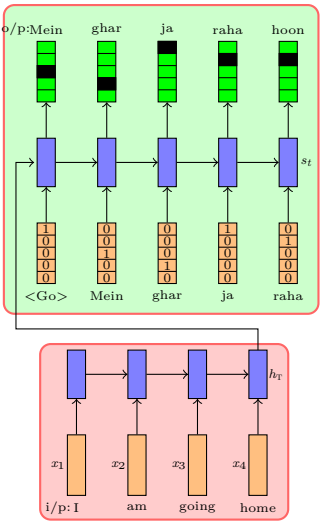

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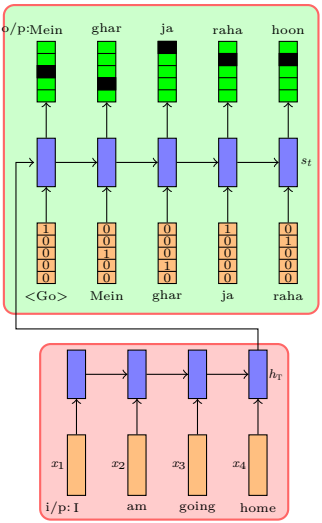

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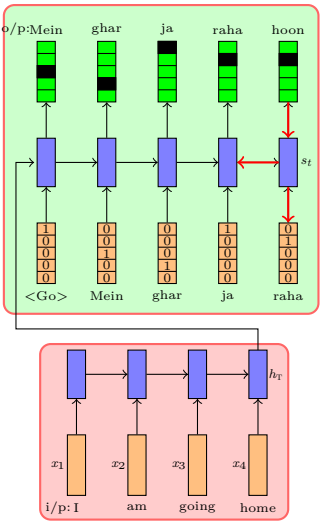

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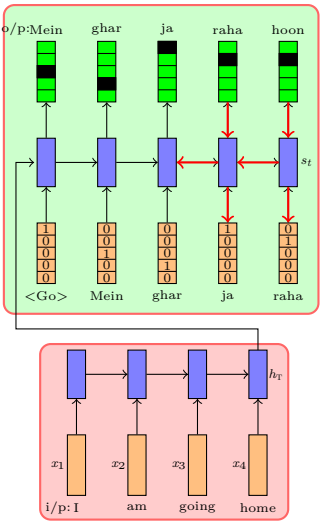

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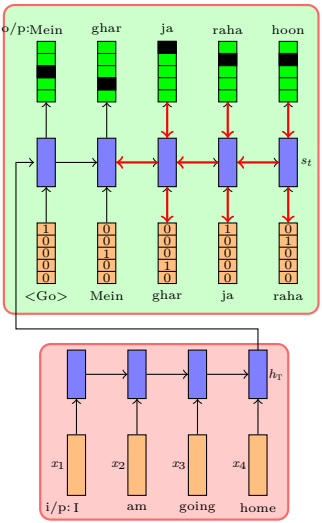

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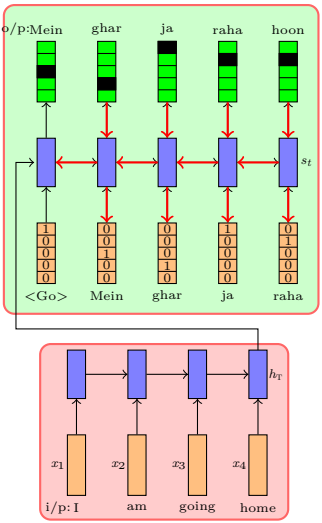

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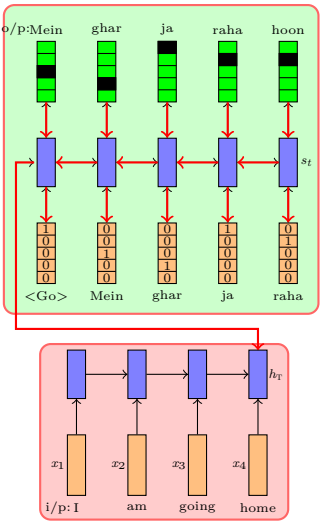

