Deep Learning for Computer Vision

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Mehta Family School of Data Science and Artificial Intelligence
IIT Guwahati
Aug-Dec 2022

So far in the class..

- Feedforward NNs

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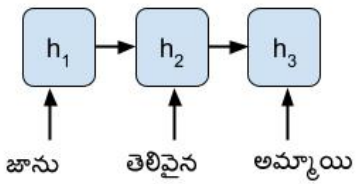
- Feedforward NNs
- RNNs

Sequence-to-Sequence tasks using RNNs

Input sequence: $x_1, x_2, \ldots x_T$

Input sequence: $y_1, y_2, \ldots y_{T'}$

Encoder: $h_t = E(x_t, h_{t-1})$



Sequence to sequence learning by Sutskever et al. NeurIPS 2014

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Last hidden state $h_T \rightarrow$ Initial state of the Decoder
S_0 and the context information C
E.g. $S_0 \leftarrow h_T$ + dense layers, and $C \leftarrow h_T$

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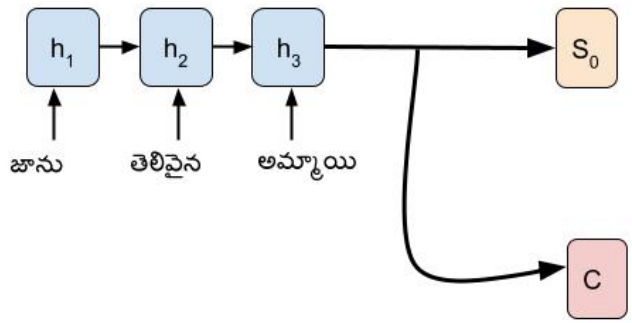

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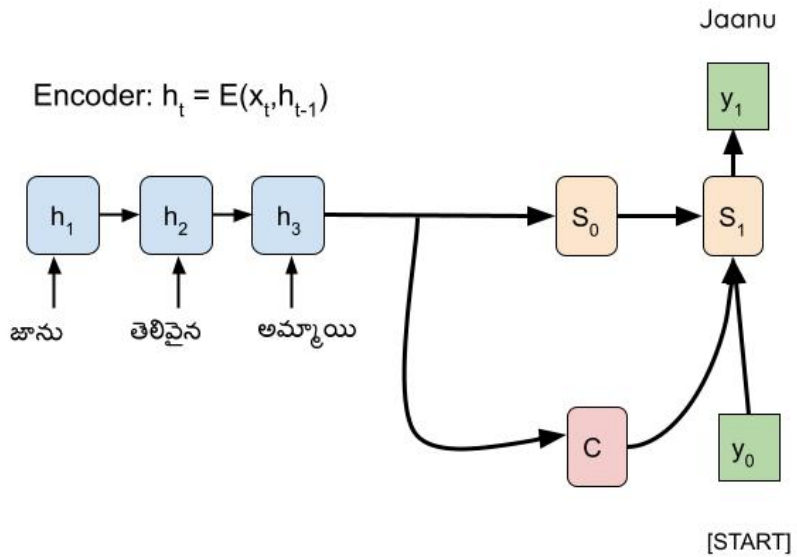

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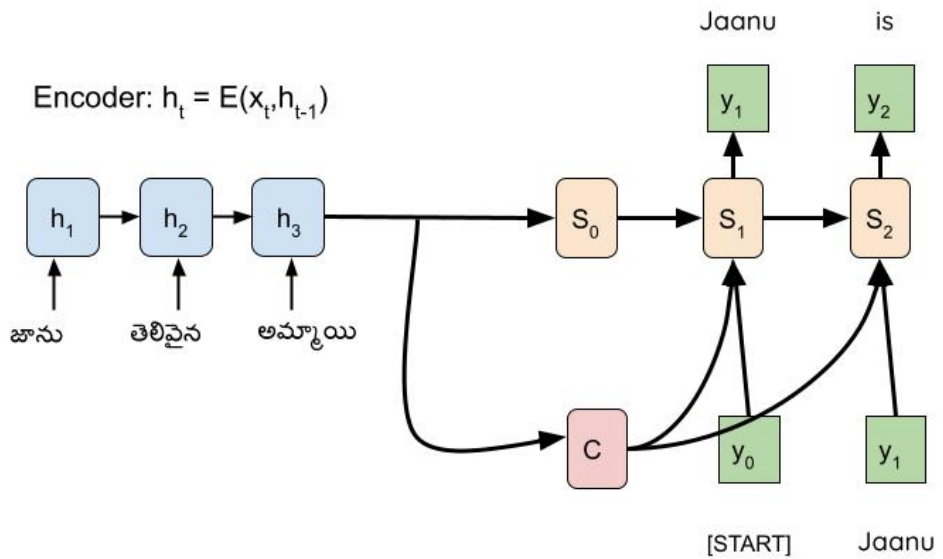

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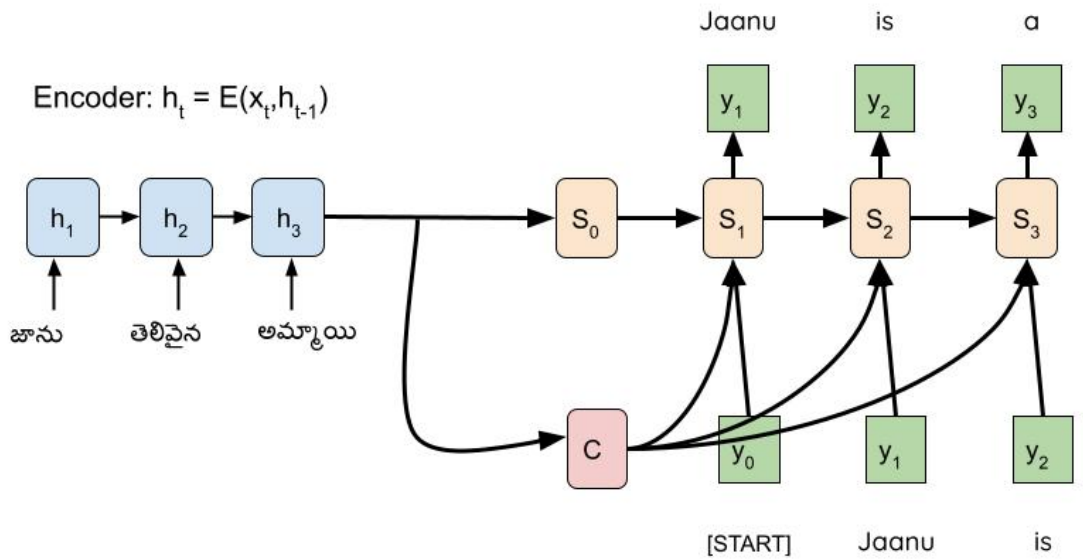

