ADL x MLDS 2017 Fall
HW2 - Video Captioning

2017/10/28

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11/12 更新：新增額外衡量BLEU score的標準

- 根據提出BLEU evaluation 的 paper，助教們和老師討論後決定新增新的衡量方式，主要的改變是正確的字的判定方法是從所有的reference sentences中做選擇，而不是每一句reference都算，再做平均。而BP中的reference 長度，是effective reference length，詳細算法可以參考此論文。
- 因此，新增一個 baseline : **BLEU@1(new) >= 0.65**
- 兩個baseline 過其中1個，即算通過baseline
- 新的bleu_eval.py : Download
  （新增新的evaluation，並將reference caption 中的句點刪除，會比原本算得再高一點點）

Introduction

Outline

- **Introduction : Video Caption Generation**
- **Sequence-to-sequence based model : S2VT**
- **Training Tips**
  - Attention
  - Schedule Sampling
  - Beamsearch
- **How to reach the baseline ?**
- **Format & Submission Rules**
  - Dataset
  - Rules & Format

Video Caption Generation

- Input: A short video
- Output: The corresponding caption that depicts the video

- There are several difficulties including:
  (1) Different attributes of video (object, action)

  (2) Variable length of I/O

  (In this task, video features will be provided)

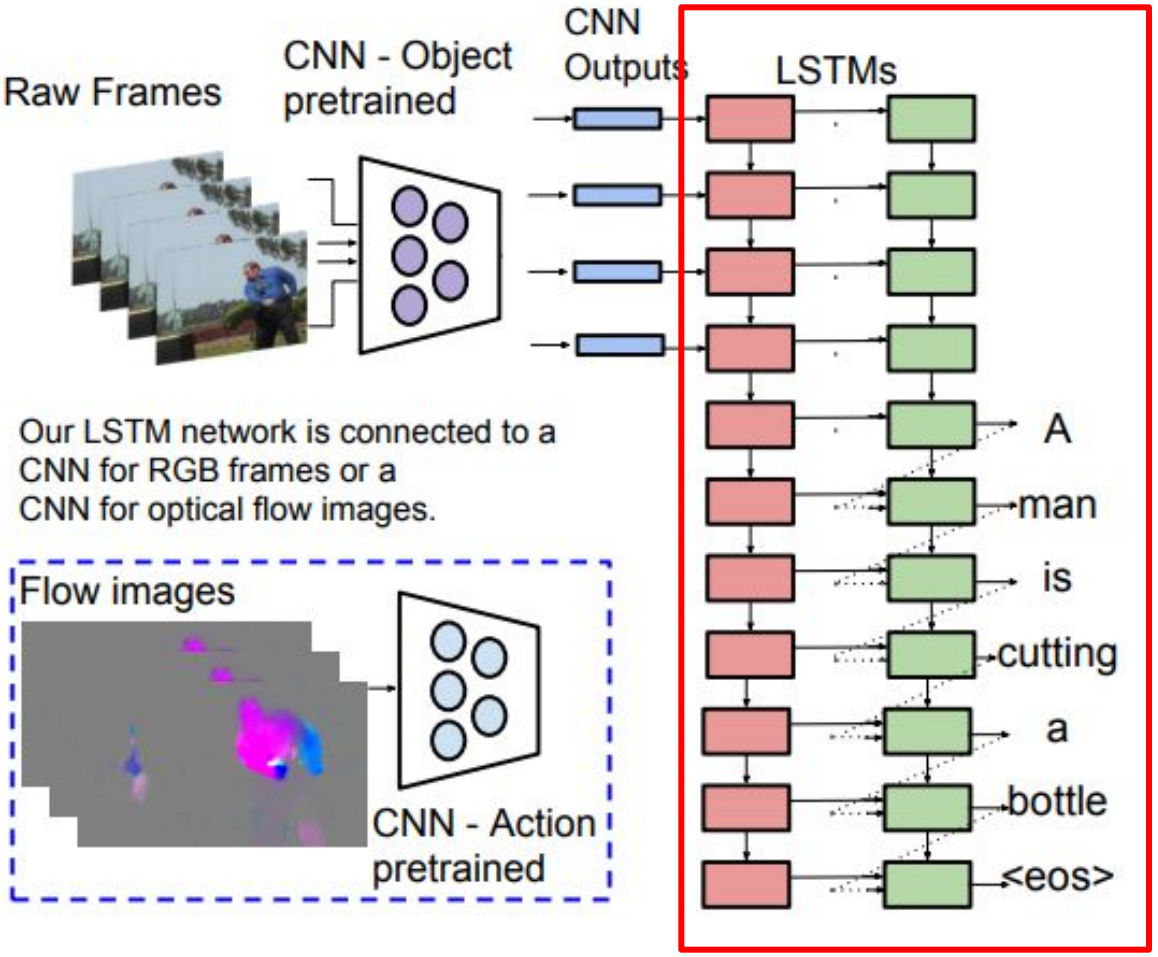
Video Caption Generation - Example

Input

Output

a man is playing a song on the piano

Sequence-to-Sequence Based Model: S2VT

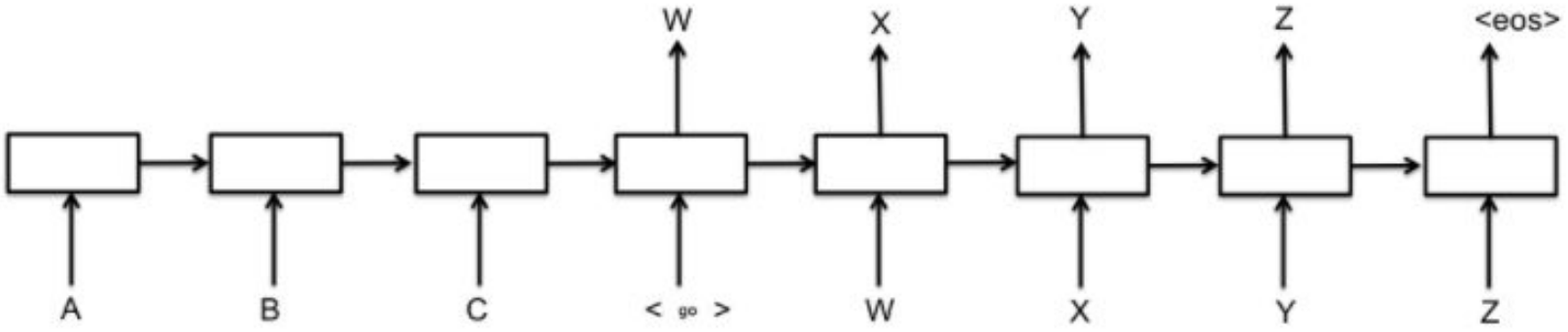


Refer to the following paper for detailed info:

