Attention & Memory

Mar 19th, 2019

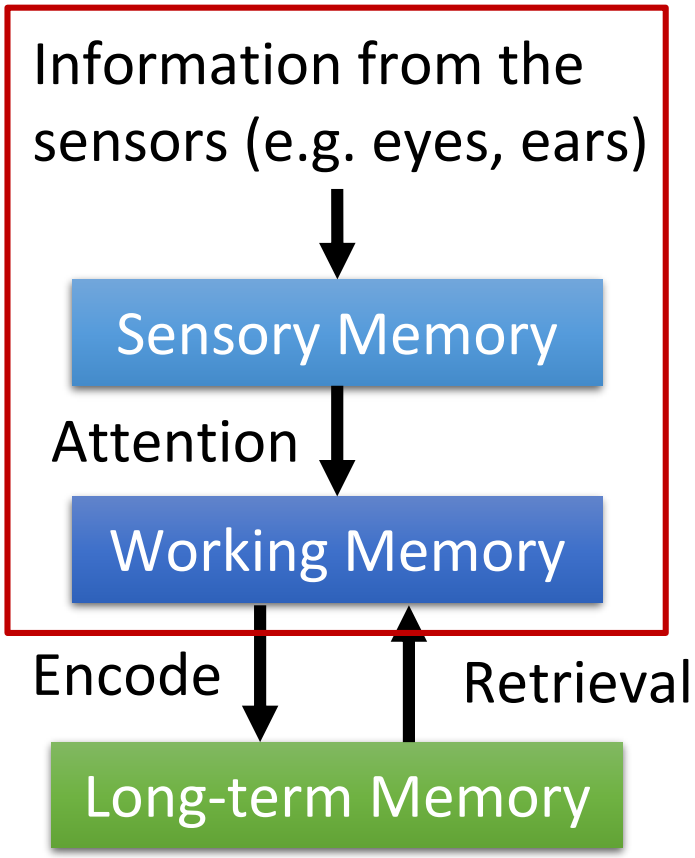
Applied Deep Learning

YUN-NUNG (VIVIAN) CHEN HTTP://ADL.MIULAB.TW

國立臺灣大學
National Taiwan University

Slides credited from Hung-Yi Lee

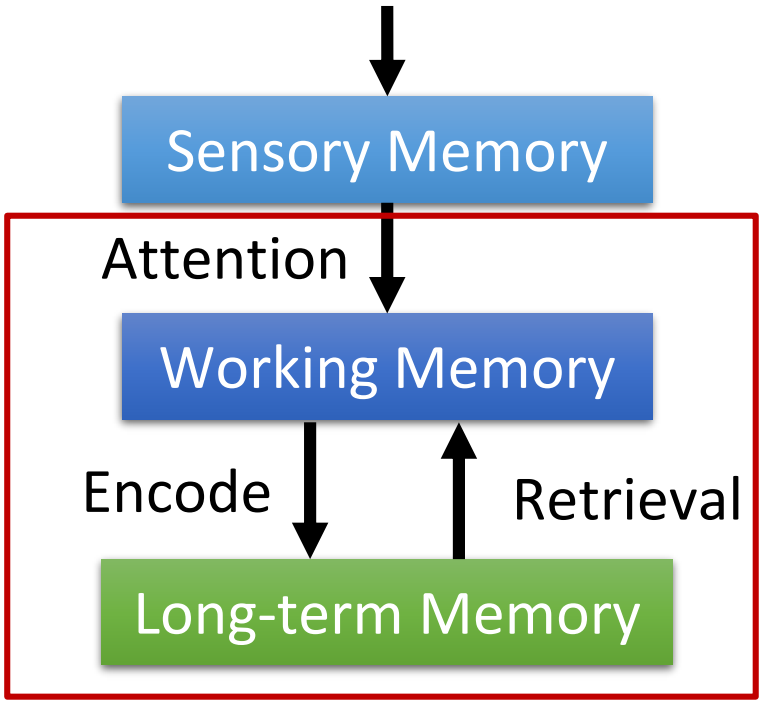
Attention and Memory



When the input is a very long sequence or an image

→ Pay attention on partial of the input object each time

Attention and Memory



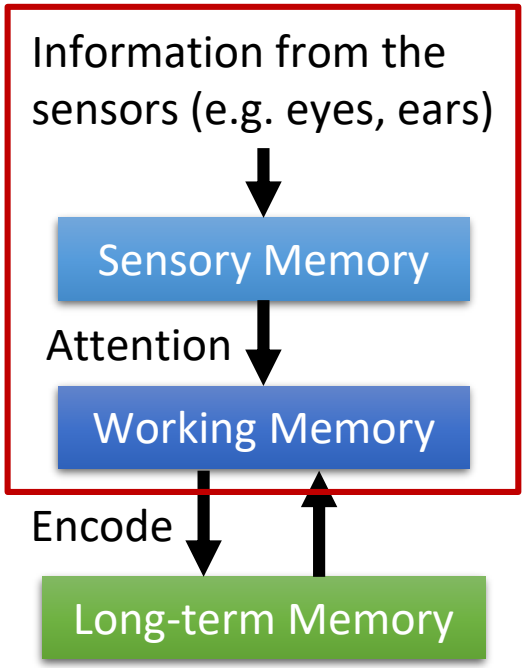
When the input is a very long sequence or an image

