Lab 13-2: Image Captioning

Datalab

2021

Outline

- Encoder-Decoder model
- Attention-based
- Assignment

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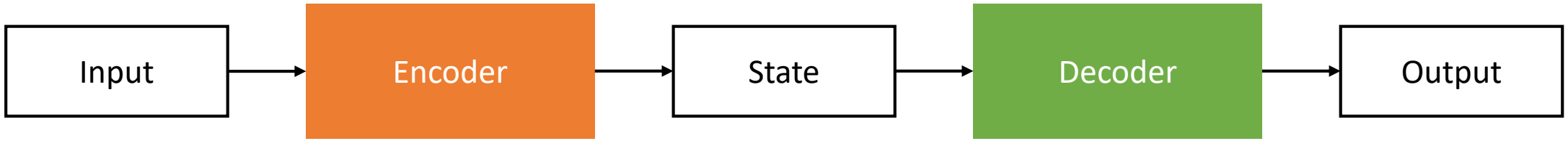
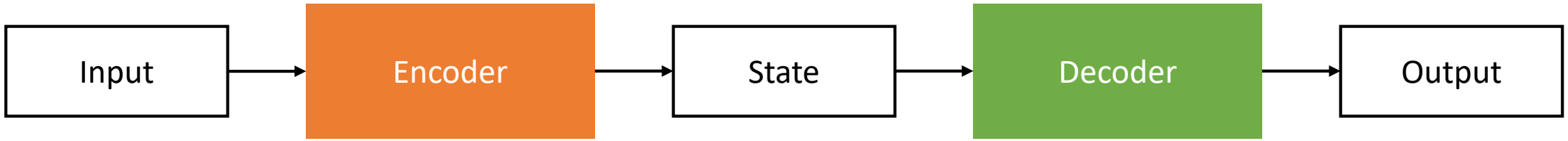
Encoder-Decoder Model

- Lab13-1 - Neural Machine Translation
  - Encoder RNN: reads the source sentence and transforms it into a rich fixed-length vector representation
  - Decoder RNN: uses the representation as the initial hidden state and generates the target sentence



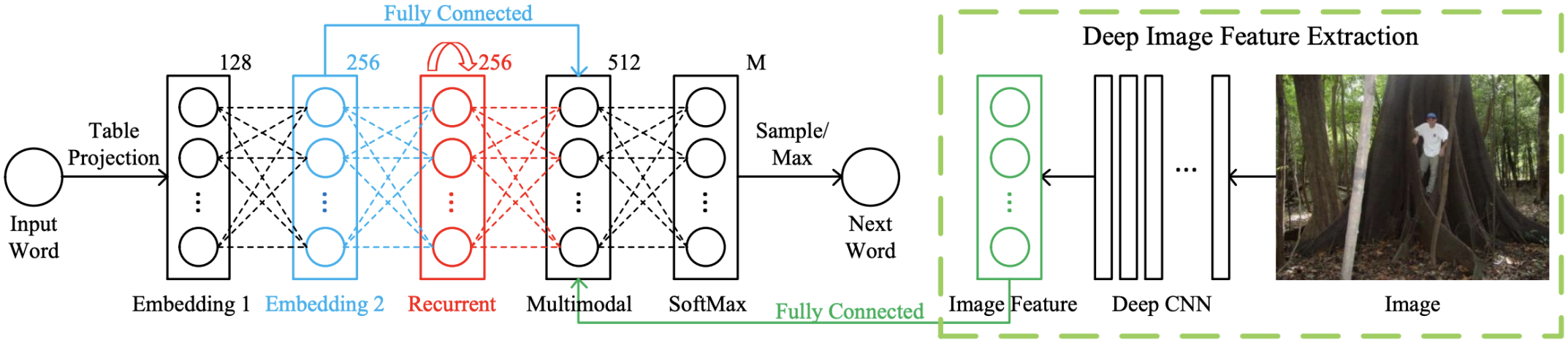
Encoder-Decoder Model

- Image Captioning
  - Encoder CNN: reads the images and transforms it into a rich fixed-length vector representation
  - Decoder RNN: uses the representation as the initial hidden state and generates the target sentence