http://www.cs.utexas.edu/users/ml/papers/venugopalan.iccv15.pdf

Seq to Seq

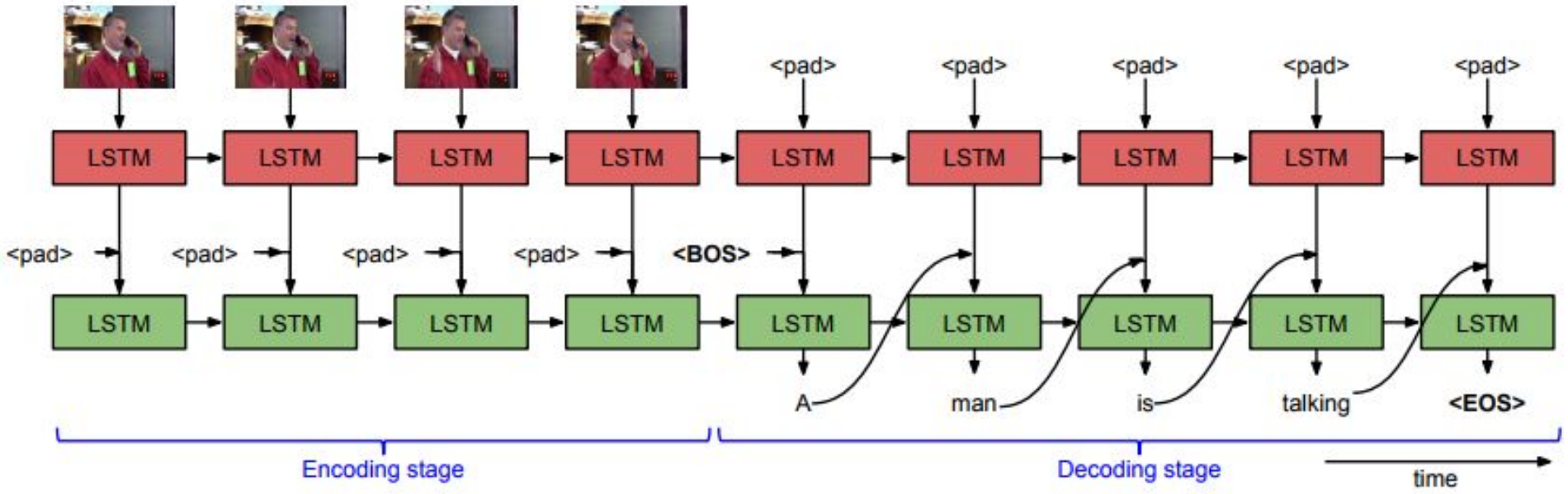
Two recurrent neural networks (RNNs)
an *encoder* that processes the input
a *decoder* that generates the output



https://www.tensorflow.org/tutorials/seq2seq

Sequence-to-Sequence Based Model: S2VT

- Two layer LSTM structure



S2VT

- **2 LSTM stacks**
  upper one is for encoding
  bottom one is for decoding.
- **Encoding stage**

  CNN features → LSTM1 → output1

- **Decoding stage**

  output1 → LSTM2 → word y_t

- Parameter sharing between 2 LSTM stacks can help reduce the complexity

S2VT

Text Input

- One-hot Vector encoding

(1-to-N coding, N is the size of the vocabulary)

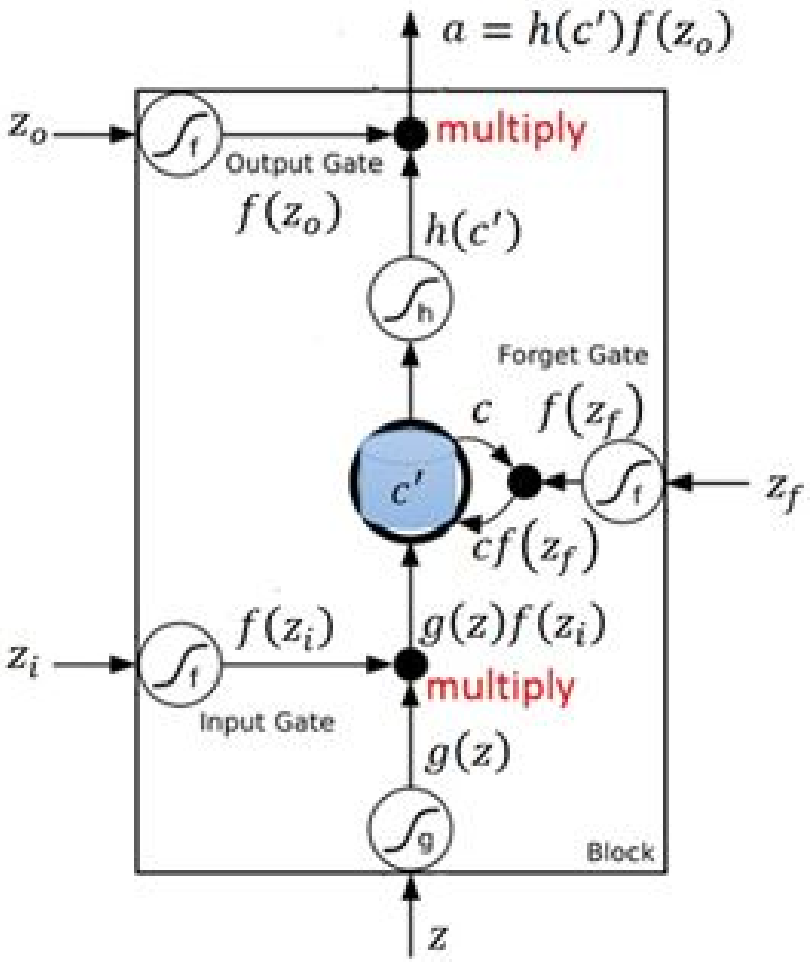
- e.g.