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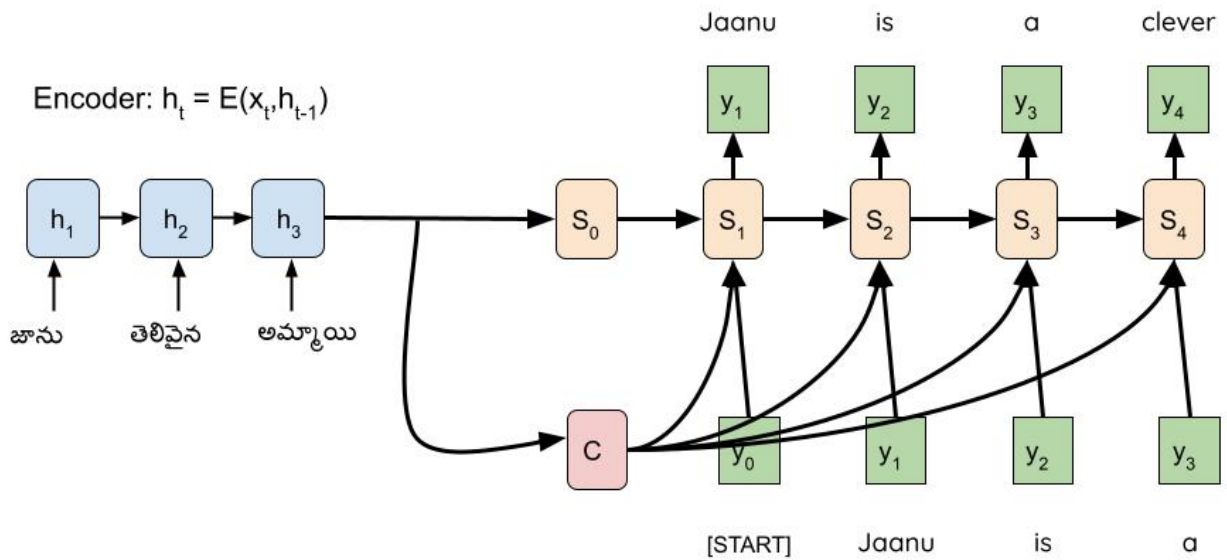

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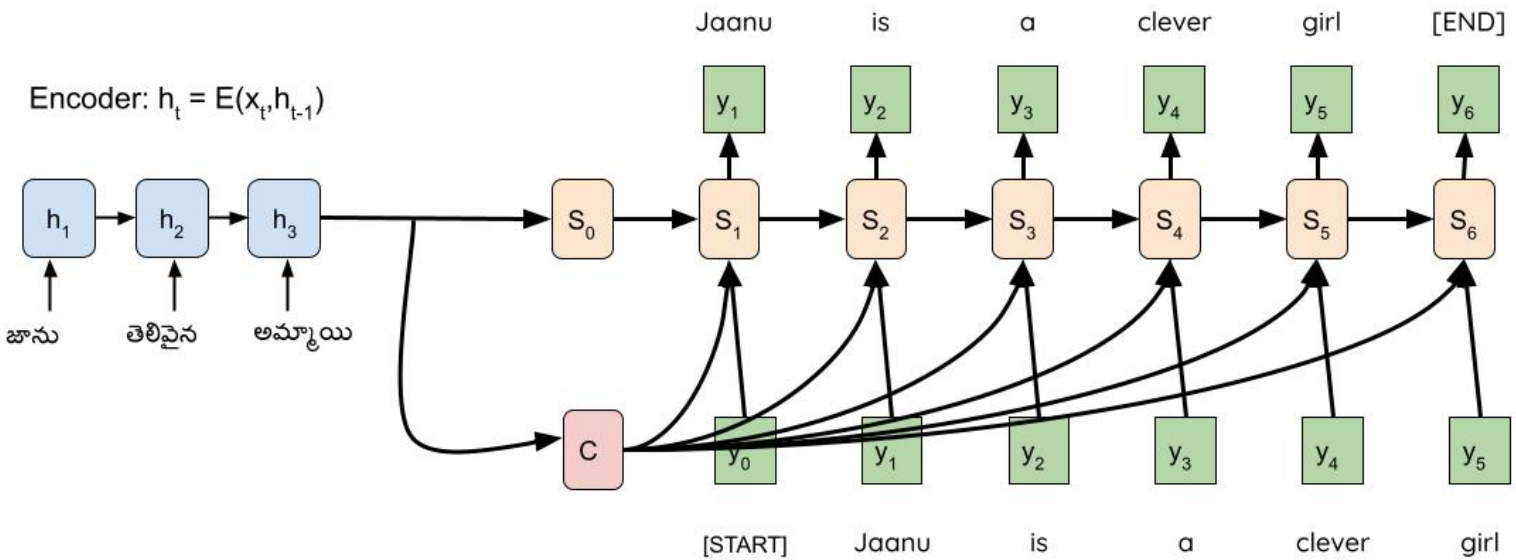

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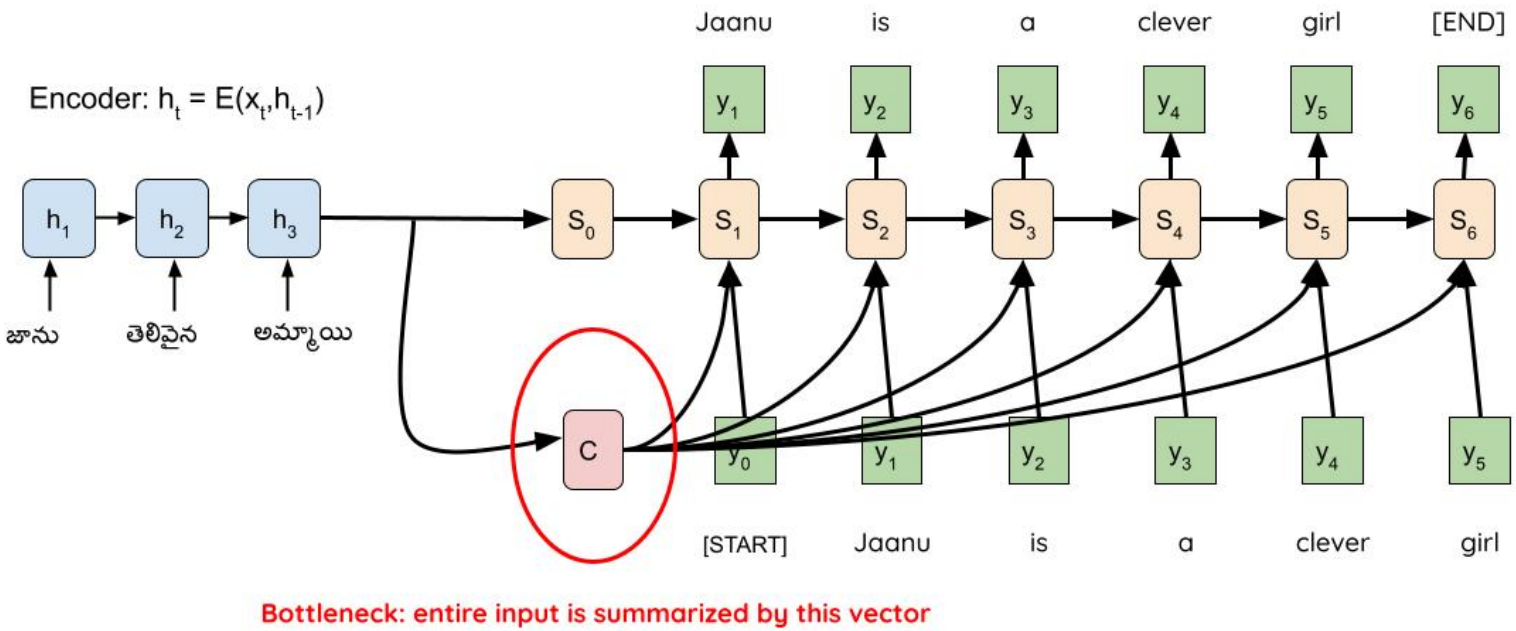