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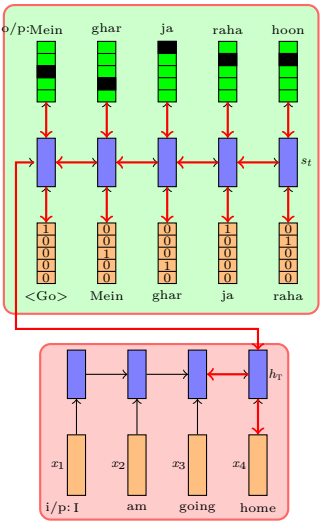

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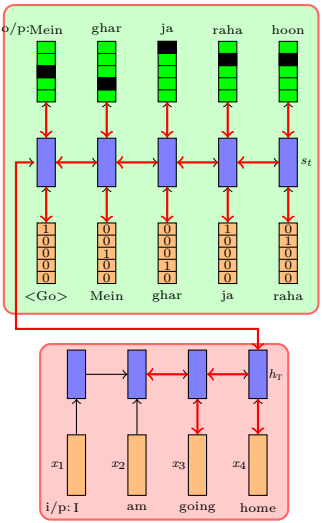

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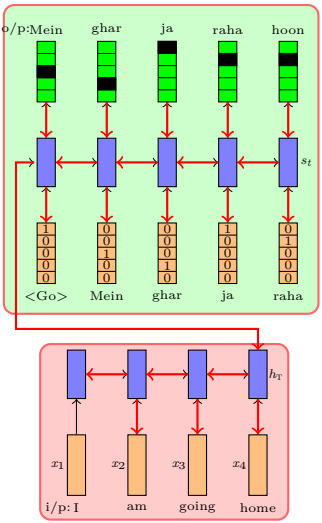

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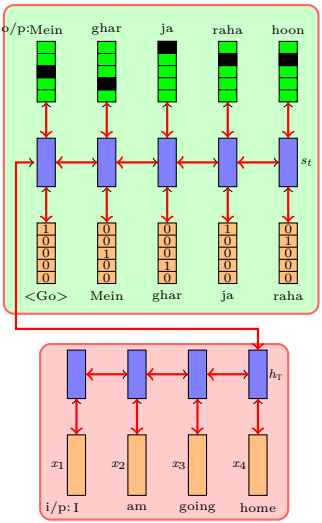

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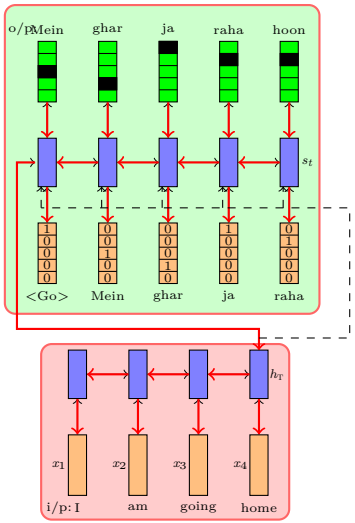

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o/p : इ ं ड ि य ा

- **Task:** Transliteration

i/p : I N D I A

o/p : इ ं ड ि य ा

- **Task:** Transliteration
- **Data:** $\{x_i = srcword_i,\ y_i = tgtword_i\}_{i=1}^{N}$

i/p : I N D I A

o/p : इ ं ड ि य ा

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i/p : I N D I A

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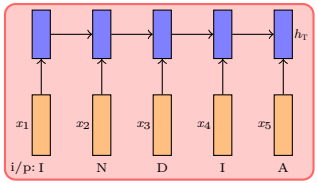

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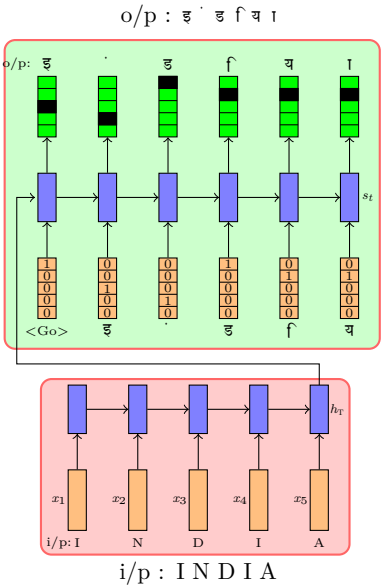