  neural = [0, 0, 0, ..., 1, 0, 0, ..., 0, 0, 0]

  network = [0, 0, 0, ..., 0, 0, 1, ..., 0, 0, 0]

S2VT

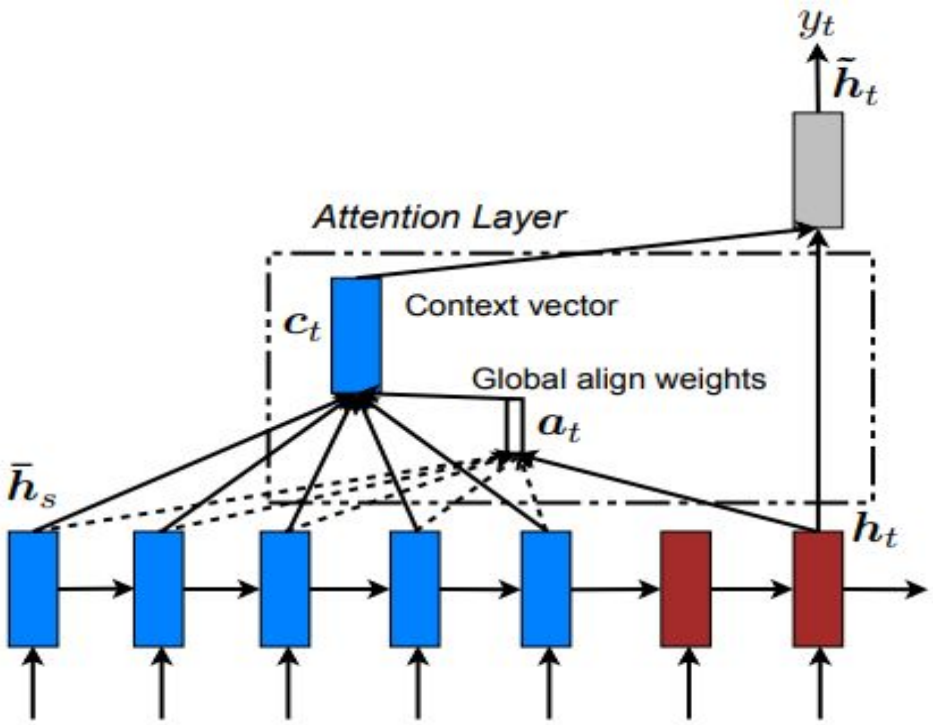
- **LSTM unit**



$$
\begin{aligned}
i_t &= \sigma(W_{xi}x_t + W_{hi}h_{t-1} + b_i) \\
f_t &= \sigma(W_{xf}x_t + W_{hf}h_{t-1} + b_f) \\
o_t &= \sigma(W_{xo}x_t + W_{ho}h_{t-1} + b_o) \\
g_t &= \phi(W_{xg}x_t + W_{hg}h_{t-1} + b_g) \\
c_t &= f_t \odot c_{t-1} + i_t \odot g_t \\
h_t &= o_t \odot \phi(c_t)
\end{aligned}
$$