→ Pay attention on partial of the input object each time

In RNN, larger memory implies more parameters

→ Increasing memory size will not increasing parameters

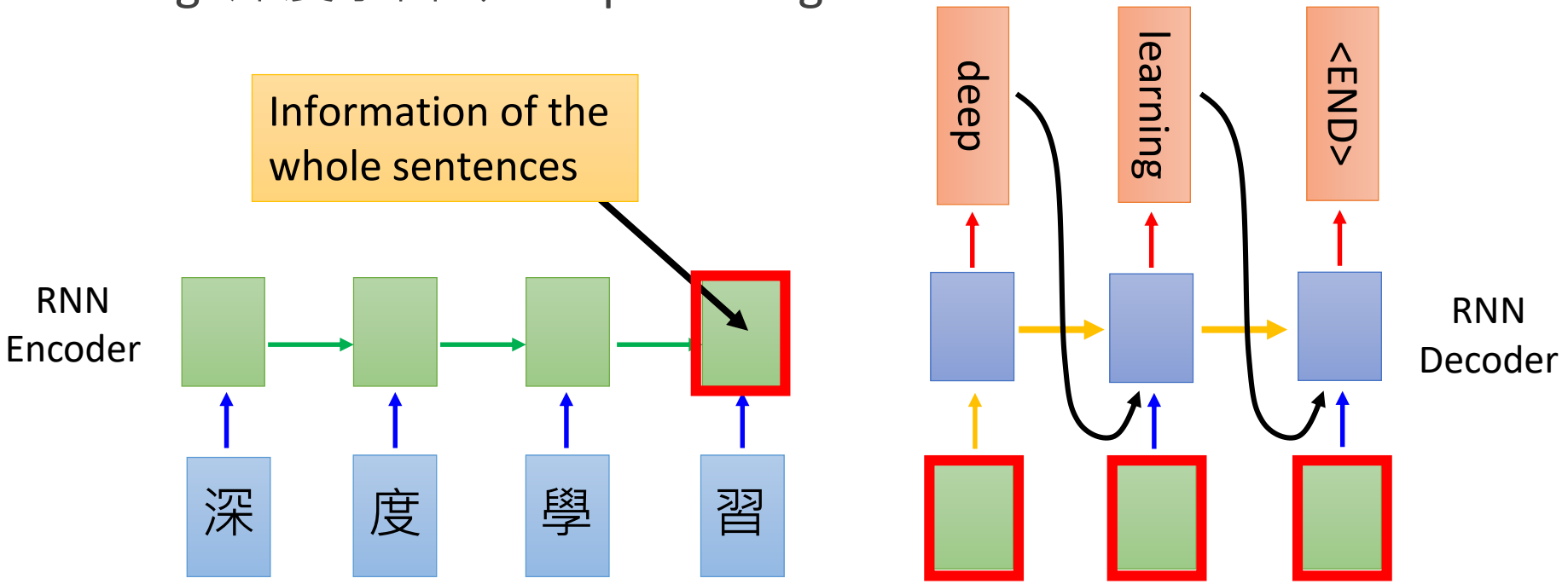
Attention on Sensory Info



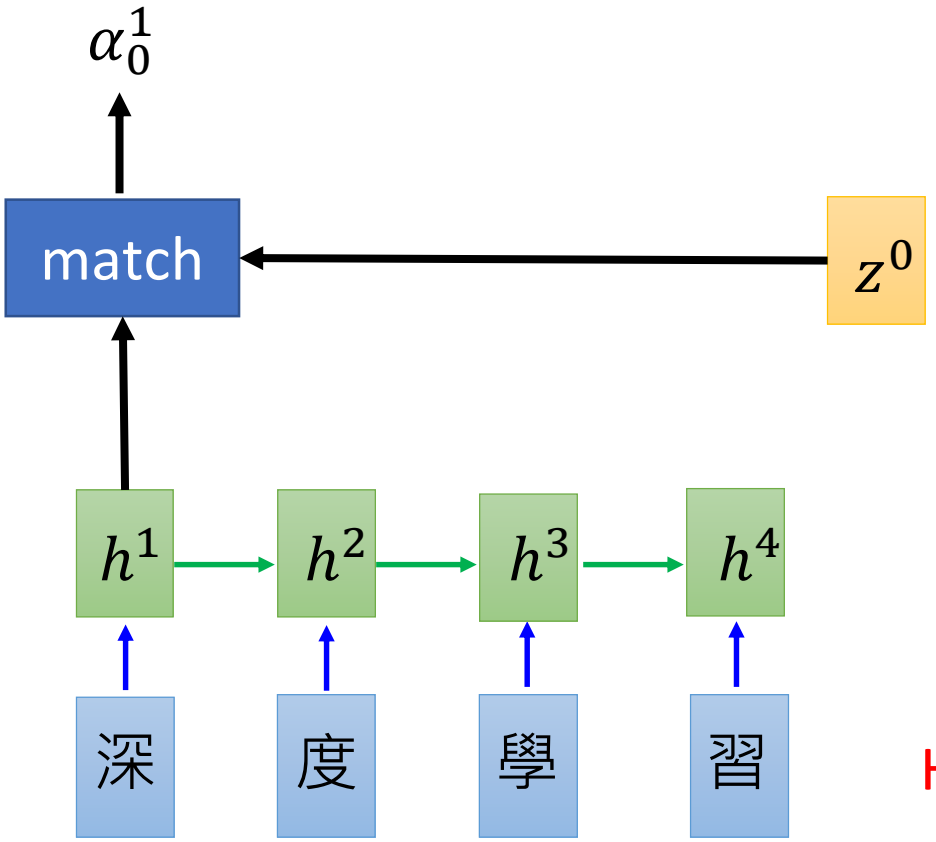
Machine Translation

Sequence-to-sequence learning: both input and output are both sequences ***with different lengths***.

E.g. 深度學習 → deep learning



Machine Translation with Attention

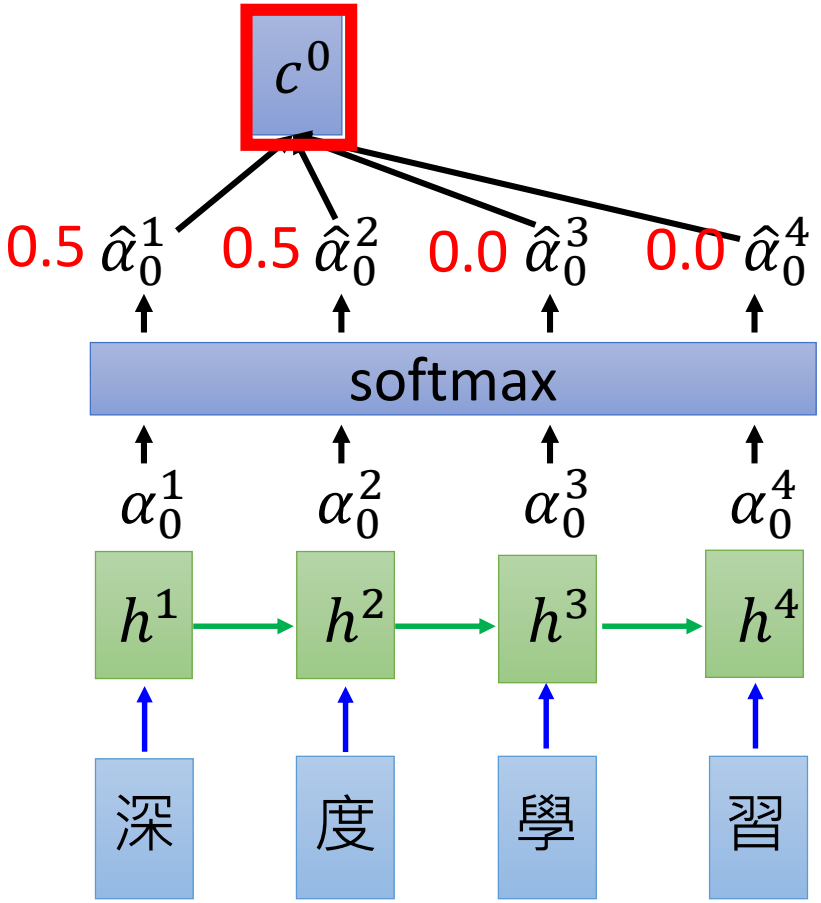


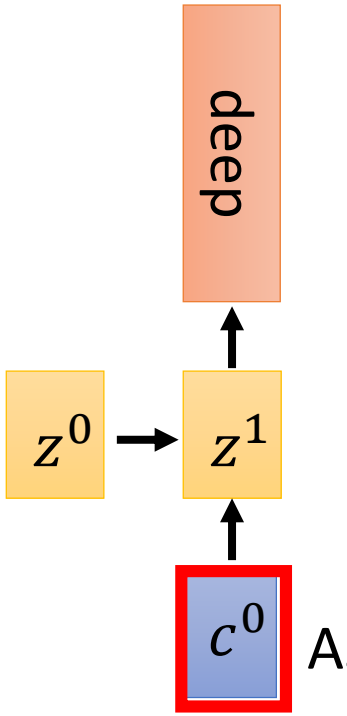
What is match ?

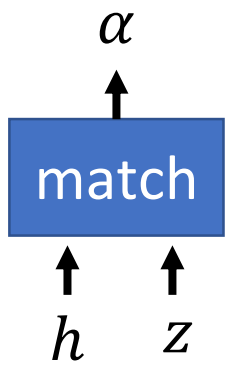
- Cosine similarity of z and h
- Small NN whose input is z and h, output a scalar
- $\alpha = h^T W z$

How to learn the parameters?