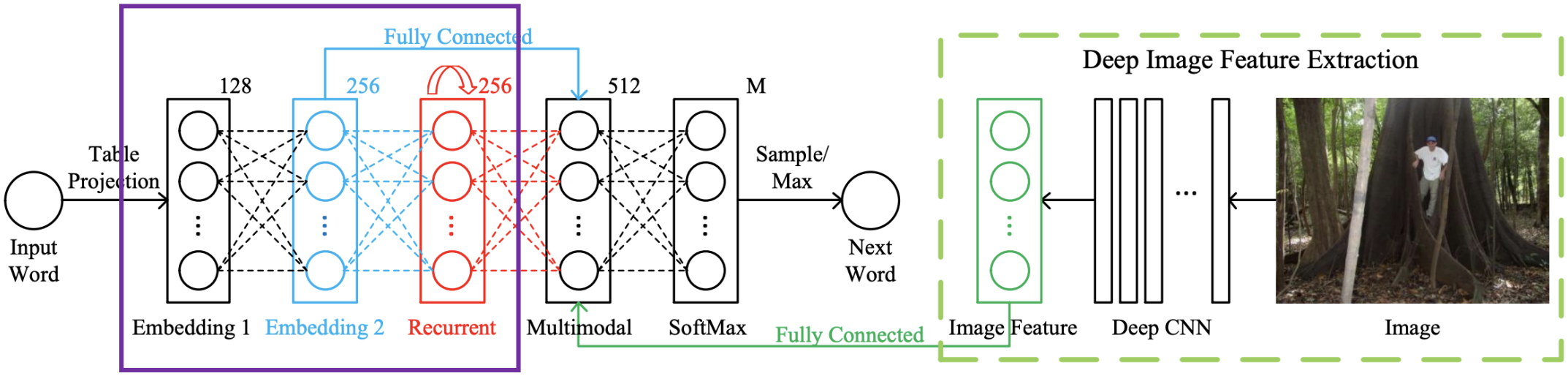
Encoder-Decoder Model

- m-RNN (multimodal RNN)