Training Tips

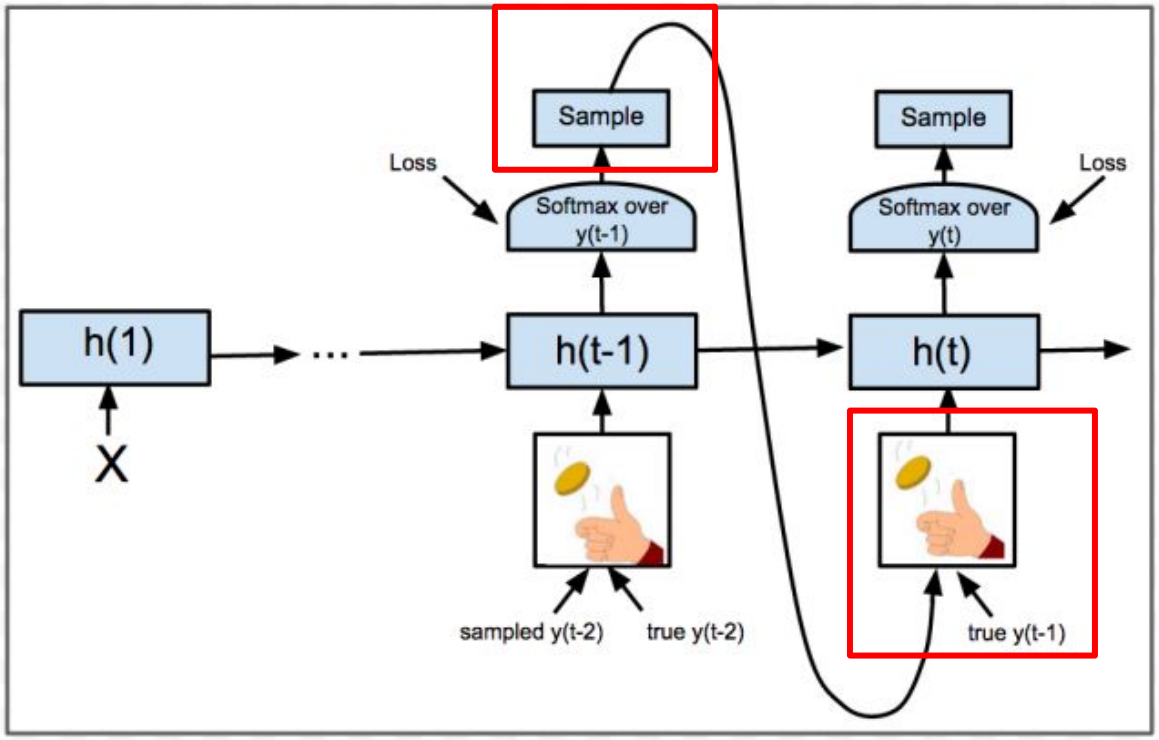
- **Attention on encoder hidden states :**
  Allow model to peek at different sections of inputs at each decoding time step