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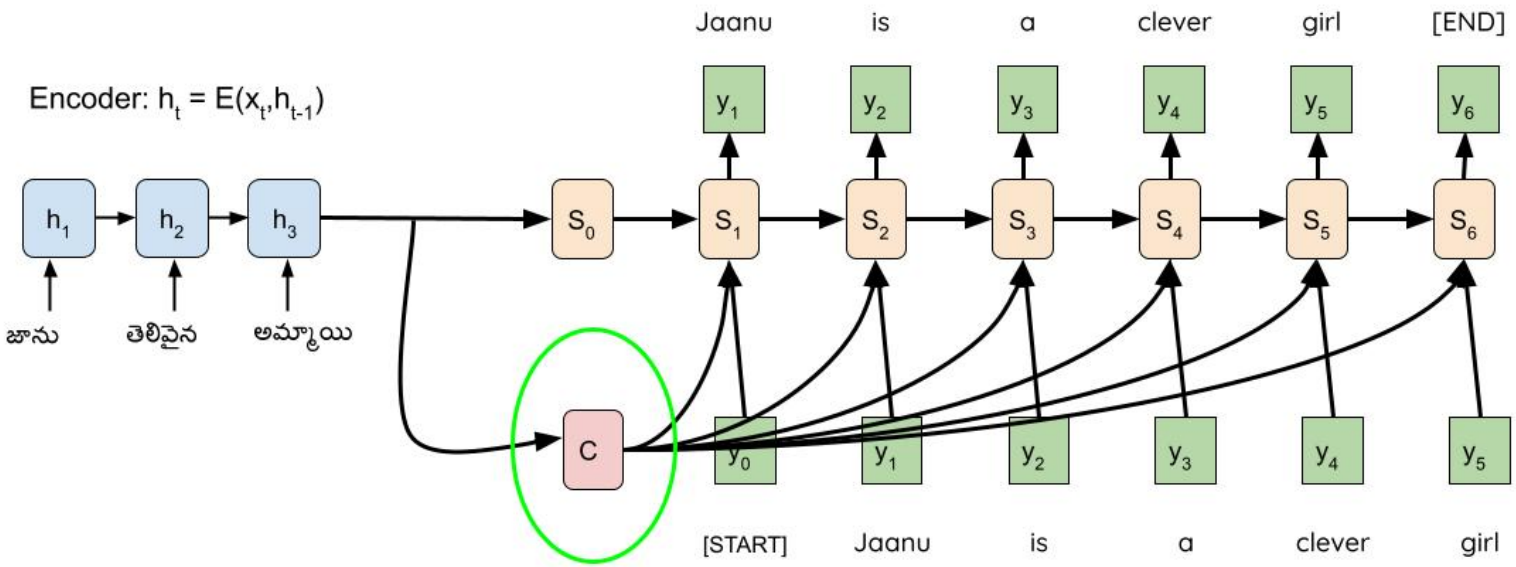

Solution: use different context at each time step!

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Sequence-to-Sequence tasks using RNNs and Attention

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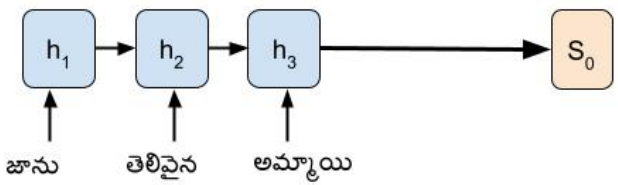
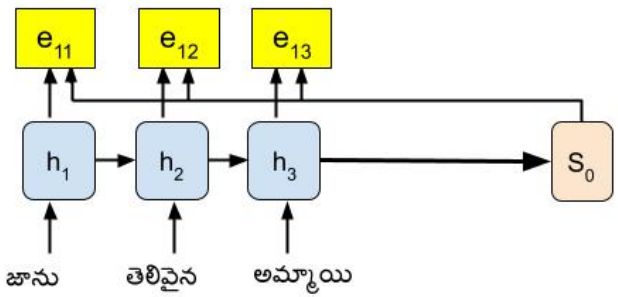


Sequence-to-Sequence tasks using RNNs and Attention

Compute the alignment scores

$e_{t,i} = f_{att}(s_{t-1}, h_i)$ f_{att} - couple of dense layers



Neural Machine Translation with aligning by Bahdanau et al. ICLR 2015

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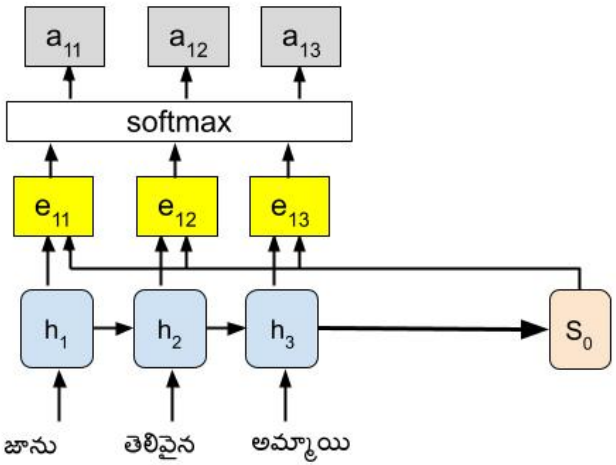

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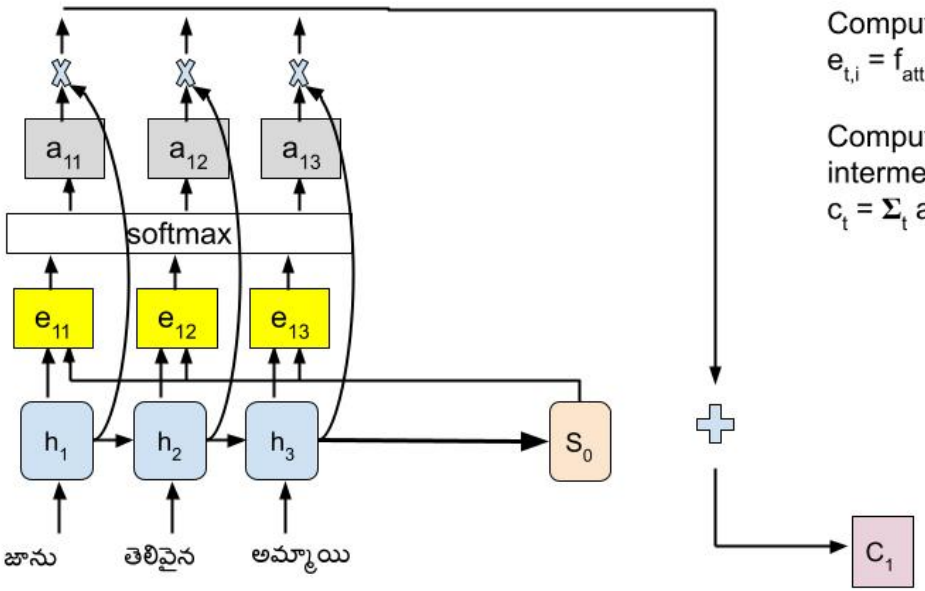

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Compute the context as a linear combination of intermediate hidden states