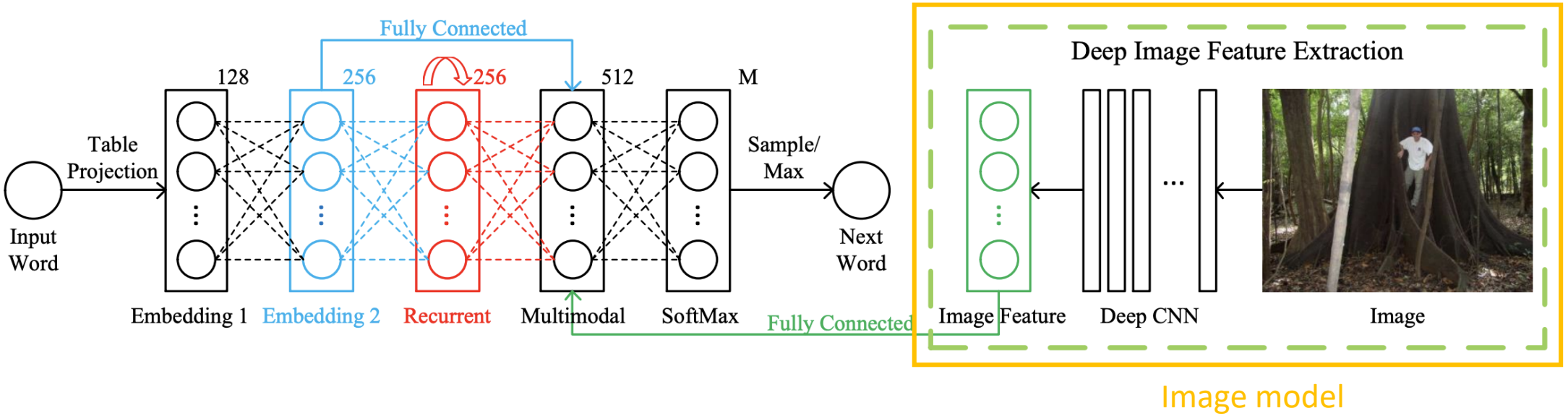
Encoder-Decoder Model

- m-RNN (multimodal RNN)
  - The language model part learns the dense feature embedding for each word



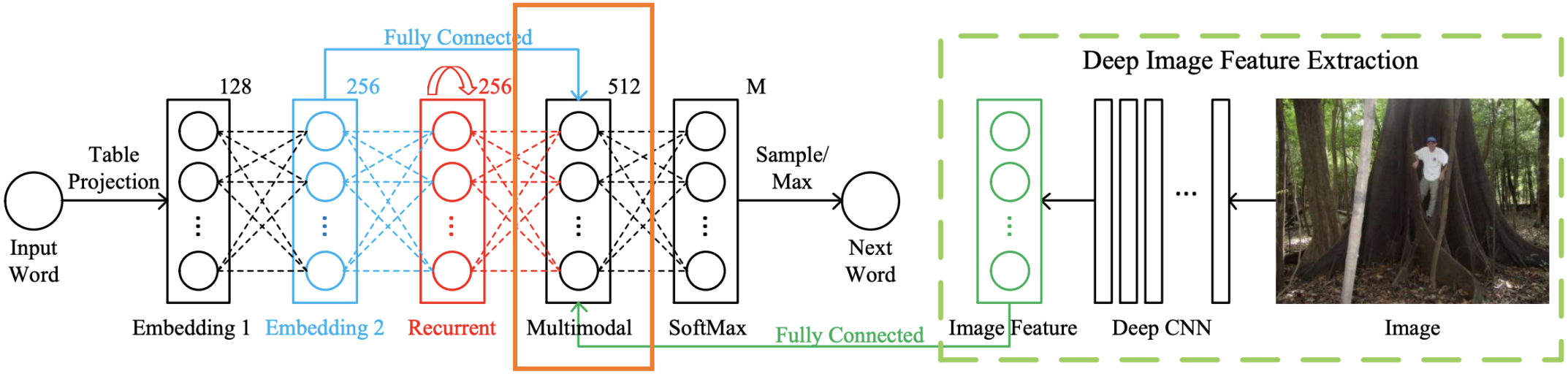
Encoder-Decoder Model

- m-RNN (multimodal RNN)
  - The language model part learns the dense feature embedding for each word
  - The image part contains a deep CNN which extracts image features