Machine Translation with Attention





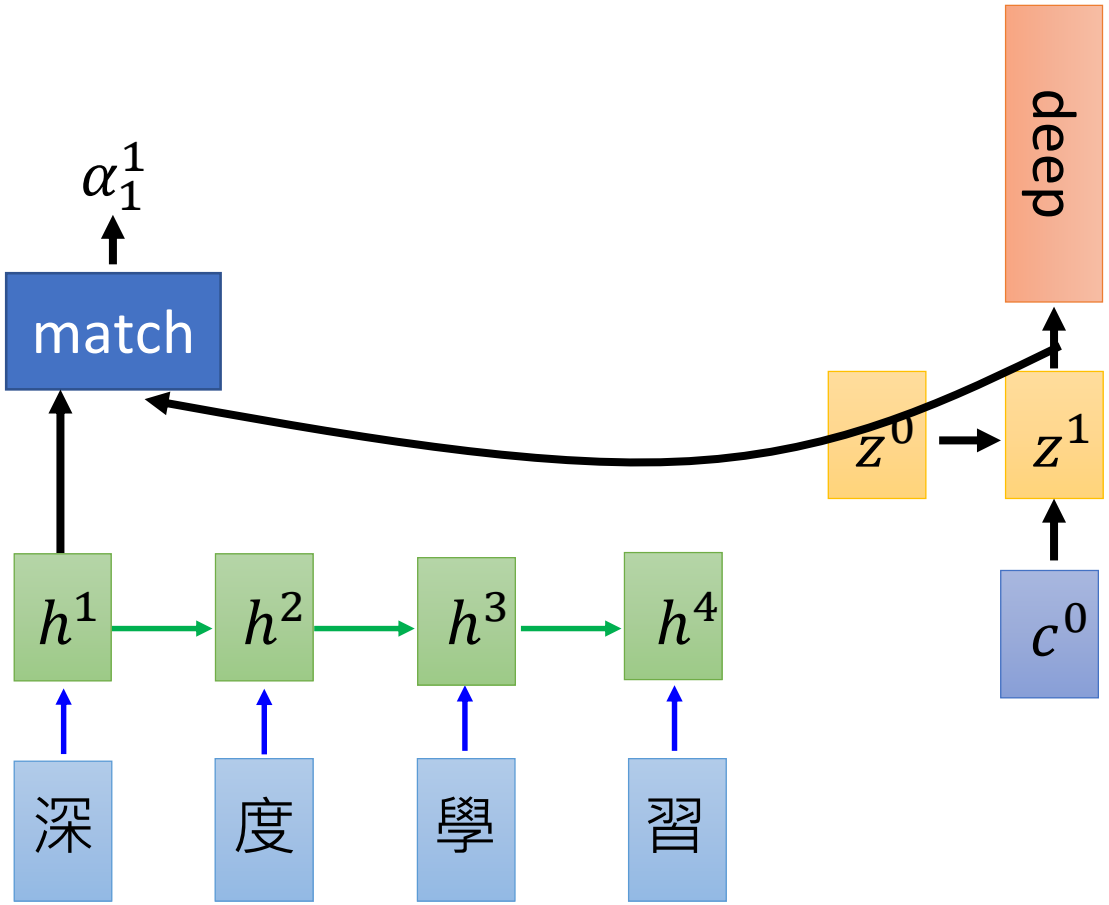


How to learn the parameters?

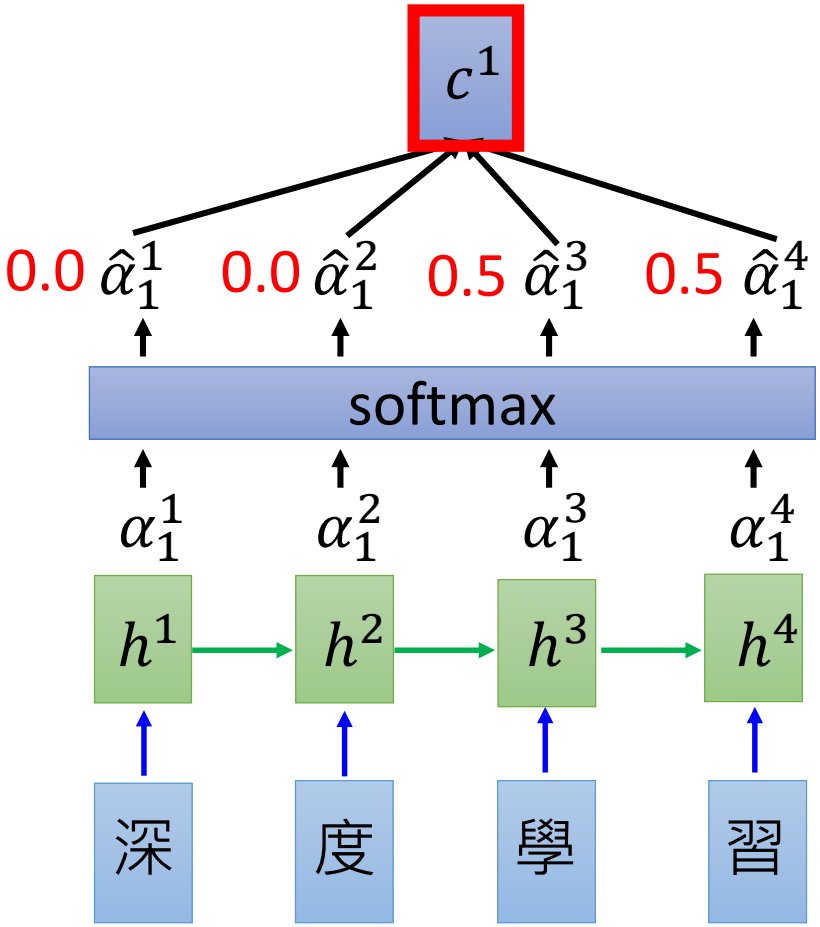
As RNN input

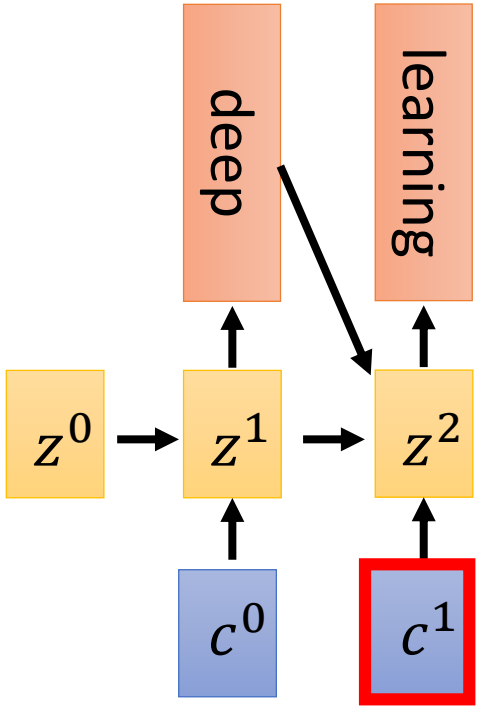
$$c^0 = \sum \hat{\alpha}_0^i h^i = 0.5h^1 + 0.5h^2$$