http://www.aclweb.org/anthology/D15-1166

Training Tips

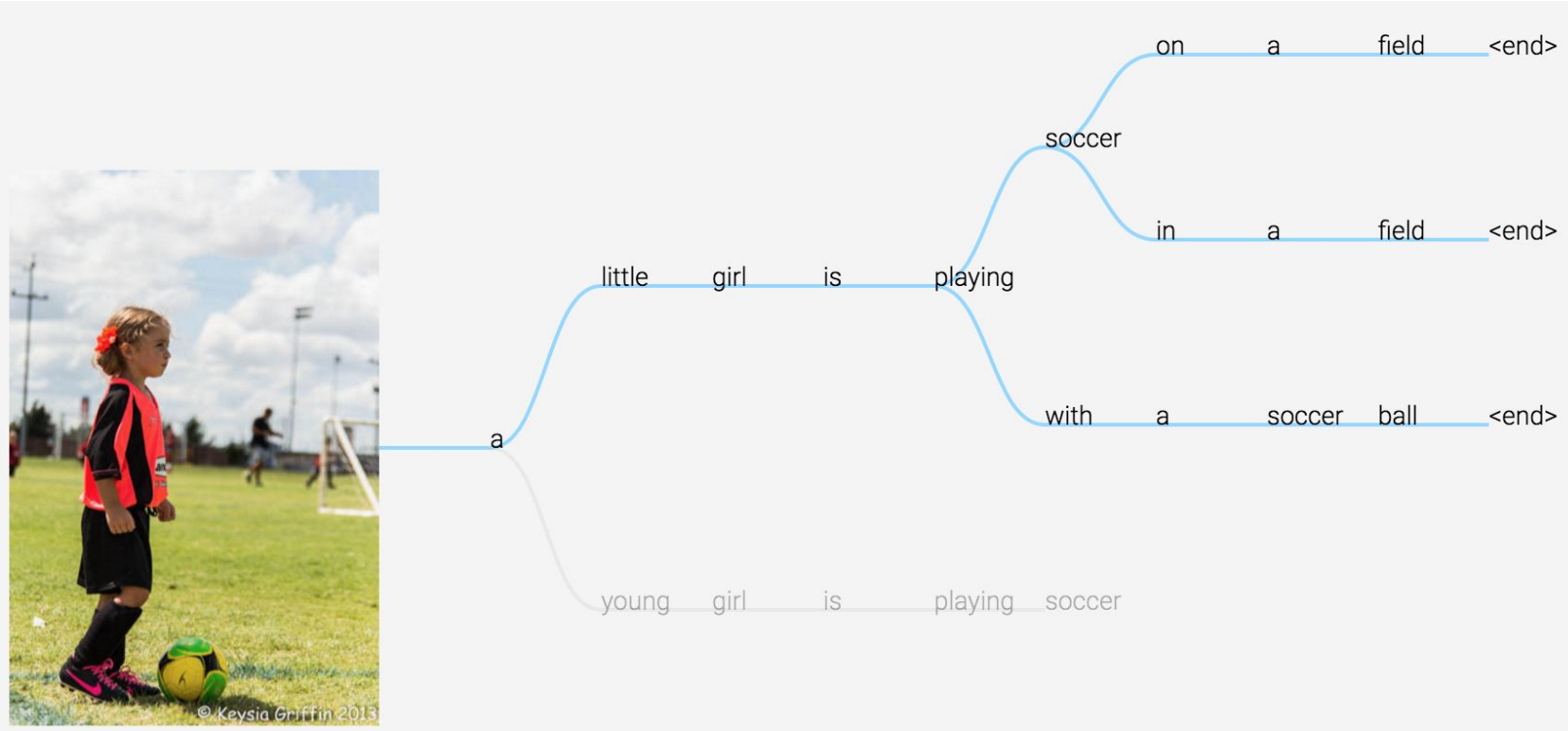
- **Schedule Sampling :**
  To solve “exposure bias” problem,
  When training, we feed (groundtruth) or (last time step’s output) as input at odds