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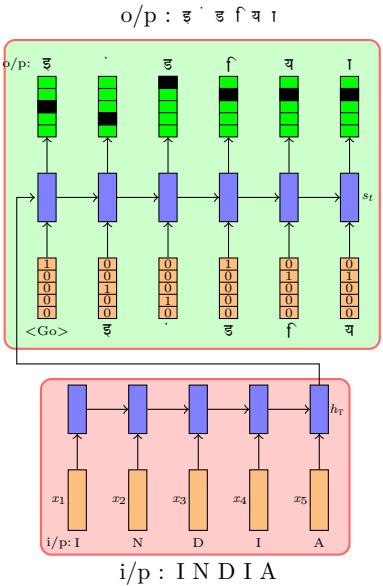


- **Task:** Transliteration
- **Data:** $\{x_i = srcword_i,\ y_i = tgtword_i\}_{i=1}^{N}$
- **Model (Option 1):**
  - **Encoder:**

$$h_t = RNN(h_{t-1}, x_{it})$$

  - **Decoder:**

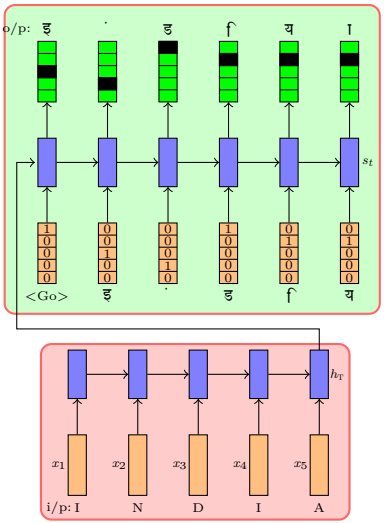
$$s_0 = h_T \quad (T \text{ is length of input})$$

$$s_t = RNN(s_{t-1}, e(\hat{y}_{t-1}))$$

$$P(y_t | y_1^{t-1}, x) = softmax(Vs_t + b)$$

- **Parameters:** $U_{dec},\ V,\ W_{dec},\ U_{enc},\ W_{enc}, b$

o/p : इ ं ड ि य ा



i/p : I N D I A

- **Task:** Transliteration
- **Data:** $\{x_i = srcword_i,\ y_i = tgtword_i\}_{i=1}^{N}$
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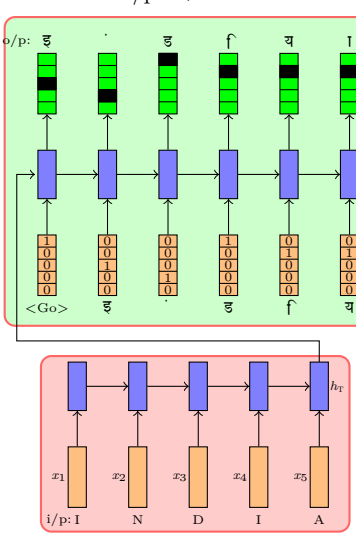
- **Parameters:** $U_{dec},\ V,\ W_{dec},\ U_{enc},\ W_{enc}, b$
- **Loss:**

$$\mathscr{L}(\theta) = \sum_{i=1}^{T} \mathscr{L}_t(\theta) = -\sum_{t=1}^{T} \log P(y_t = \ell_t|y_1^{t-1}, x)$$



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- **Parameters:** $U_{dec},\ V,\ W_{dec},\ U_{enc},\ W_{enc}, b$
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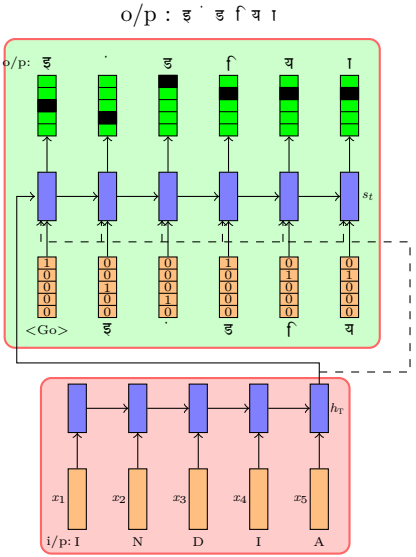
- **Algorithm:** Gradient descent with backpropagation