Machine Translation with Attention



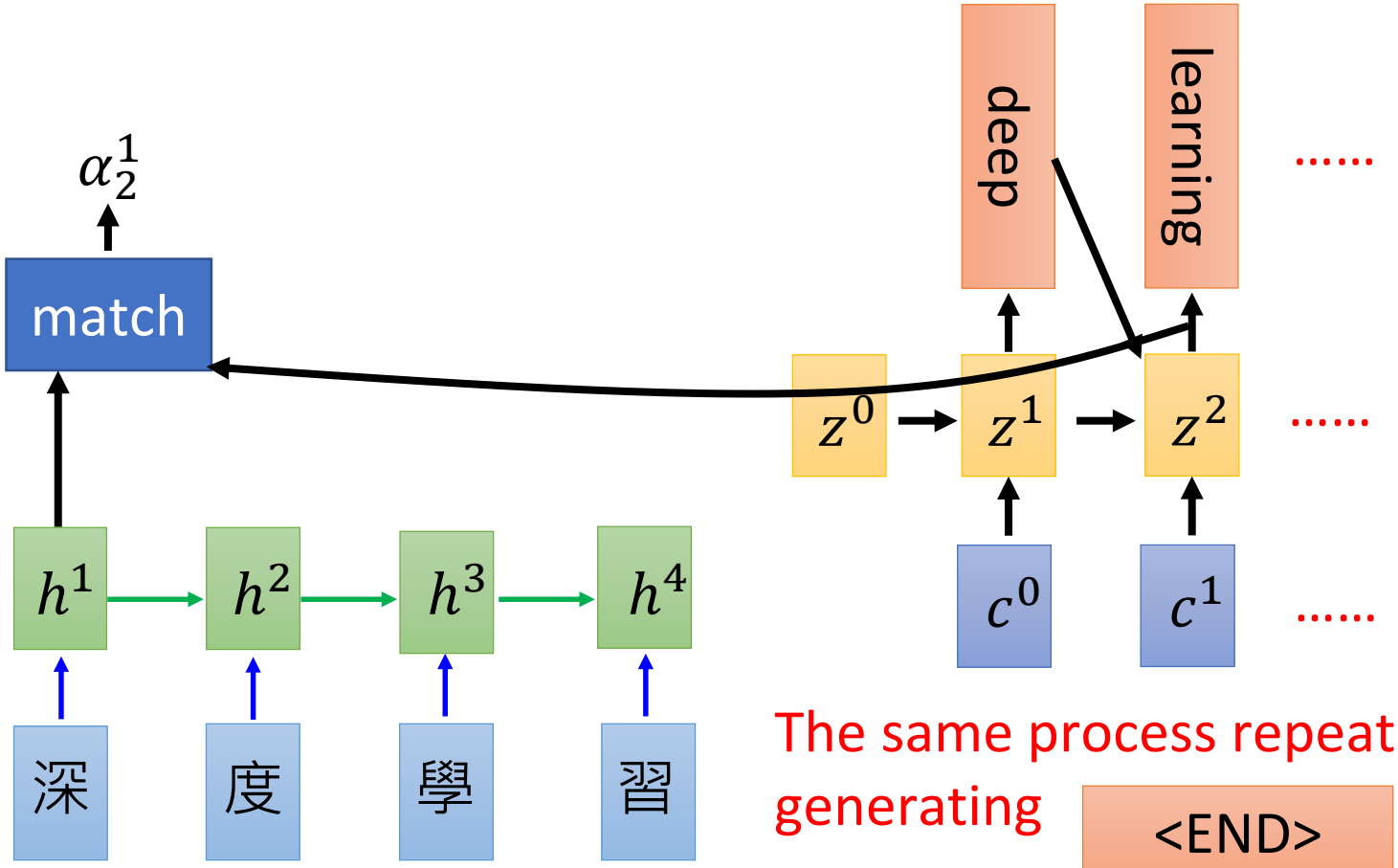
Machine Translation with Attention





$$c^1 = \sum \hat{\alpha}_1^i h^i = 0.5h^3 + 0.5h^4$$

Machine Translation with Attention



Speech Recognition with Attention

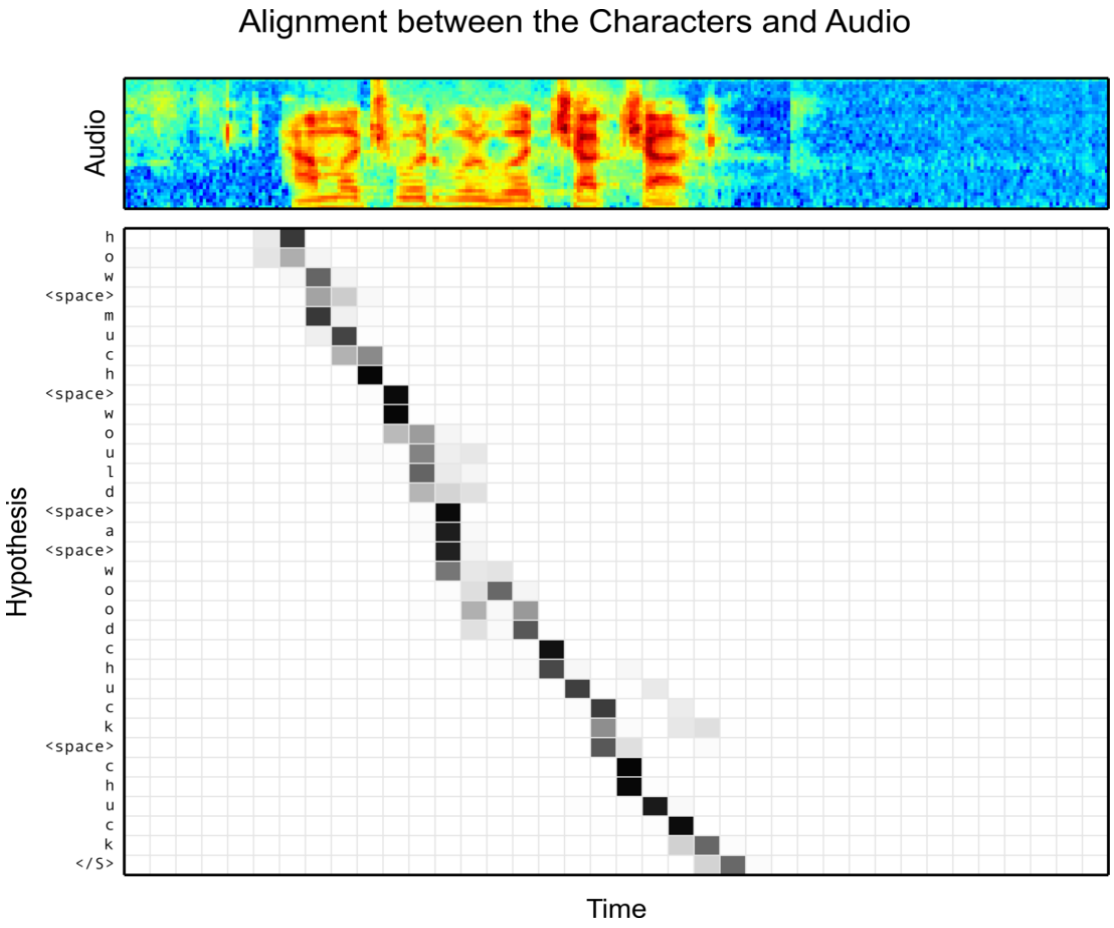
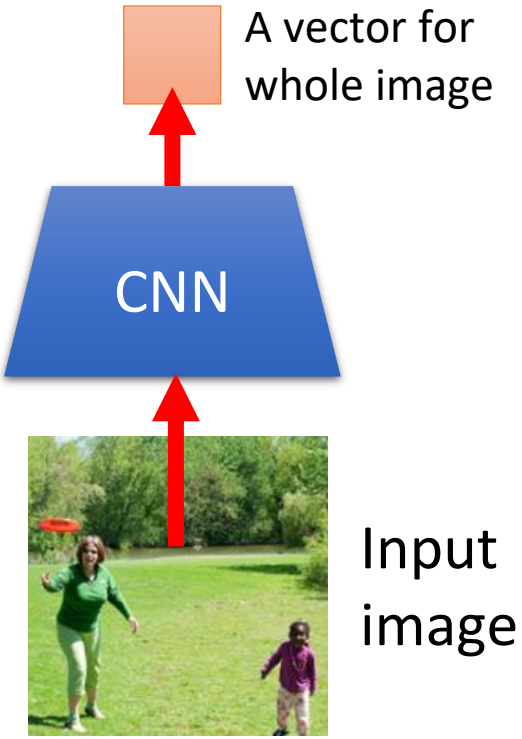