Encoder-Decoder Model

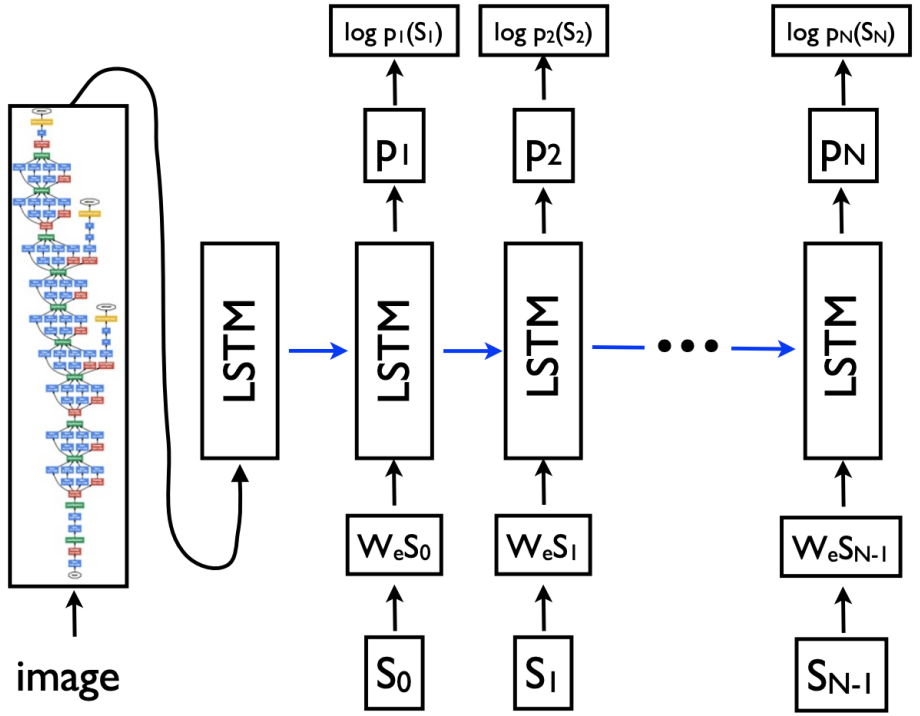
- m-RNN (multimodal RNN)
  - The language model part learns the dense feature embedding for each word
  - The image part contains a deep CNN which extracts image features
  - The multimodal part connects the language model and the deep CNN together by a one-layer representation



Multimodal model

Encoder-Decoder Model

- NIC
  - A generative model based on a deep recurrent architecture that combines recent advances in computer vision and machine translation
  - Uses a more powerful CNN in the encoder
  - The image is only input once