$c_t = \Sigma_t a_{i,t} . h_t$

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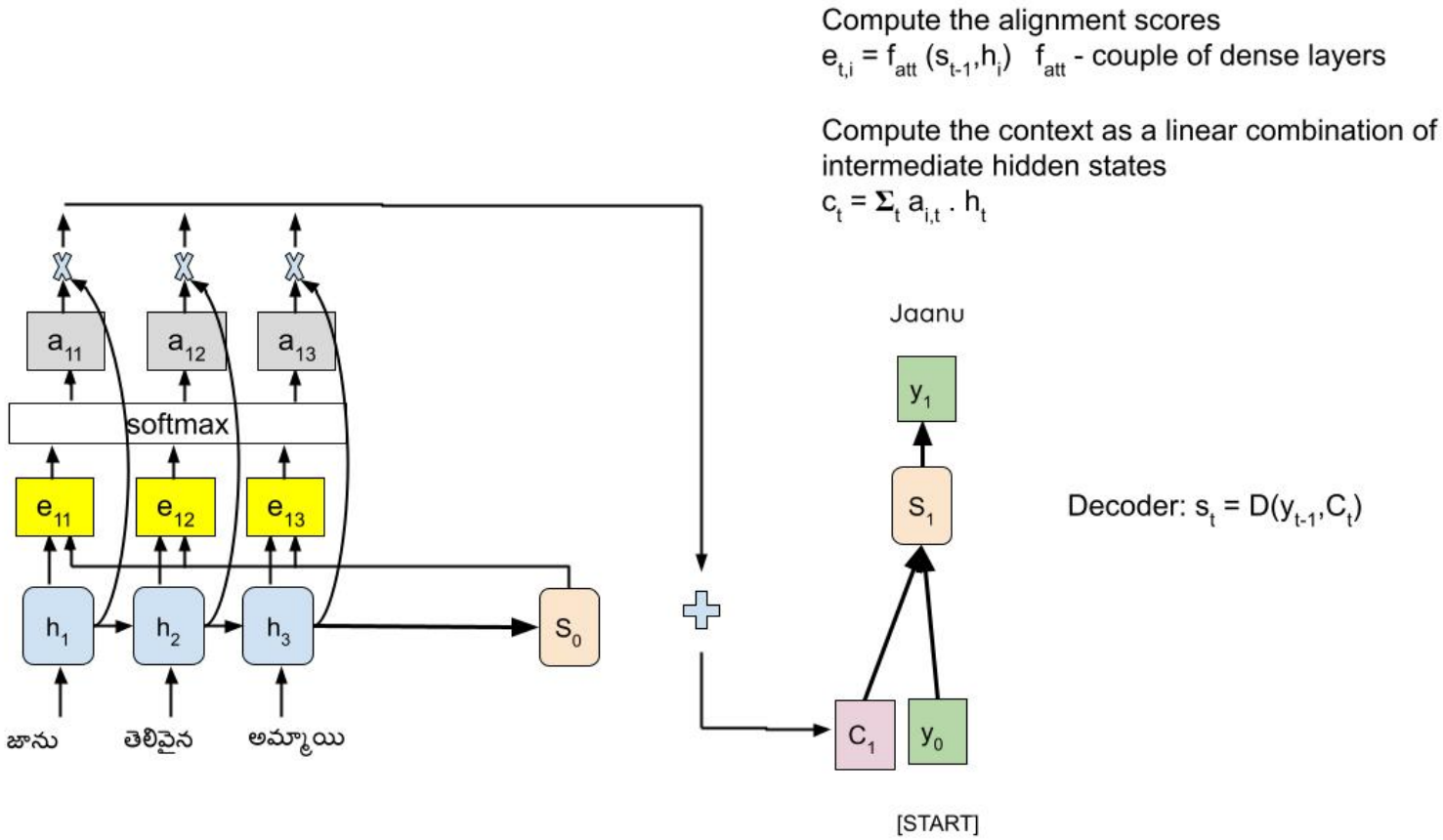

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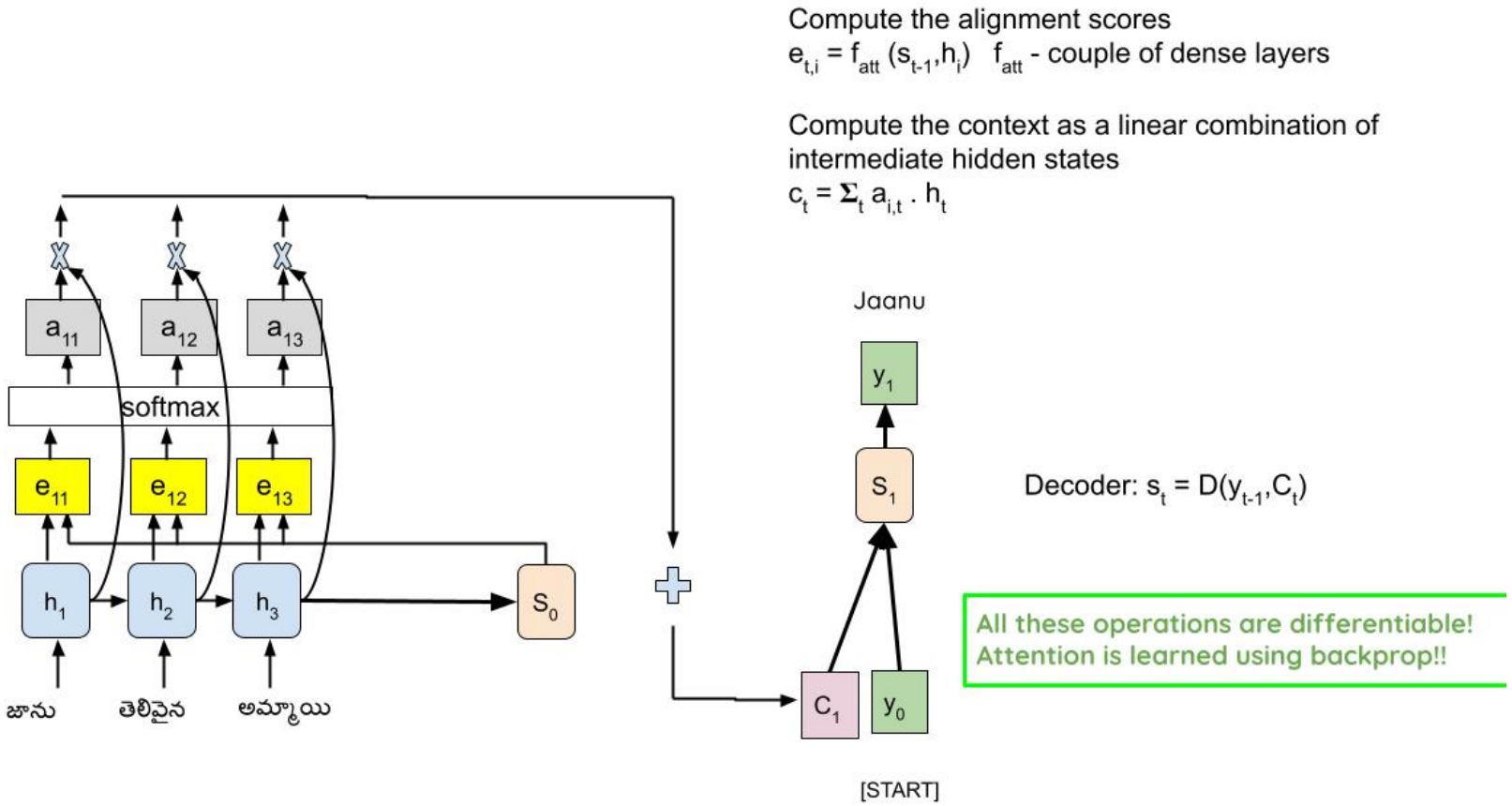

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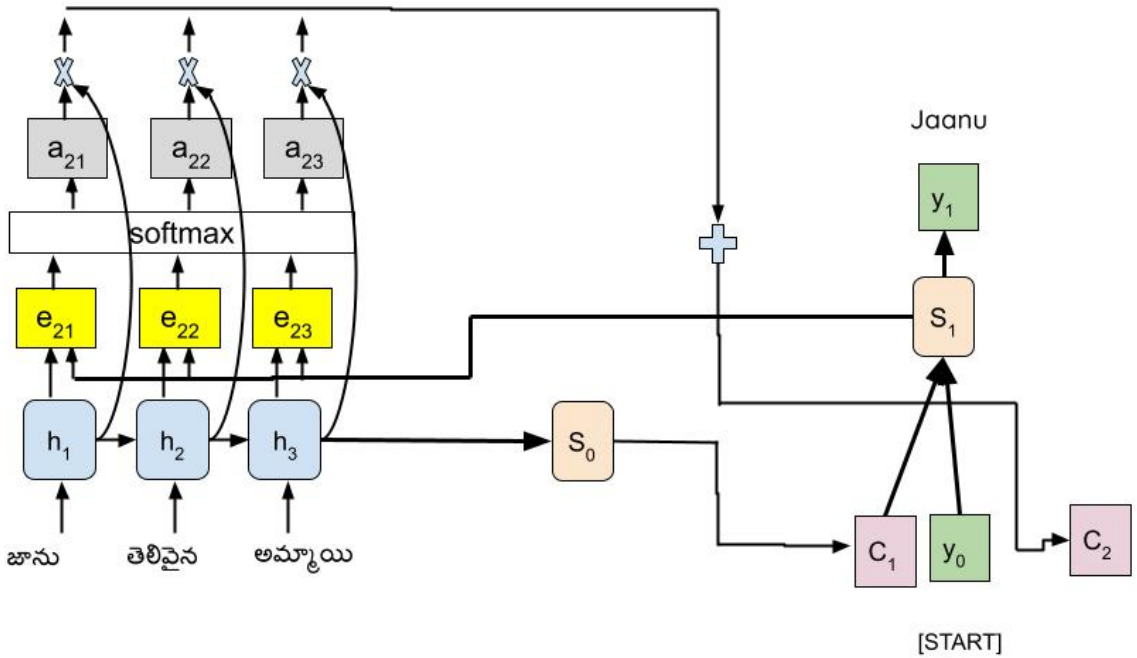