- **Task:** Transliteration
- **Data:** $\{x_i = srcword_i,\ y_i = tgtword_i\}_{i=1}^{N}$
- **Model (Option 2):**
  - **Encoder:**

$$h_t = RNN(h_{t-1}, x_{it})$$

  - **Decoder:**

$$s_0 = h_T \quad (T \text{ is length of input})$$
$$s_t = RNN(s_{t-1}, [e(\hat{y}_{t-1}), h_T])$$
$$P(y_t | y_1^{t-1}, x) = softmax(Vs_t + b)$$

- **Parameters:** $U_{dec},\ V,\ W_{dec},\ U_{enc},\ W_{enc}, b$
- **Loss:**

$$\mathscr{L}(\theta) = \sum_{i=1}^{T} \mathscr{L}_t(\theta) = -\sum_{t=1}^{T} \log P(y_t = \ell_t | y_1^{t-1}, x)$$

- **Algorithm:** Gradient descent with backpropagation

O/p: White

- **Task:** Image Question Answeing

Question: What is the bird's color

O/p: White

- **Task:** Image Question Answeing
- **Data:** $\{x_i = \{I, q\}_i,\ y_i = Answer_i\}_{i=1}^{N}$

Question: What is the bird's color

O/p: White

- **Task:** Image Question Answeing
- **Data:** $\{x_i = \{I, q\}_i,\ y_i = Answer_i\}_{i=1}^{N}$
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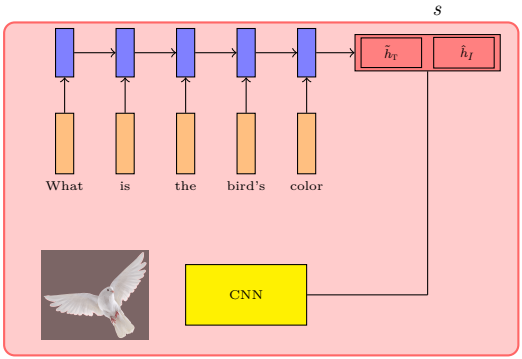
Question: What is the bird's color

O/p: White



Question: What is the bird's color

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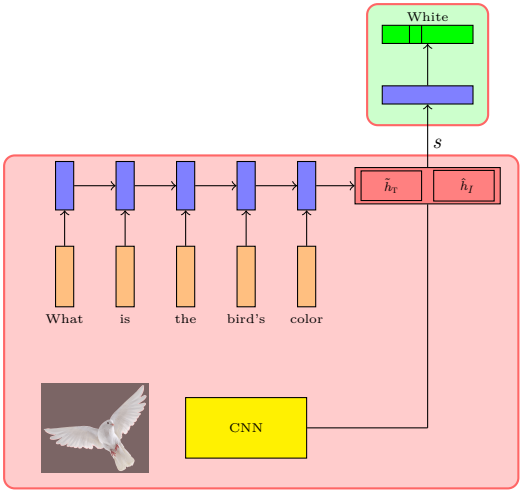
- **Model:**
  - **Encoder:**

$$\hat{h}_I = CNN(I),\ \tilde{h}_t = RNN(\tilde{h}_{t-1}, q_{it})$$

$$s = [\tilde{h}_T; \hat{h}_I]$$

O/p: White



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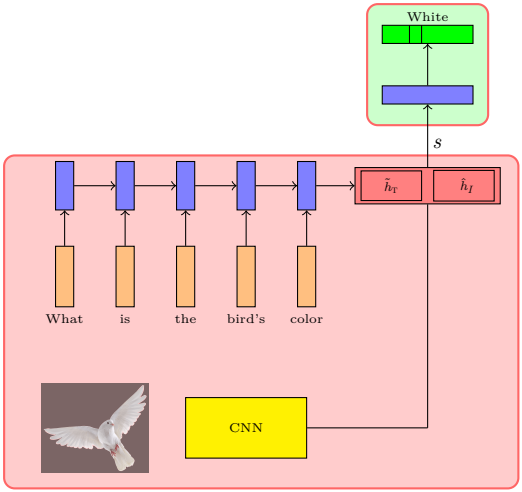
    $$s = [\tilde{h}_T; \hat{h}_I]$$
  - **Decoder:**