Image Captioning

Input: image

Output: word sequence



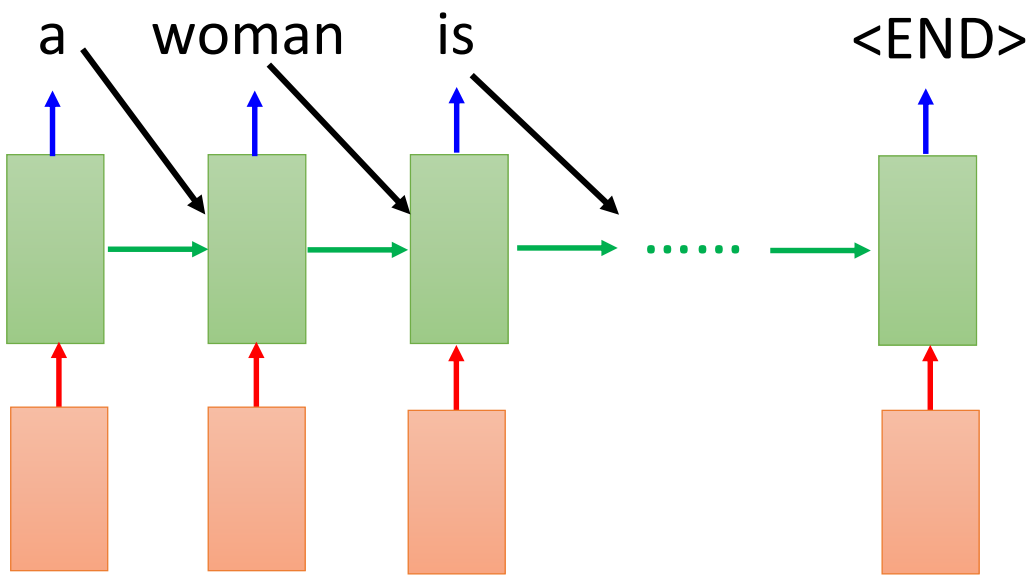


Image Captioning with Attention

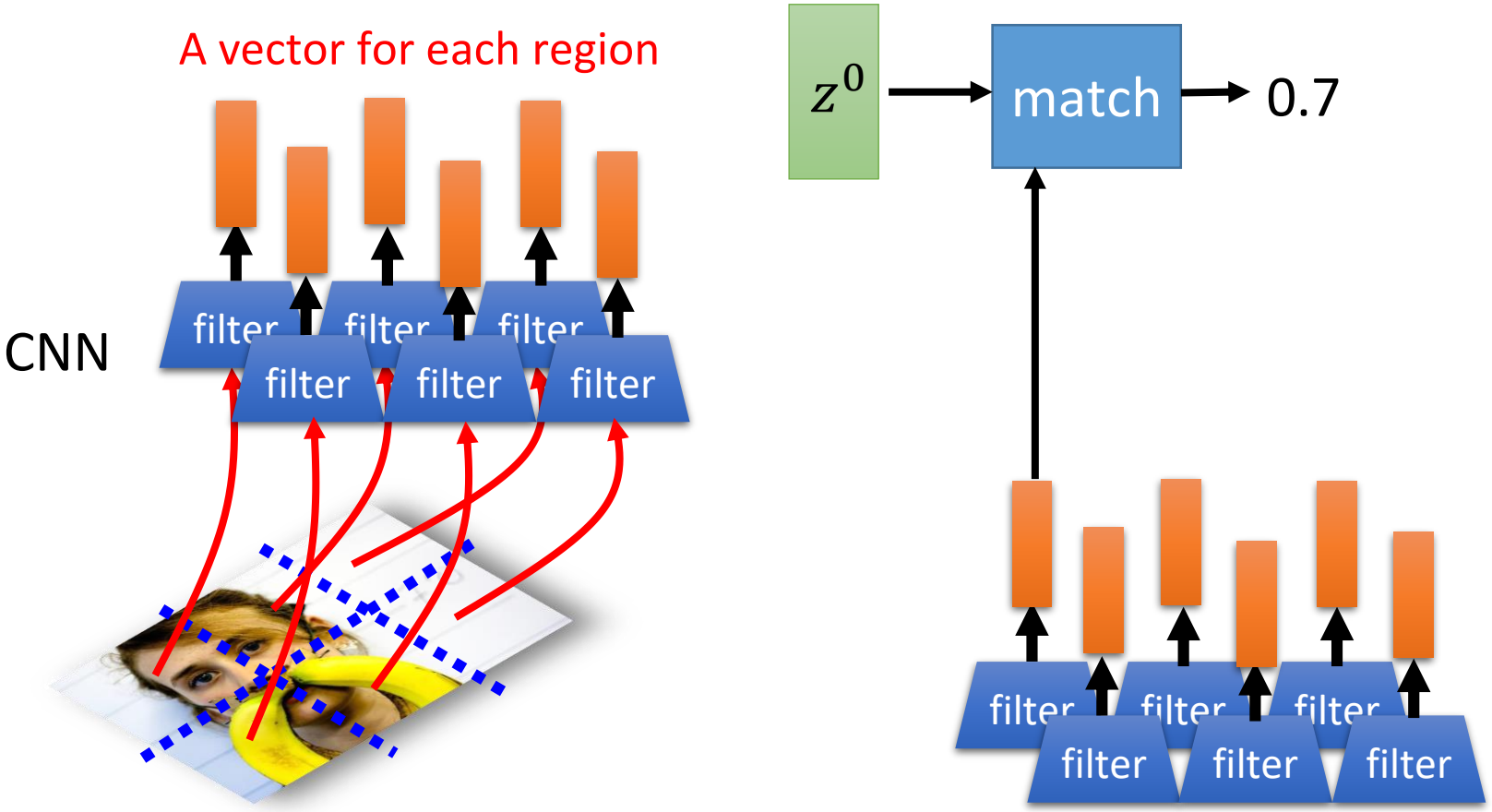


Image Captioning with Attention

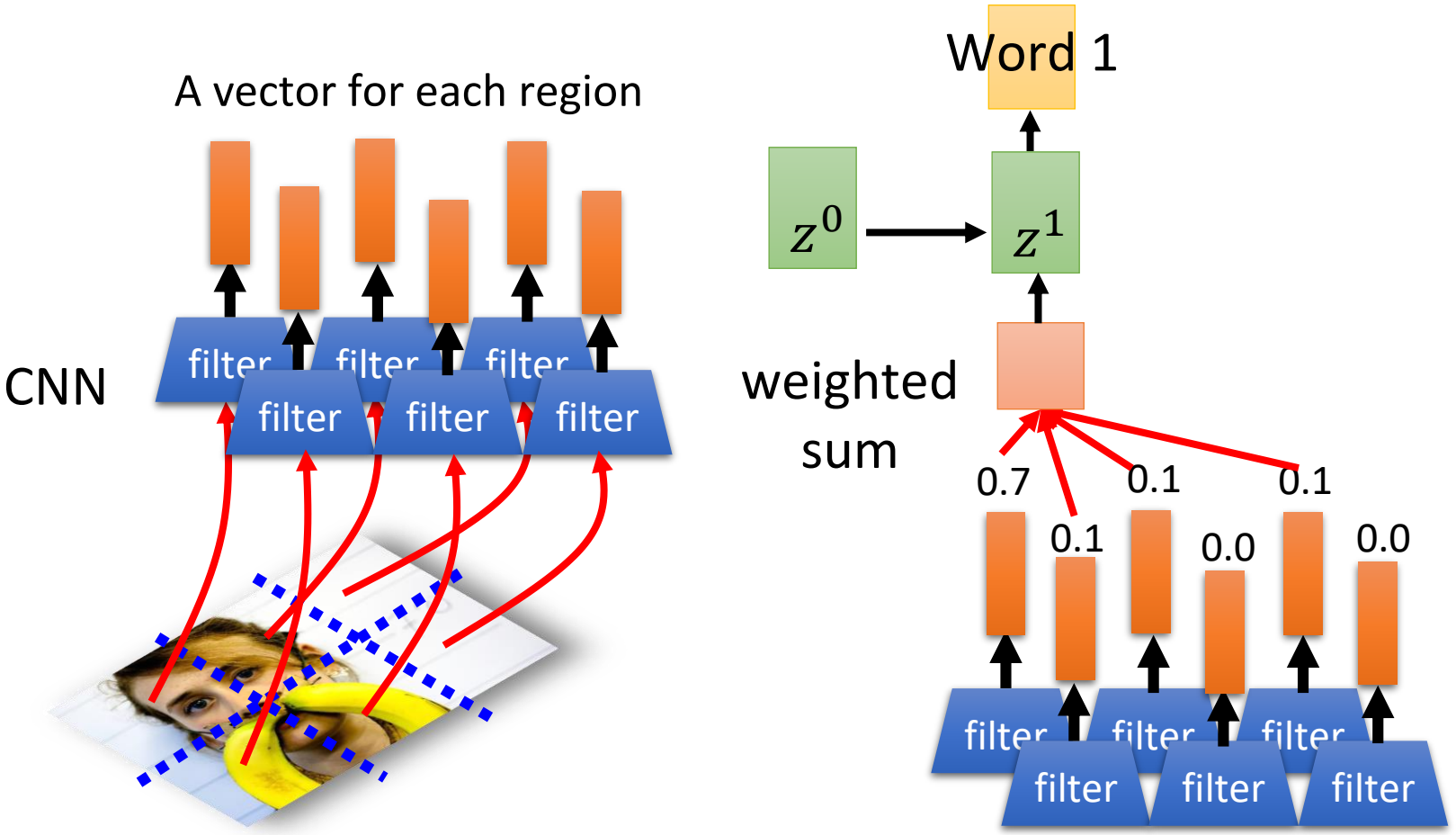


Image Captioning with Attention

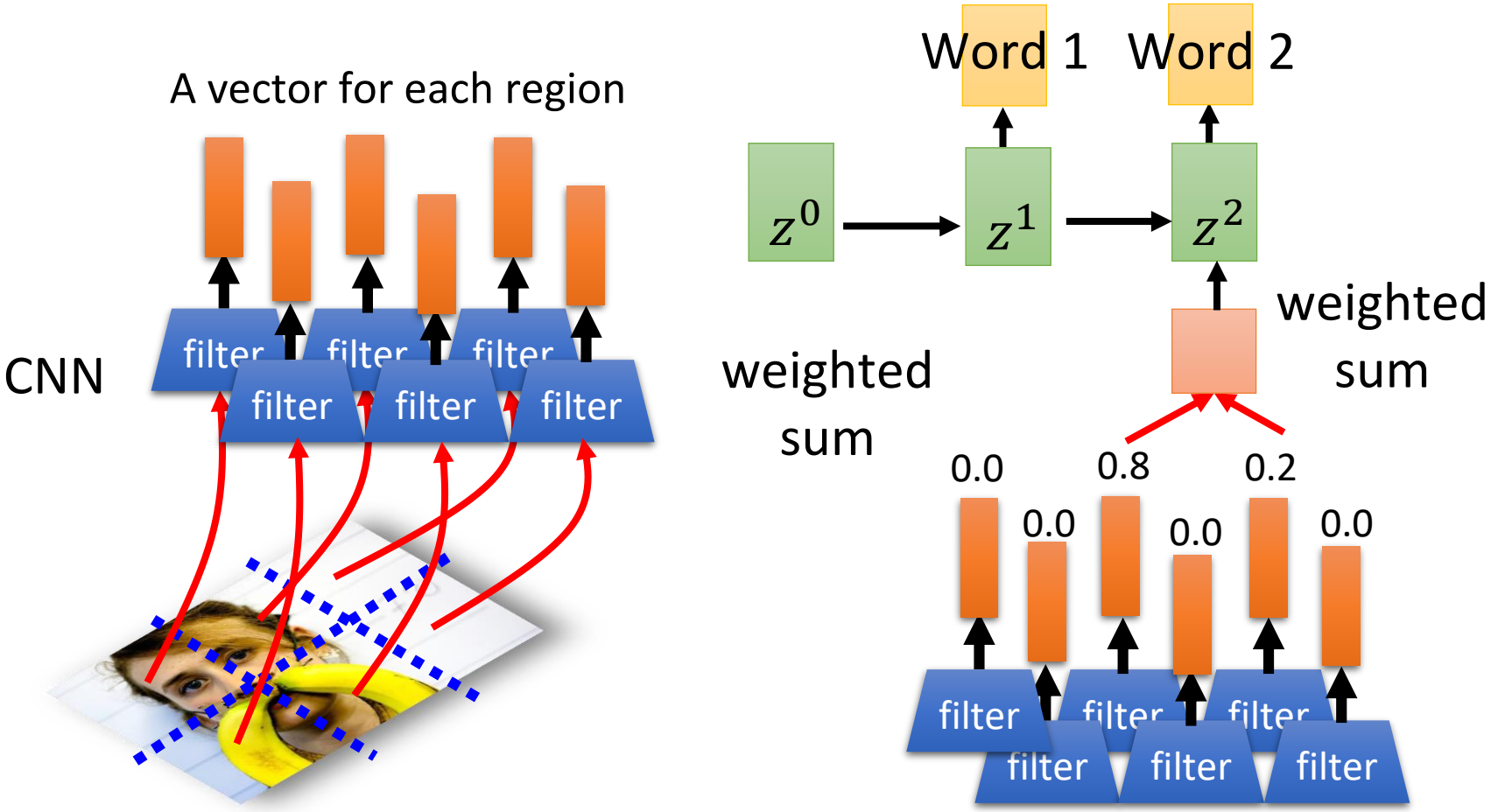


Image Captioning

Good examples

A woman is throwing a frisbee in a park.

A dog is standing on a hardwood floor.

A stop sign is on a road with a mountain in the background.

A little girl sitting on a bed with a teddy bear.