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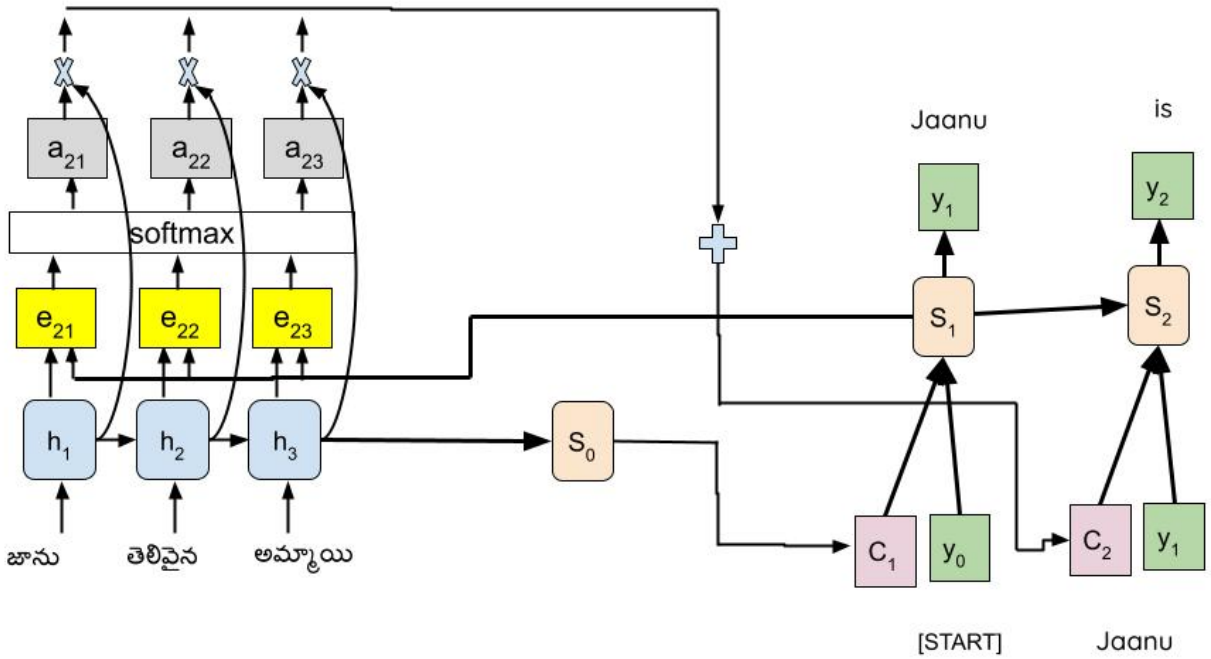

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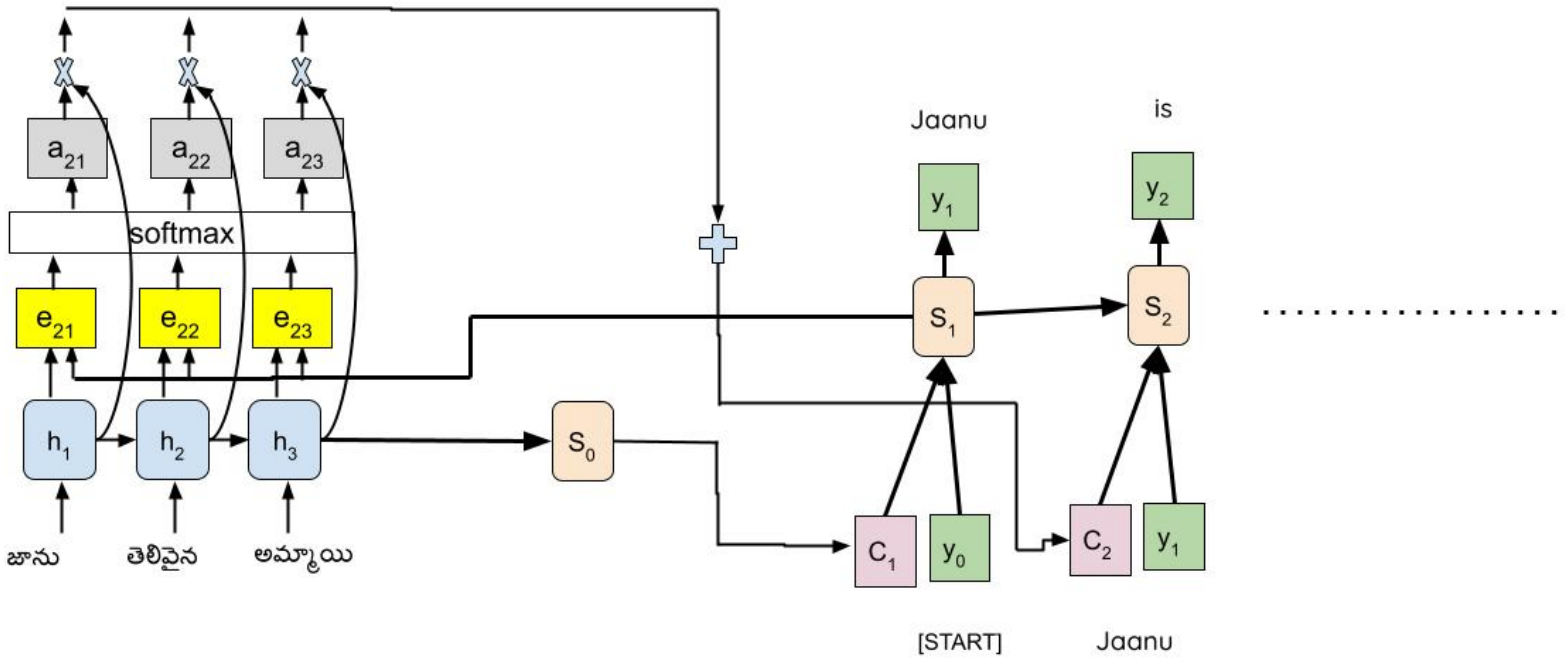

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Sequence-to-Sequence tasks using RNNs and Attention

- Employs a different context at each time step of decoding

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Sequence-to-Sequence tasks using RNNs and Attention

- Employs a different context at each time step of decoding
- No more bottleneck-ing of the input

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Sequence-to-Sequence tasks using RNNs and Attention

- Employs a different context at each time step of decoding
- No more bottleneck-ing of the input
- Decoder can 'attend' to different portions of the input at each time step