    $$P(y|q, I) = softmax(Vs + b)$$

O/p: White



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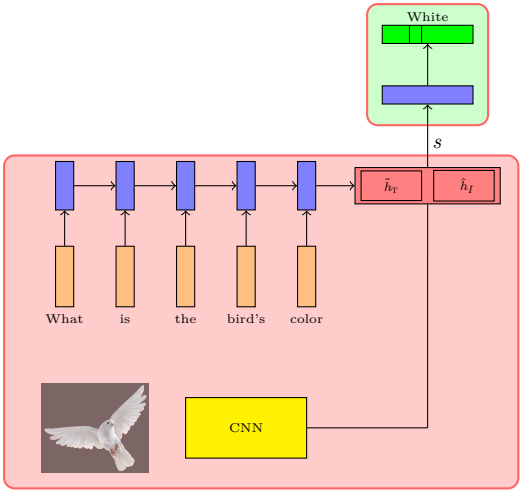
- **Parameters:** $V,\ b,\ U_q,\ W_q,\ W_{conv}, b$

O/p: White



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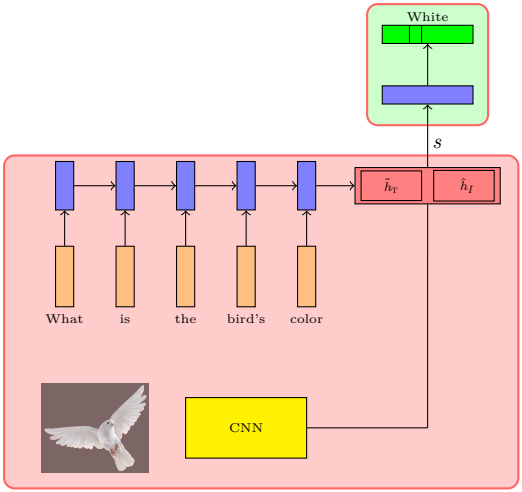
  $$\mathscr{L}(\theta) = -\log P(y = \ell | I, q)$$

O/p: White



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- **Algorithm:** Gradient descent with backpropagation

o/p : India won
the world cup

- **Task:** Document Summarization

i/p : India beats Srilanka to win ICC WC 2011.
Dhoni and Gambhir's half centuries help beat SL

o/p : India won the world cup

- **Task:** Document Summarization
- **Data:** $\{x_i = Document_i, y_i = Summary_i\}_{i=1}^{N}$

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o/p : India won the world cup

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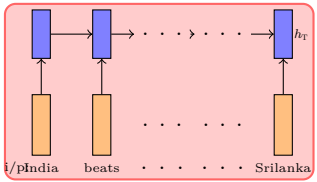
  - **Encoder:**

$$h_t = RNN(h_{t-1}, x_{it})$$



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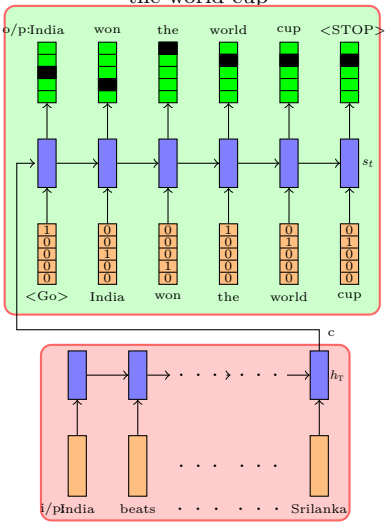

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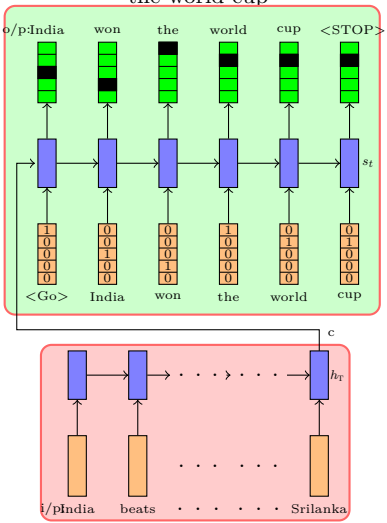
o/p : India won the world cup