A group of people sitting on a boat in the water.

A giraffe standing in a forest with trees in the background.

Image Captioning

Bad examples

A large white bird standing in a forest.

A woman holding a clock in her hand.

A man wearing a hat and a hat on a skateboard.

A person is standing on a beach with a surfboard.

A woman is sitting at a table with a large pizza.

A man is talking on his cell phone while another man watches.

Video Captioning

Ref: A man and a woman ride a motorcycle

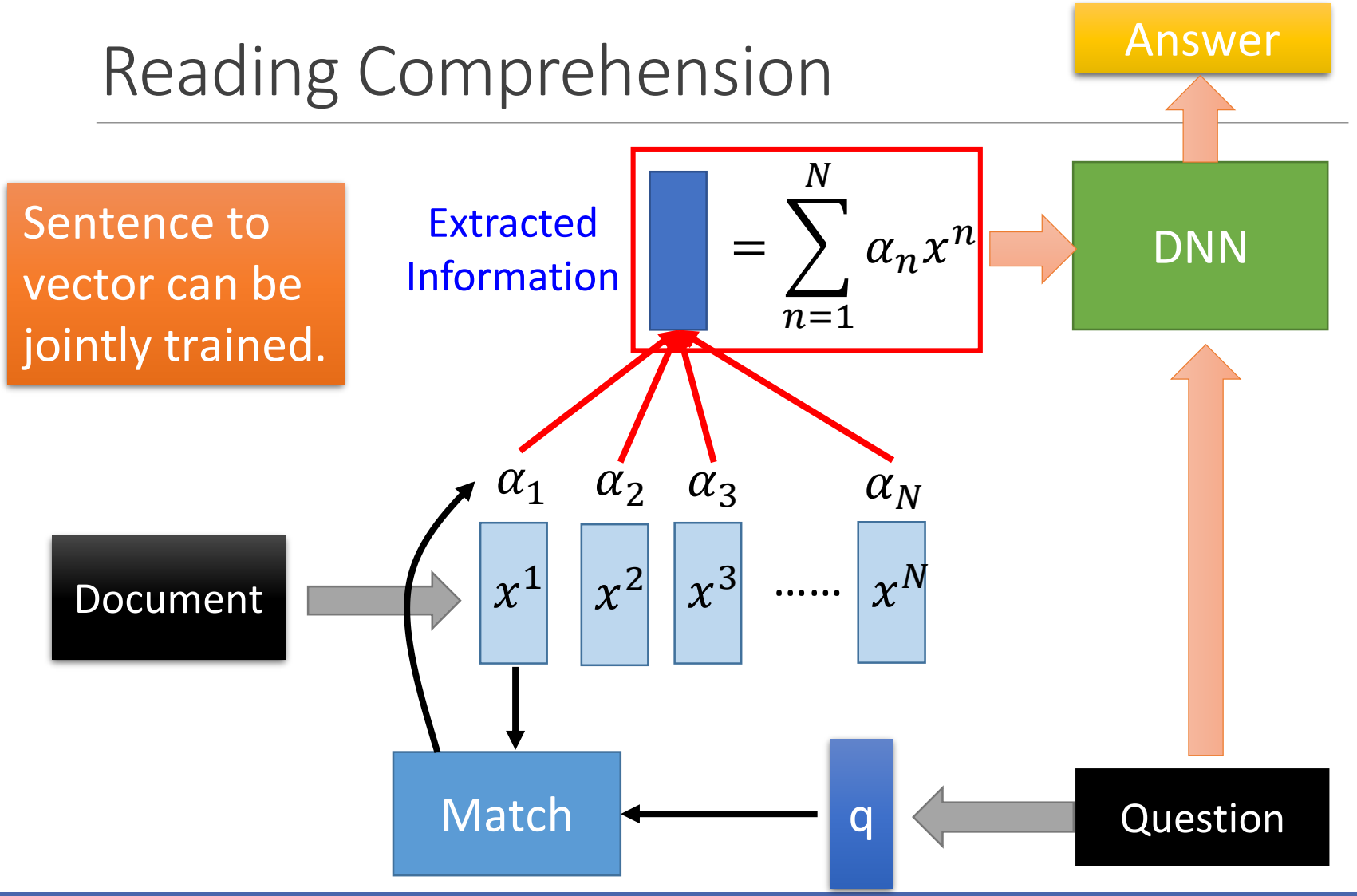
A **man** and a **woman** are **talking** on the **road**