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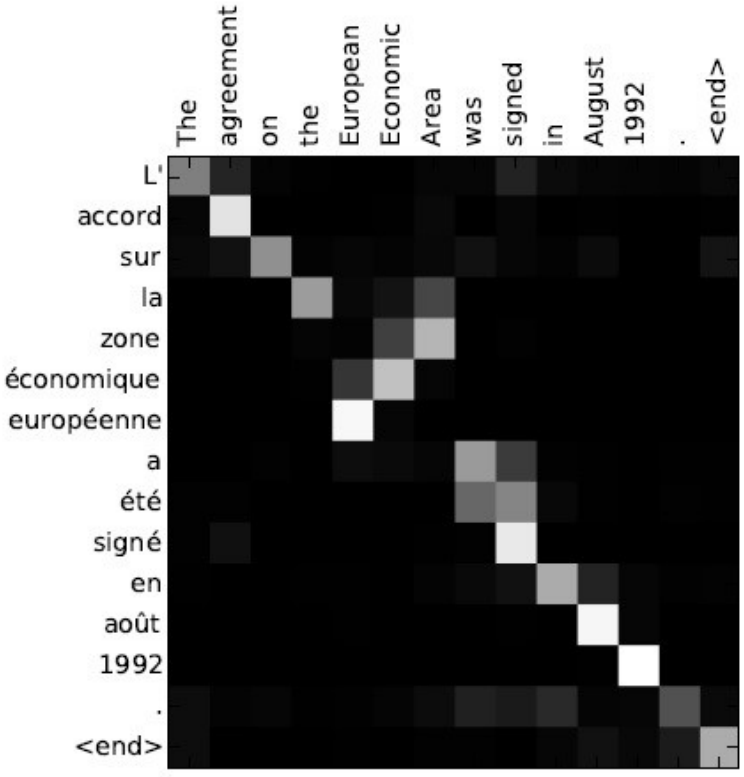
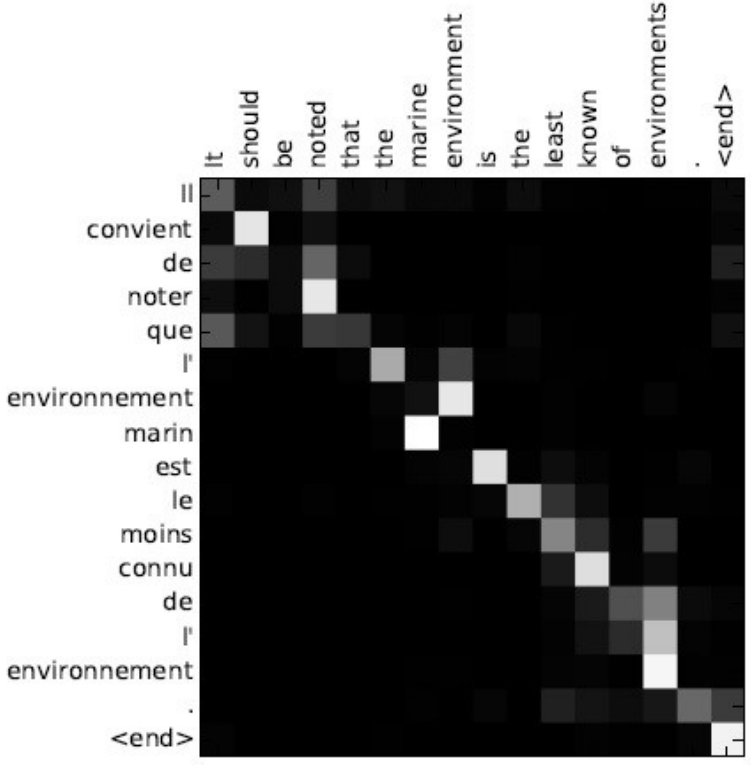
Sequence-to-Sequence tasks using RNNs and Attention





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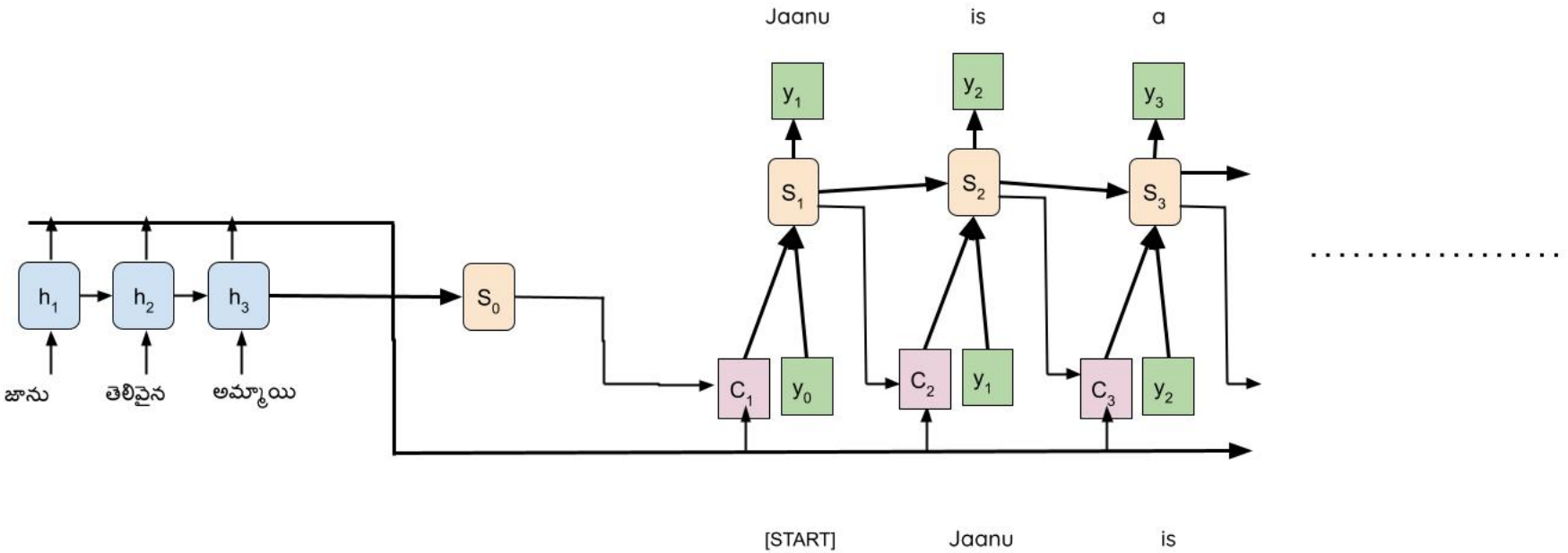