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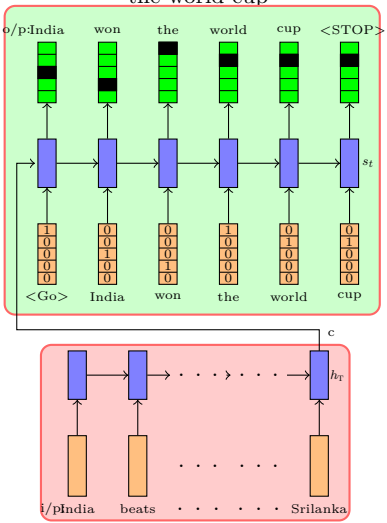
- **Parameters:** $U_{dec},\ V,\ W_{dec},\ U_{enc},\ W_{enc}, b$

o/p : India won the world cup



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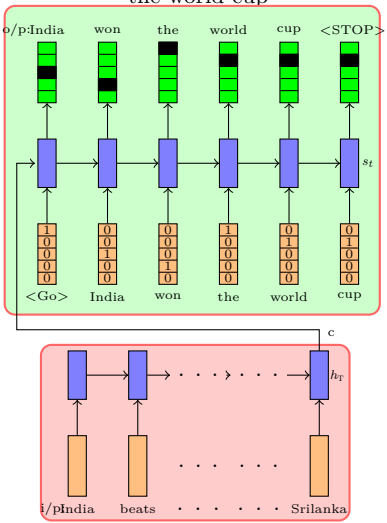
o/p : India won the world cup



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- **Algorithm:** Gradient descent with backpropagation

o/p : A man walking on a rope

- **Task:** Video Captioning



. . .


o/p : A man walking on a rope

- **Task:** Video Captioning
- **Data:** $\{x_i = video_i,\ y_i = desc_i\}_{i=1}^{N}$



. . .


o/p : A man walking on a rope

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- **Model:**



. . .


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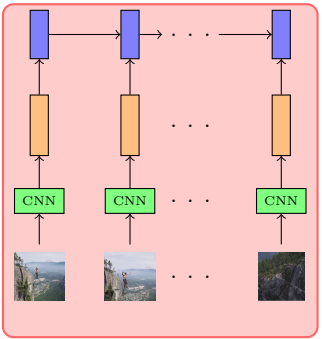

- **Task:** Video Captioning
- **Data:** $\{x_i = video_i,\ y_i = desc_i\}_{i=1}^{N}$
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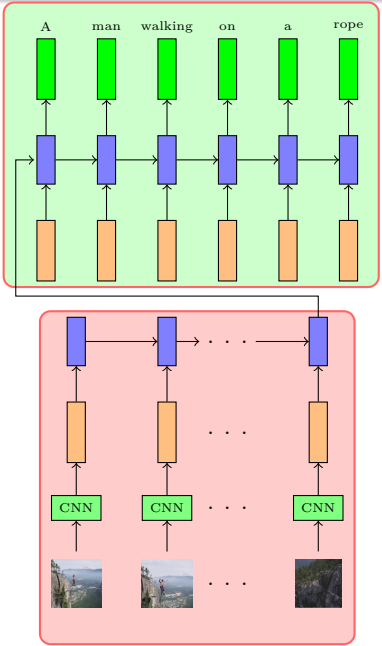

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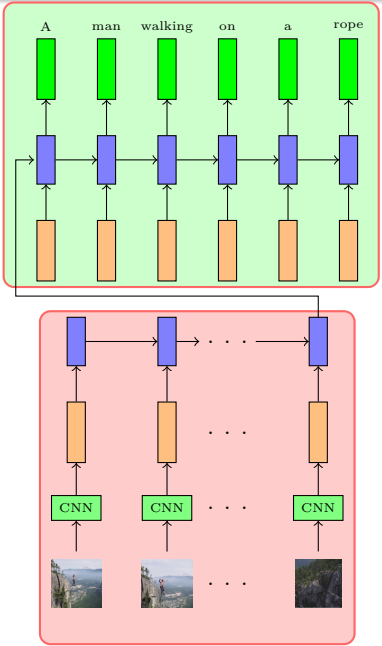