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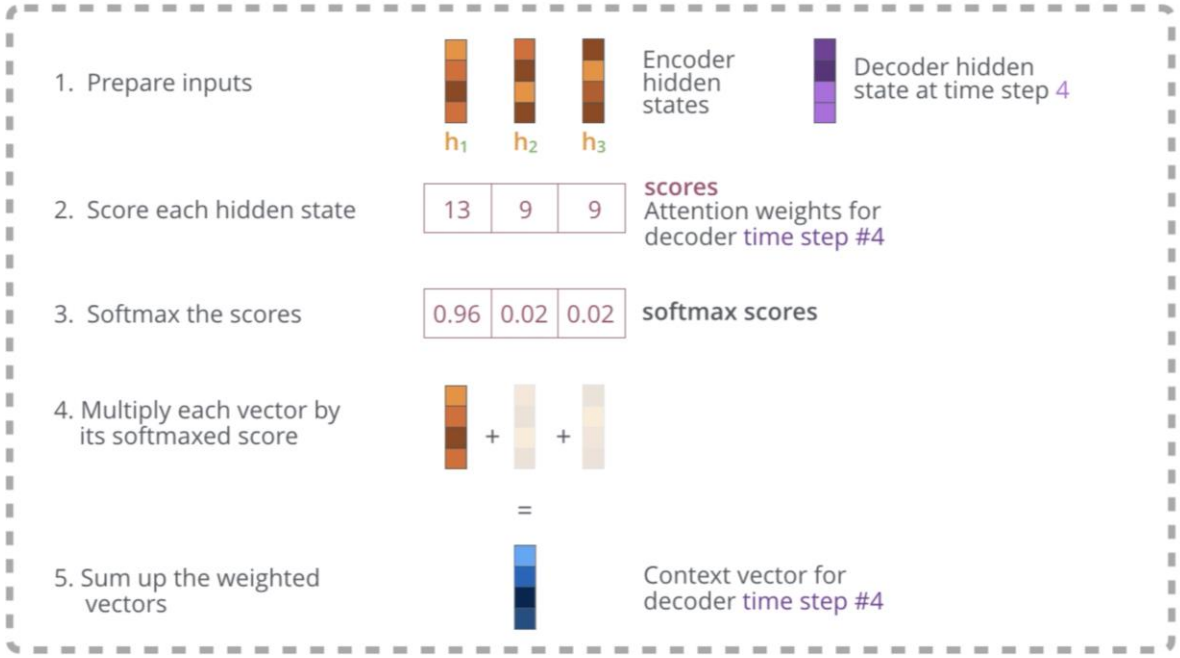
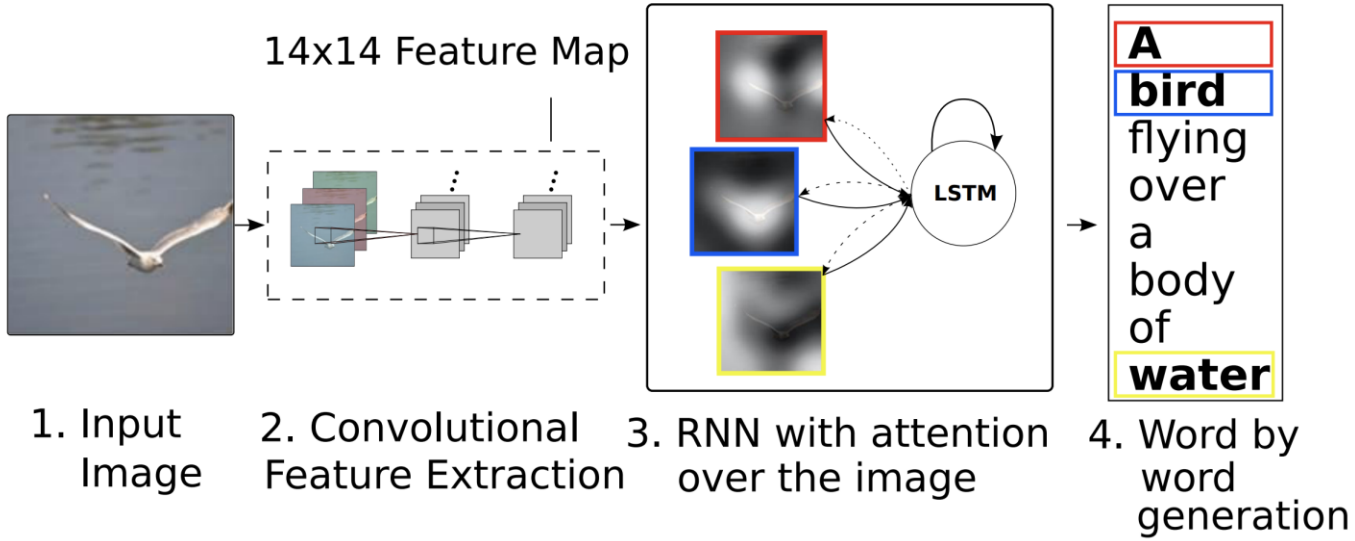
Attention Based

- Attention allows the model to focus on the relevant parts of the input sequence as needed