- Decoder doesn't consider the h_i to be an ordered set

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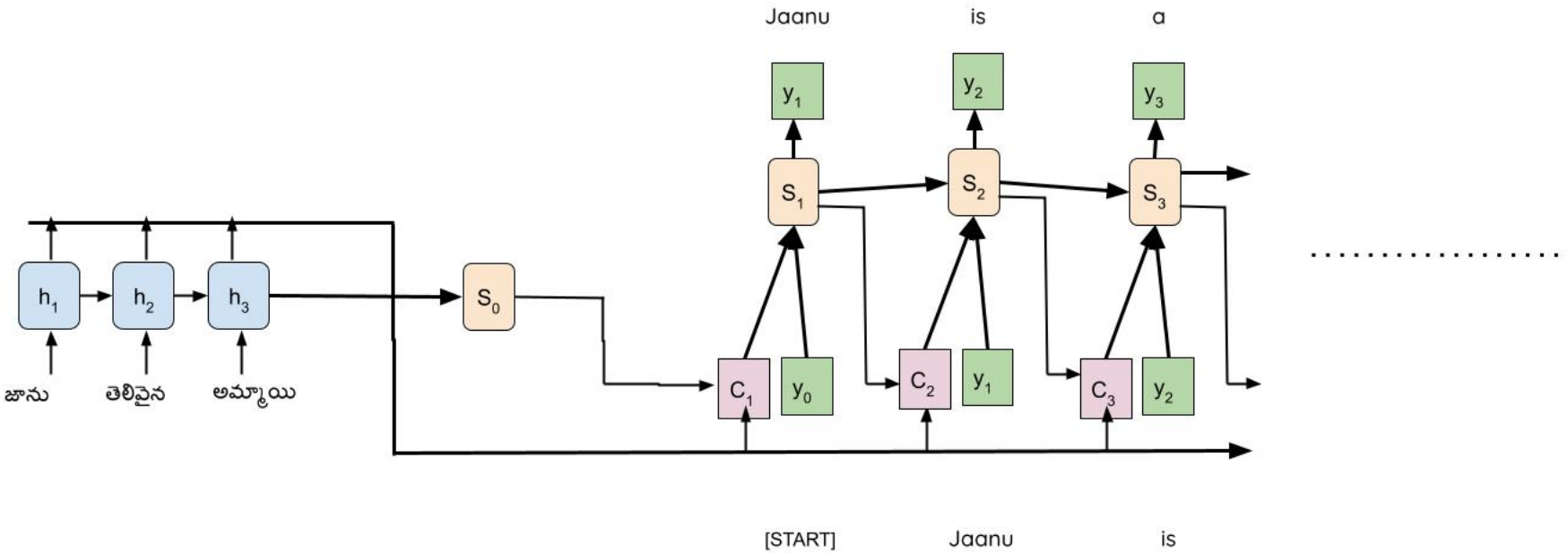

- Decoder doesn't consider the h_i to be an ordered set
- This architecture can be exploited to process a set of inputs h_i

Image captioning using RNNs and Attention

h_{11}	h_{12}	h_{13}
h_{21}	h_{22}	h_{23}
h_{31}	h_{32}	h_{33}

Show Attend and Tell by Xu et al. 2015

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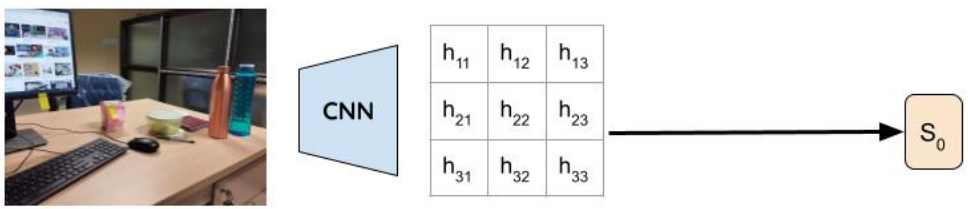

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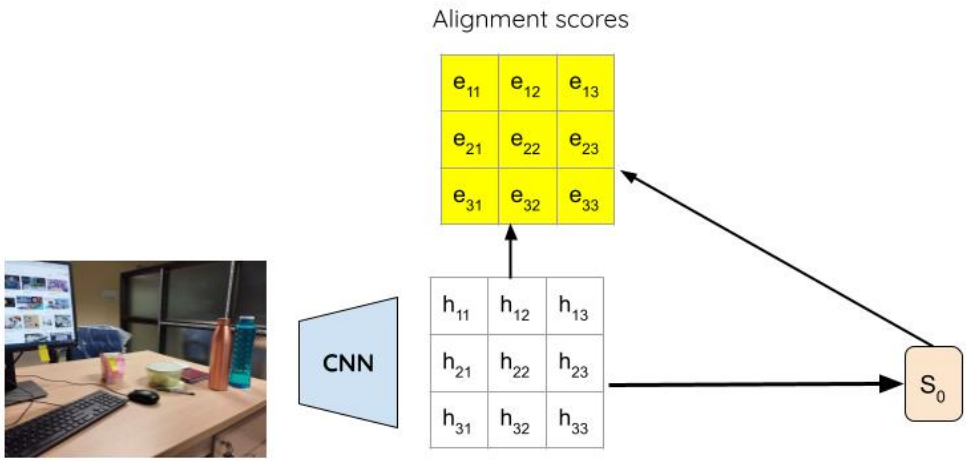

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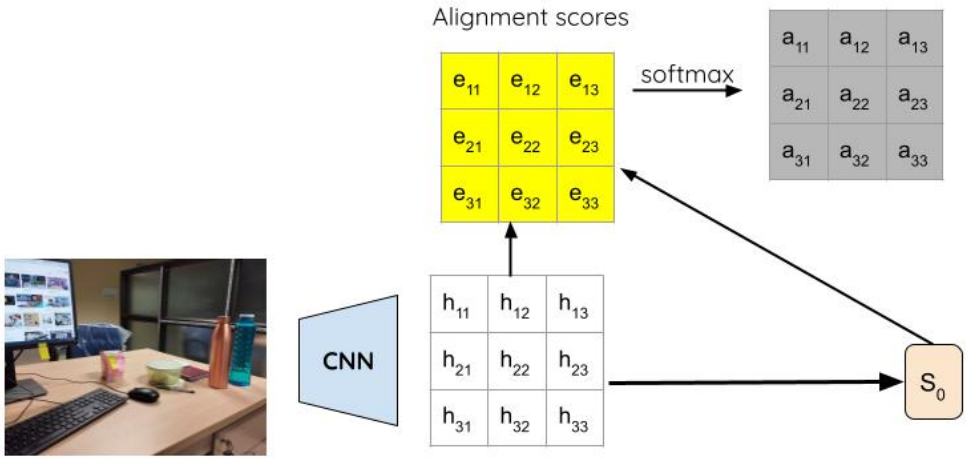

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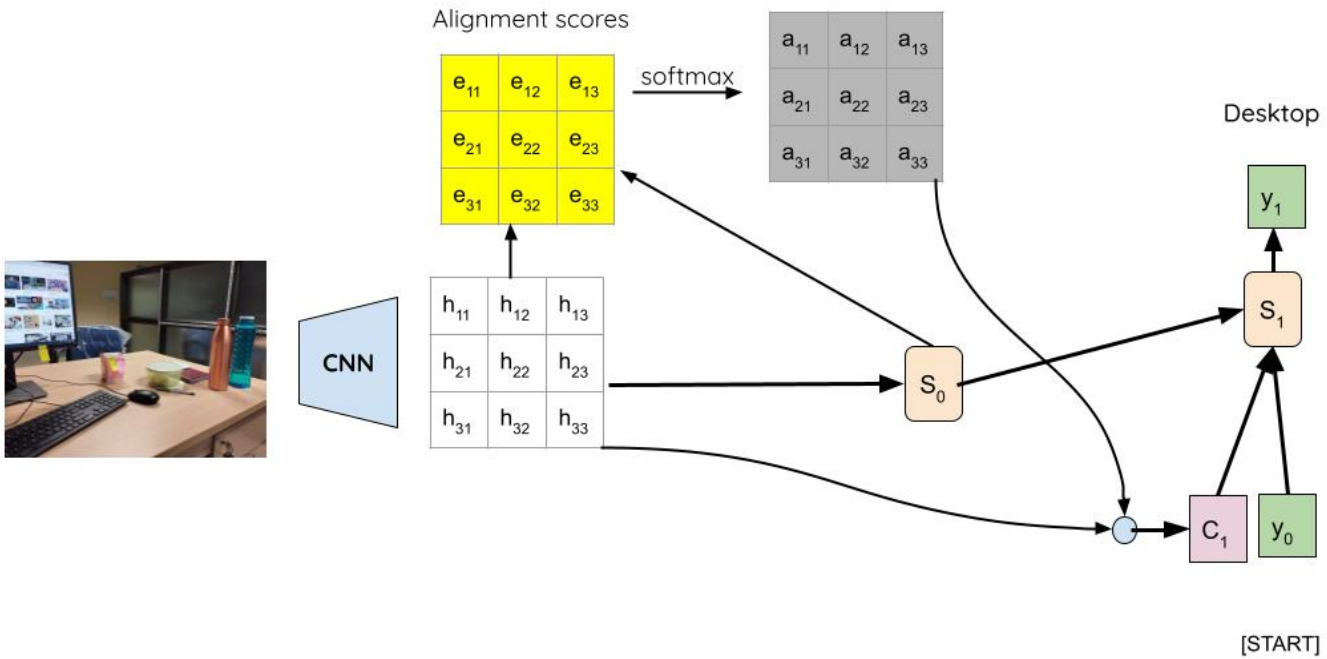