Video Captioning

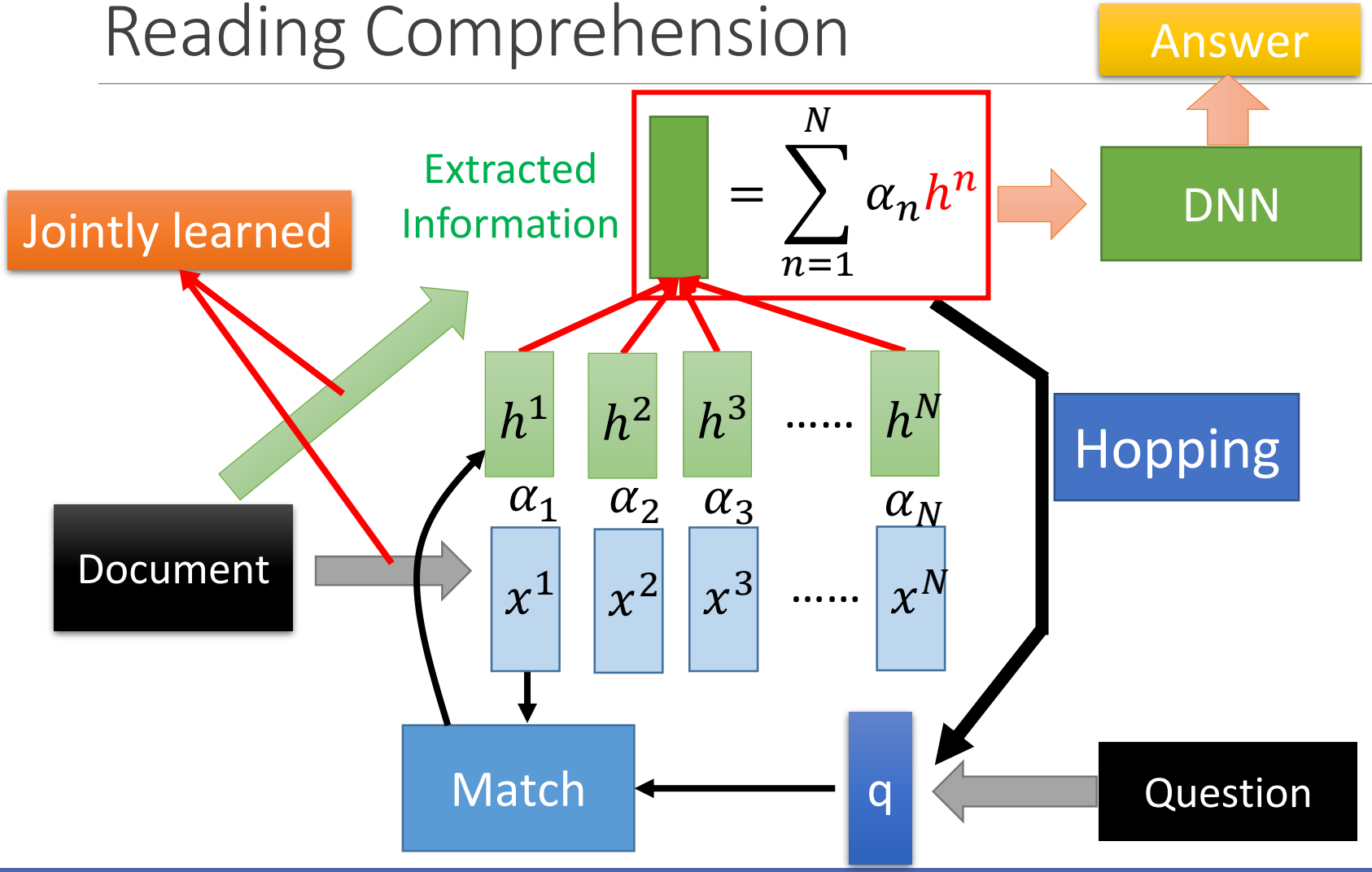
Ref: A woman is frying food

Someone is **frying** a **fish** in a **pot**

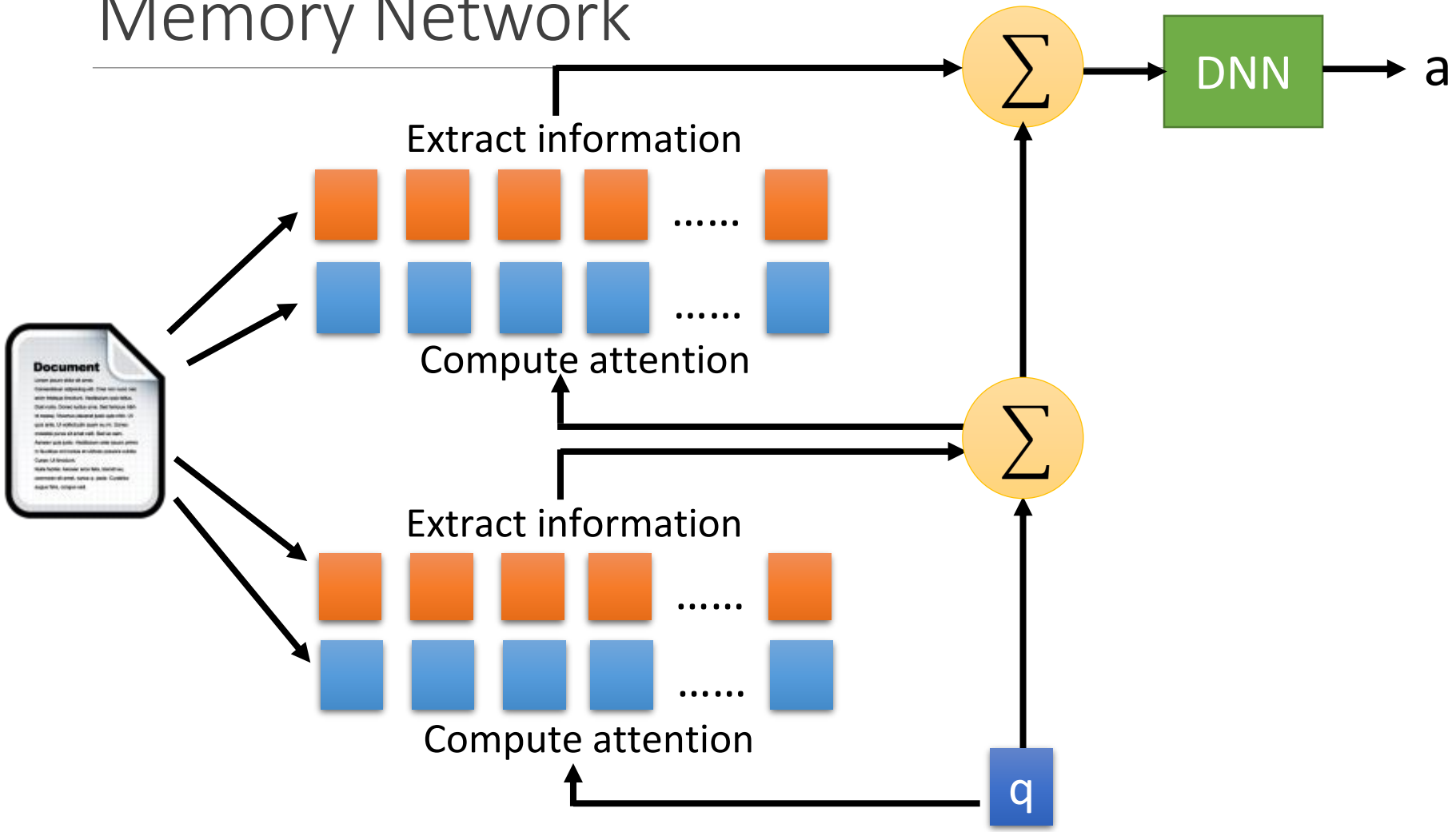
Reading Comprehension



Reading Comprehension



Memory Network



Memory Network

Muti-hop performance analysis

Story (1: 1 supporting fact)	Support	Hop 1	Hop 2	Hop 3
Daniel went to the bathroom.		0.00	0.00	0.03
Mary travelled to the hallway.		0.00	0.00	0.00
John went to the bedroom.		0.37	0.02	0.00
John travelled to the bathroom.	yes	0.60	0.98	0.96
Mary went to the office.		0.01	0.00	0.00
Where is John? Answer: bathroom		**Prediction: bathroom**		

Story (16: basic induction)	Support	Hop 1	Hop 2	Hop 3
Brian is a frog.	yes	0.00	0.98	0.00
Lily is gray.		0.07	0.00	0.00
Brian is yellow.	yes	0.07	0.00	1.00
Julius is green.		0.06	0.00	0.00
Greg is a frog.	yes	0.76	0.02	0.00
What color is Greg? Answer: yellow		**Prediction: yellow**		

https://www.facebook.com/Engineering/videos/10153098860532200/

Conversational QA – CoQA, QuAC

Jessica went to sit in her rocking chair. Today was her birthday and she was turning 80. Her granddaughter Annie was coming over in the afternoon and Jessica was very excited to see her. Her daughter Melanie and Melanie's husband Josh were coming as well. Jessica had . . .