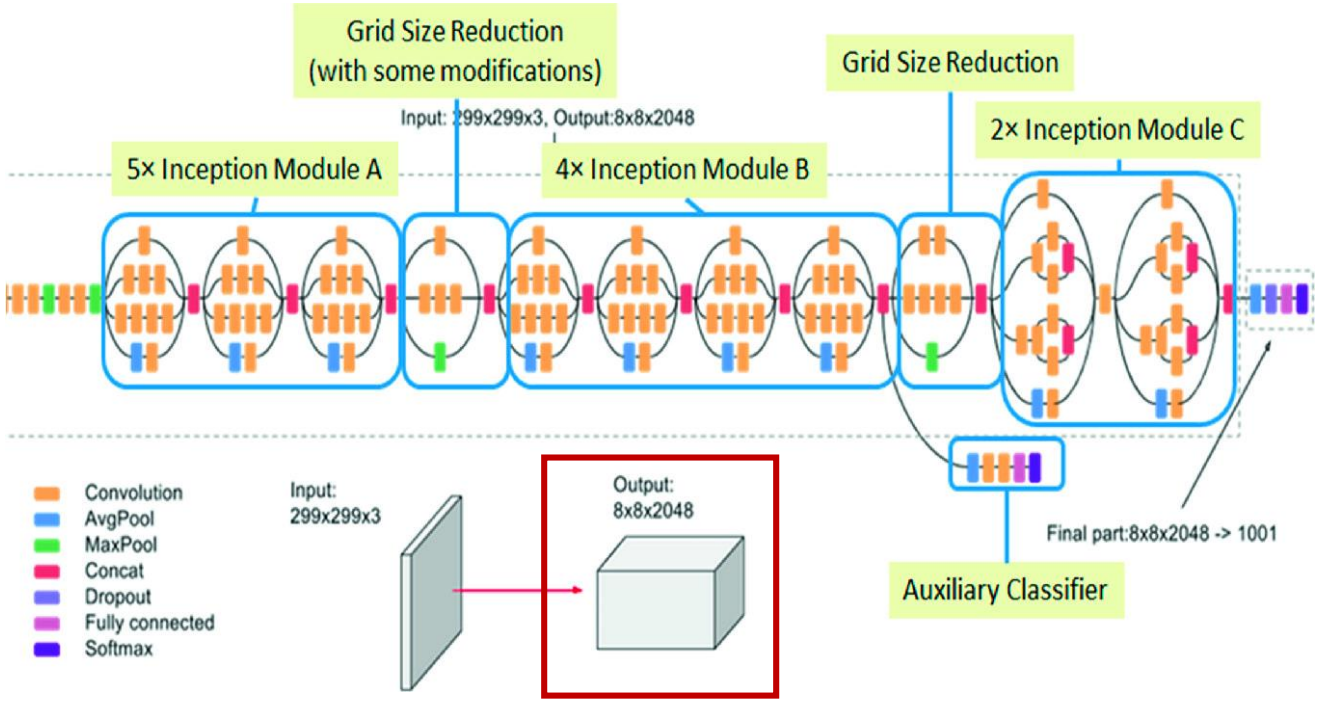
Attention Based

- Attention allows the model to focus on the relevant parts of the input sequence as needed
  - Show, Attend and Tell: Neural Image Caption Generation with Visual Attention