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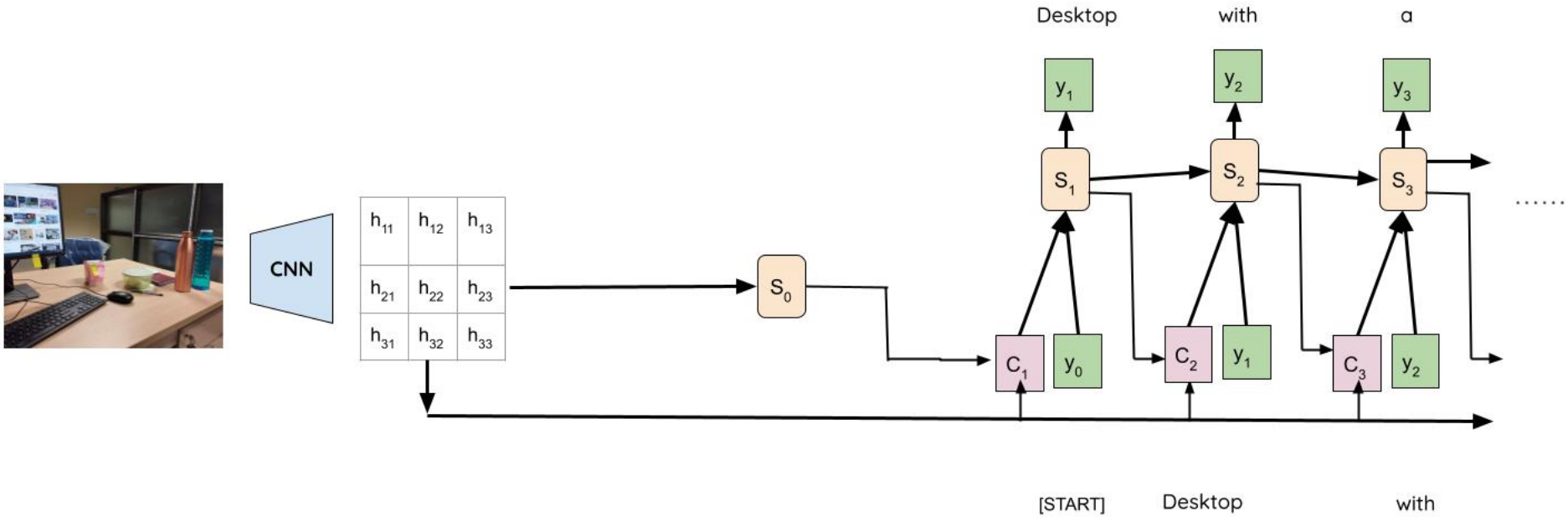

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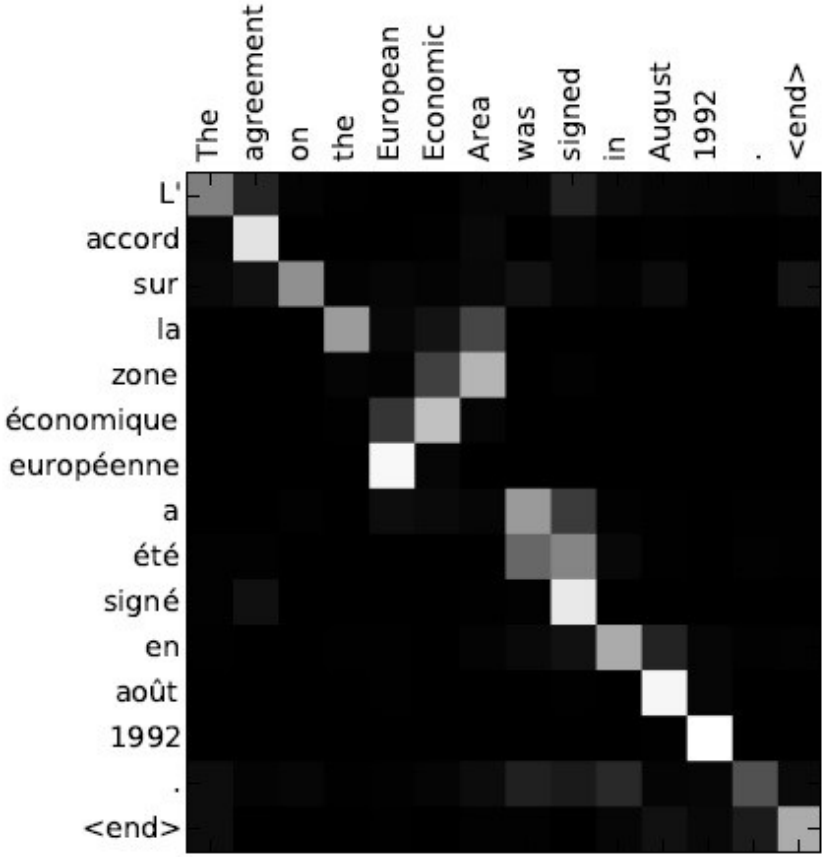

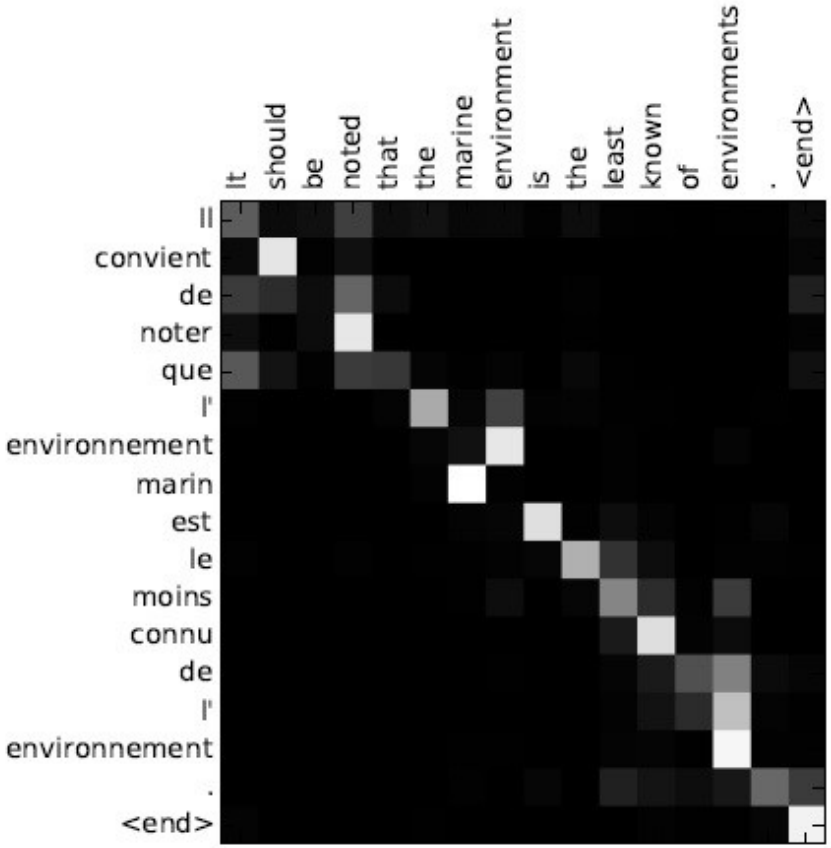

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