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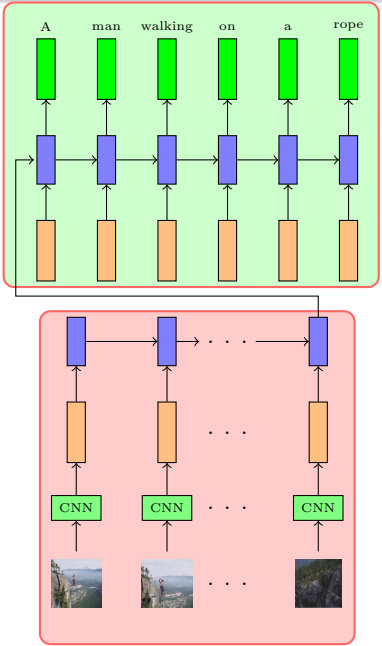
- **Parameters:** U_{dec}, W_{dec}, V, b, W_{conv}, U_{enc}, W_{enc}, b



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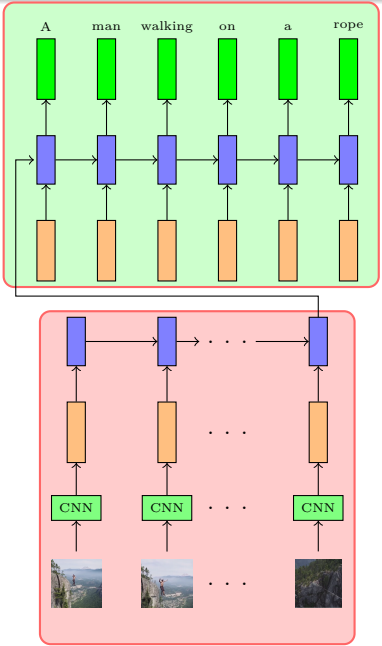

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o/p: Surya Namaskar

- **Task:** Video Classification

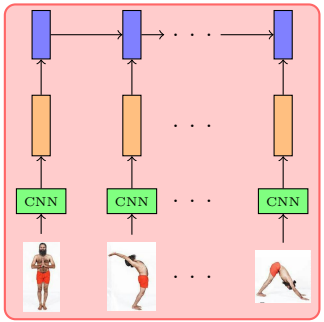
o/p: Surya Namaskar

- **Task:** Video Classification
- **Data:** $\{x_i = Video_i,\ y_i = Activity_i\}_{i=1}^{N}$

o/p: Surya Namaskar

- **Task:** Video Classification
- **Data:** $\{x_i = Video_i,\ y_i = Activity_i\}_{i=1}^{N}$
- **Model:**

o/p: Surya Namaskar



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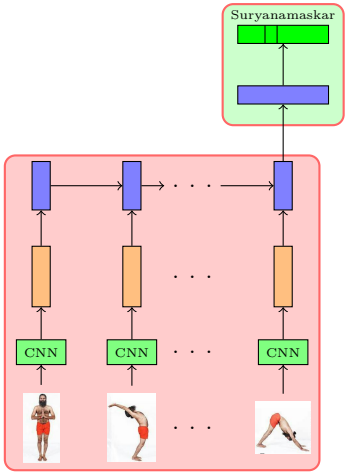

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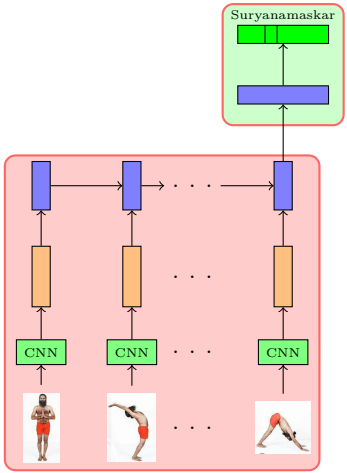
o/p: Surya Namaskar