Attention Based

- First, extract the features from image

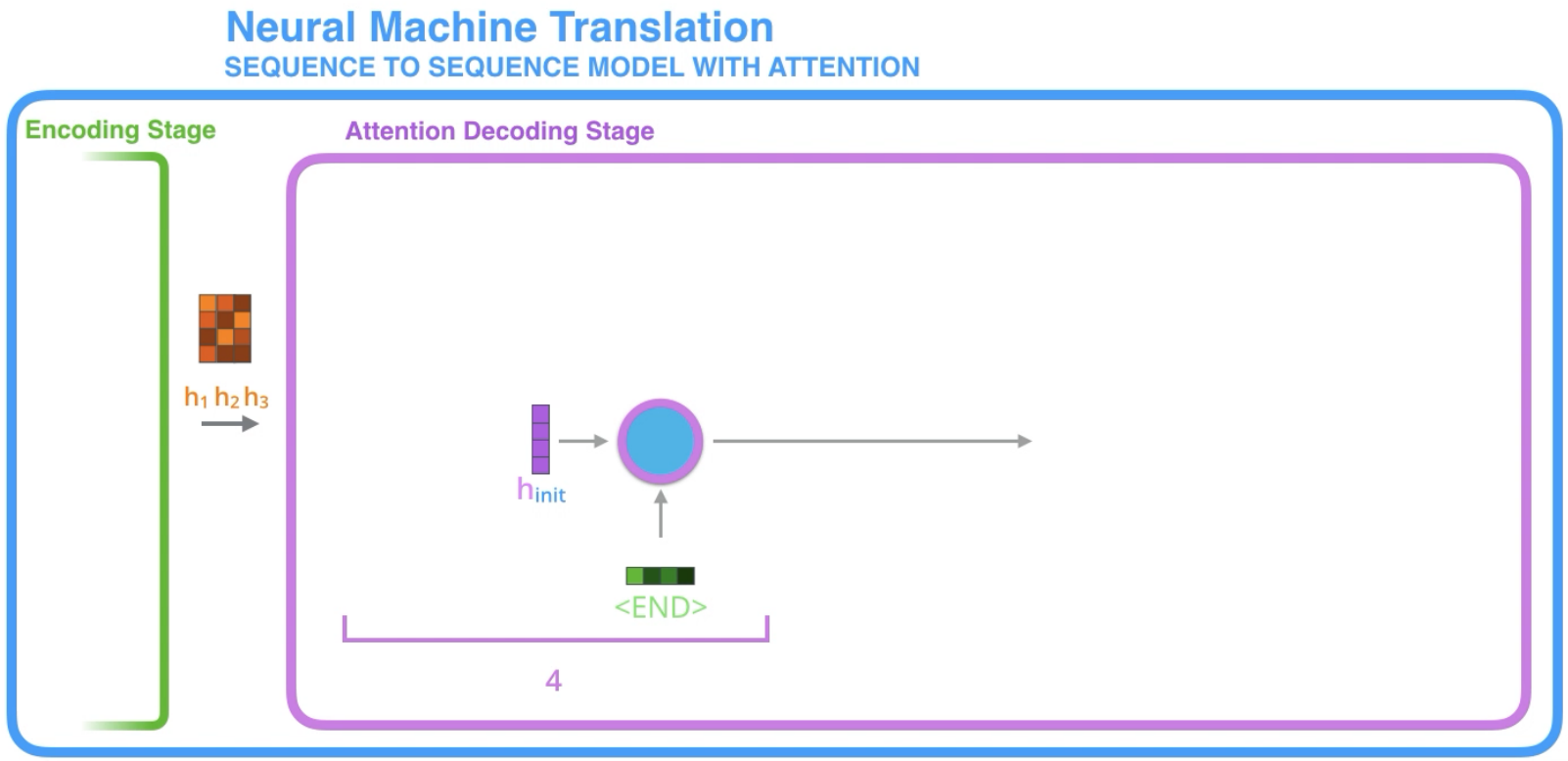


Attention Based

- First, extract the features from image
- We have a 8*8*2048 size feature map, the last layer has 8*8 pixel locations which corresponds to certain portion in image
- That means we have 64 pixel locations
- The model will then learn an attention over these locations

Attention Based

- The rest is similar to the neural machine translation task



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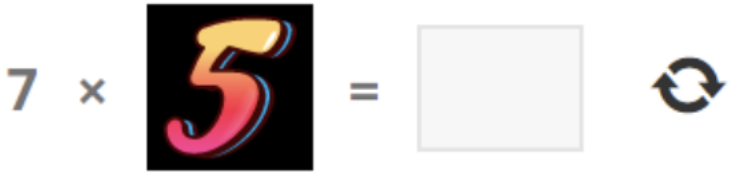
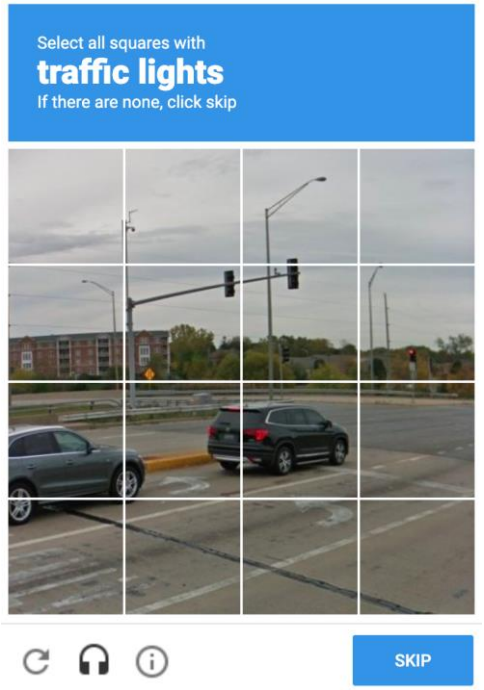
Assignment