The QA pairs are conversations.

Q1: Who had a birthday?

A1: Jessica

Q2: How old would she be?

A2: 80

Q3: Did she plan to have any visitors?

A3: Yes

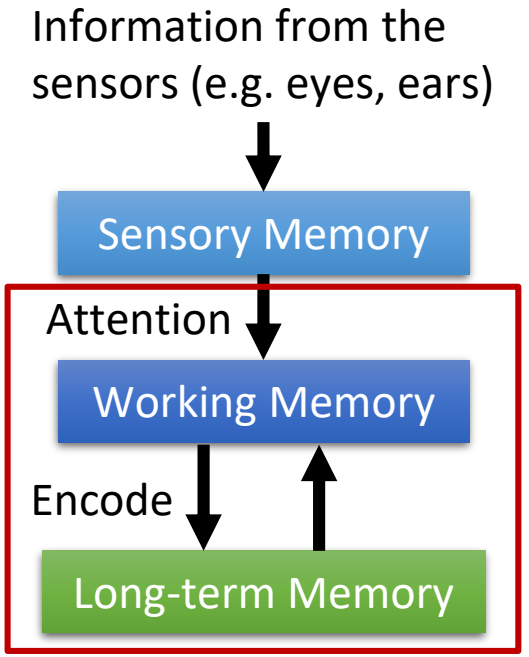
Q4: How many?

A4: Three

Q5: Who?

A5: Annie, Melanie, and Josh

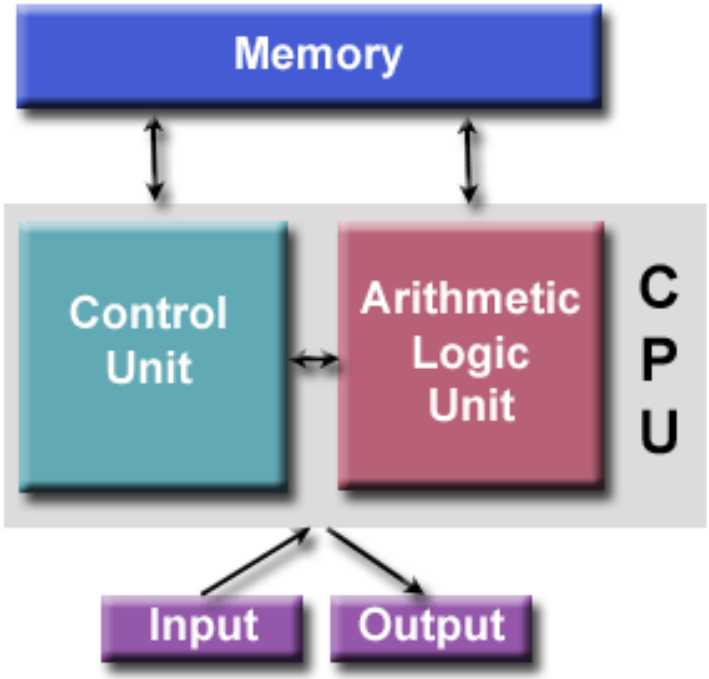
Attention on Memory



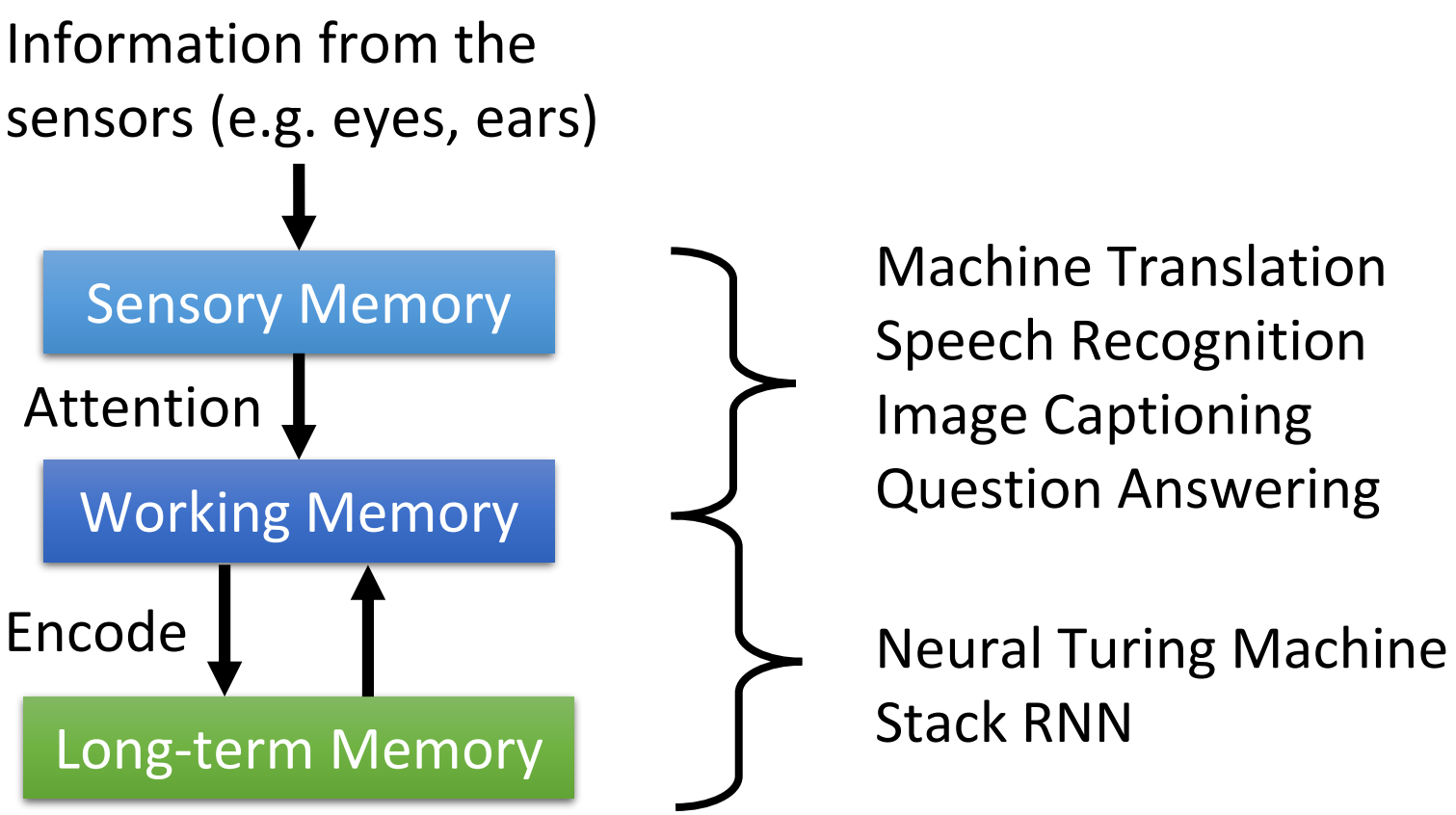
Neural Turing Machine

Von Neumann architecture

Neural Turing Machine is an advanced RNN/LSTM.



Concluding Remarks



Reference

End-To-End Memory Networks. S. Sukhbaatar, A. Szlam, J. Weston, R. Fergus. arXiv Pre-Print, 2015.

Neural Turing Machines. Alex Graves, Greg Wayne, Ivo Danihelka. arXiv Pre-Print, 2014

Ask Me Anything: Dynamic Memory Networks for Natural Language Processing. Kumar et al. arXiv Pre-Print, 2015

Neural Machine Translation by Jointly Learning to Align and Translate. D. Bahdanau, K. Cho, Y. Bengio; International Conference on Representation Learning 2015.

Show, Attend and Tell: Neural Image Caption Generation with Visual Attention. Kelvin Xu et. al.. arXiv Pre-Print, 2015.

Attention-Based Models for Speech Recognition. Jan Chorowski, Dzmitry Bahdanau, Dmitriy Serdyuk, Kyunghyun Cho, Yoshua Bengio. arXiv Pre-Print, 2015.

A Neural Attention Model for Abstractive Sentence Summarization. A. M. Rush, S. Chopra and J. Weston. EMNLP 2015.