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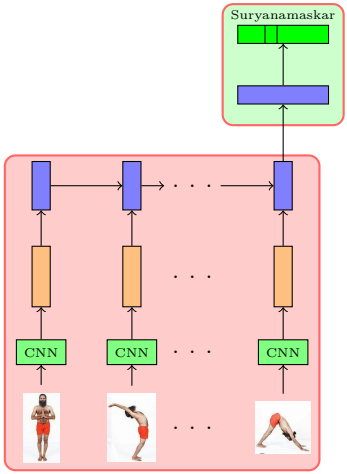
- **Parameters:** $V,\ b,\ W_{conv},\ U_{enc},\ W_{enc}, b$

o/p: Surya Namaskar



- **Task:** Video Classification
- **Data:** $\{x_i = Video_i,\ y_i = Activity_i\}_{i=1}^{N}$
- **Model:**
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- **Parameters:** $V,\ b,\ W_{conv},\ U_{enc},\ W_{enc}, b$
- **Loss:**

$$\mathscr{L}(\theta) = -\log P(y = \ell | Video)$$

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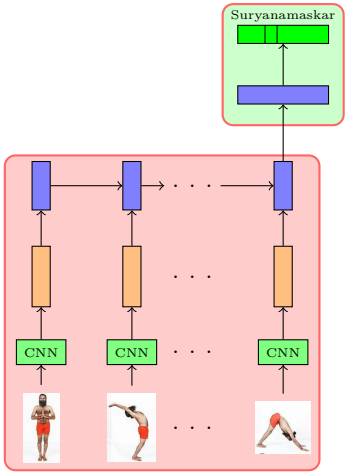

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o/p: I am fine

- **Task:** Dialog

i/p: How are you

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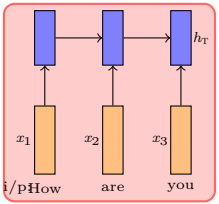

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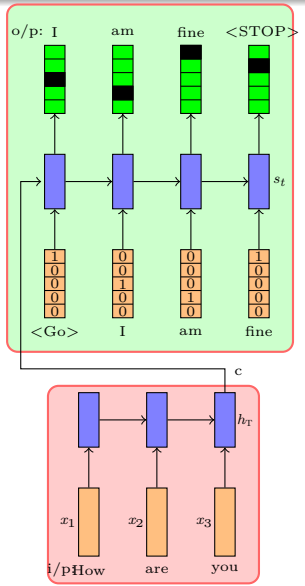

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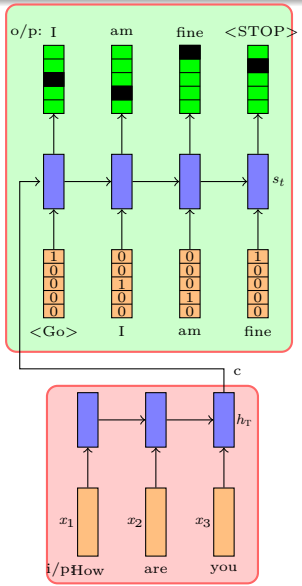

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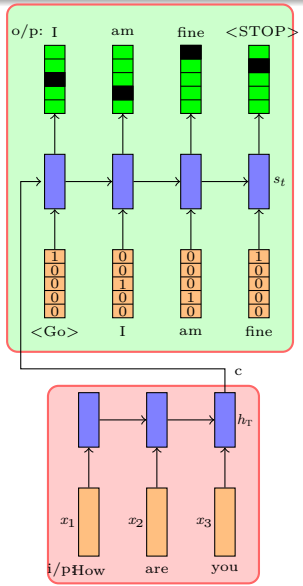

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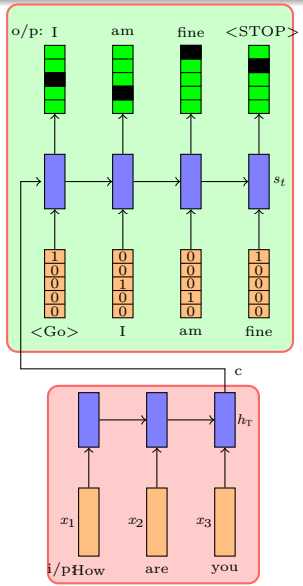

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- Encoder decoder models can be made even more expressive by adding an "attention" mechanism
- We will first motivate the need for this and then explain how to model it