- CAPTCHA
  - An acronym for “Completely Automated Public Turing test to tell Computers and Humans Apart”
  - A type of challenge–response test used in computing to determine whether or not the user is human
  - Prevents spam attacks and protects websites from bots



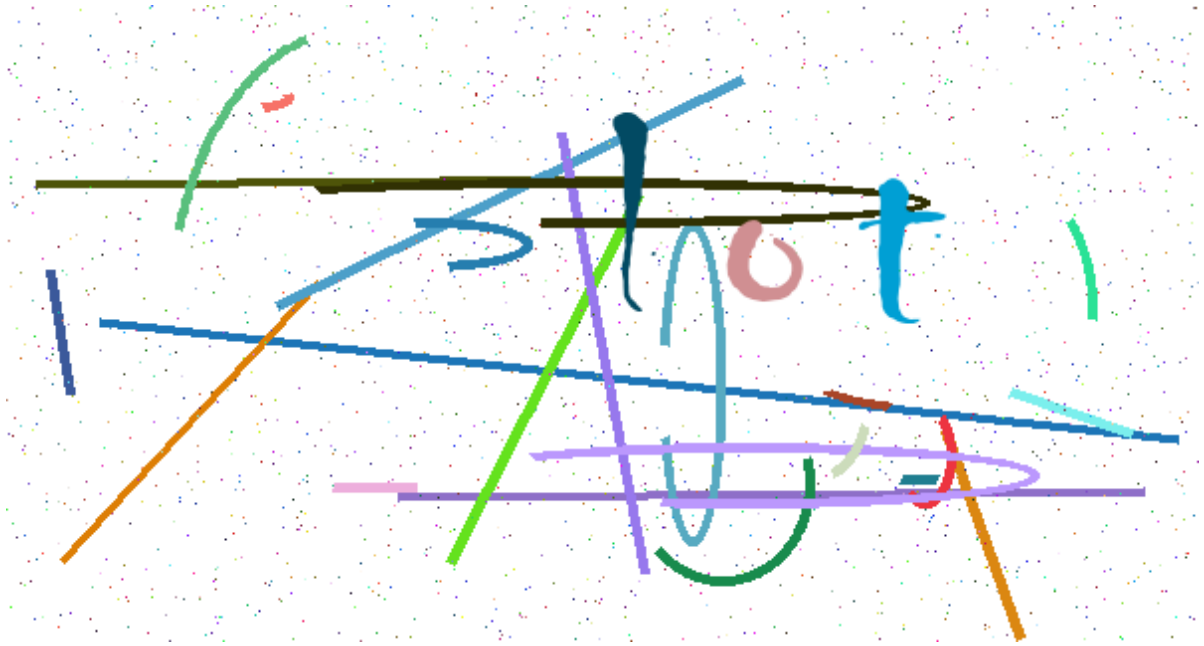
Assignment

- reCAPTCHA
  - Establish that a computer user is human
  - Assist in the digitization of books or improve machine learning



Assignment

- We are going to train a captcha recognizer in this lab
- Dataset
  - 140,000 CAPTCHAs



Assignment

- Requirement
  - Use any model architectures you want
  - Design your own model architecture
  - The first 100,000 as training data, the next 20,000 as validation data, and the rest as testing data
  - Only if the whole word matches exactly does it count as correct
  - Predict the answer to the testing data and write them in a file
  - Testing accuracy should be at least 90%
- Please submit your code file and the answer file

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```
a0 thus
a1 www
a2 tied
a3 ids
a4 jam
a5 zoo
a6 apple
a7 big
a8 lot
a9 above
a10 ooo
```