https://arxiv.org/abs/1506.03099

Training Tips

Beamsearch : keep a fixed number of paths



Training Tips

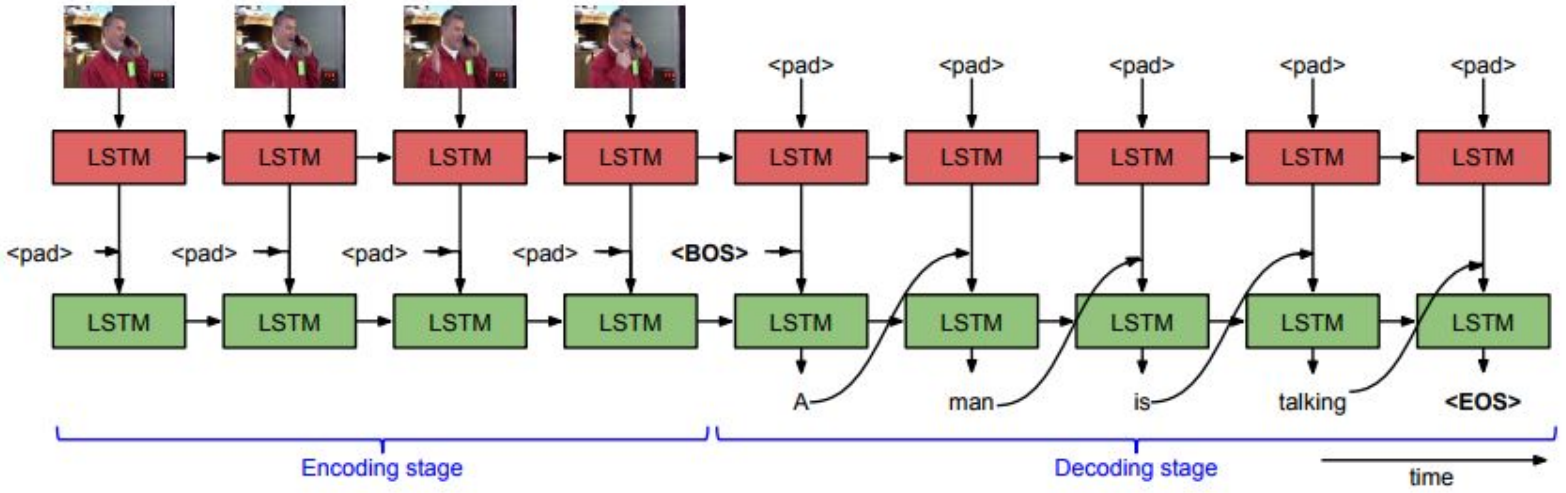
Beamsearch

Demo

http://dbs.cloudcv.org/captioning

Baseline

S2VT model



- Training Epoch = 200
- LSTM dimension = 256
- Learning rate = 0.001
- vocab size = 3000
- AdamOptimizer
- Training time = 72 mins, by using 960 TX

Baseline BLEU@1= 0.25 (Captions Avg.)

Baseline

Evaluation - BLEU@1

Precision = correct words / candidate length

$$\mathrm{BP} = \begin{cases} 1 & \text{if } c > r \\ e^{(1-r/c)} & \text{if } c \leq r \end{cases}$$

where c = candidate length, r = reference length

BLEU@1 = BP * Precision

http://www1.cs.columbia.edu/nlp/sgd/bleu.pdf

Baseline

Evaluation - BLEU@1

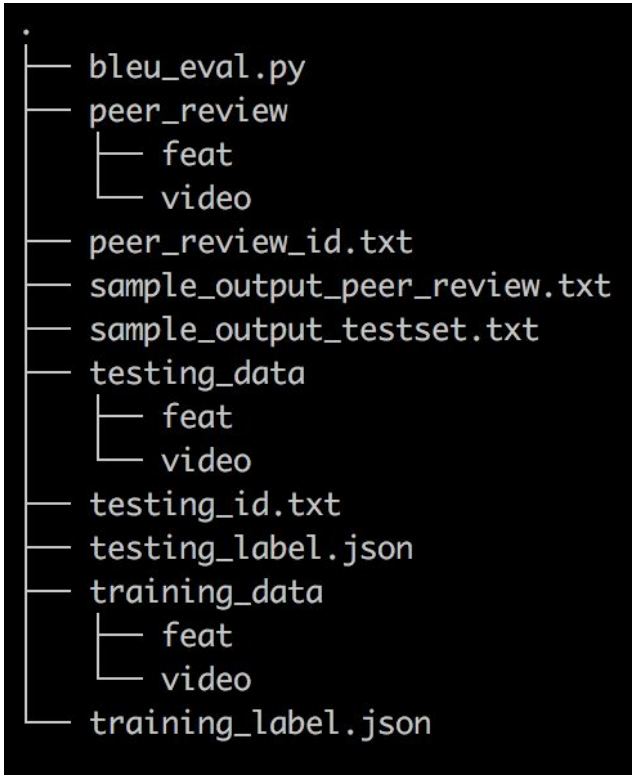
Ground Truth : ***a man is mowing a lawn***
Prediction : ***a man is riding a man on a woman is riding a motorcycle***
BLEU : 1 * 4/13 = 0.308

MSVD Dataset

Data

- **MSVD**
  - 1450 videos for training
  - 100 videos for testing
- **peer review**
  - several videos (more than 10)

- Download Link



Kaggle

There is NO kaggle competition!

HW Rules

Peer review

- Captions of video are hard to evaluate by machine.
- Students of ADLxMLDS should help review captions produced by other’s model.

Special Mission

- To encourage the students to start the homework as early as possible.
- Upload captions of some videos in testing set.
- Please upload your model to your github , and write hw2_special.sh to produce corresponding captions.
  - Usage : hw2_special.sh [the data directory] [output_file]
  - The format of output file should be the same as sample_output_testset.txt, but only consist of five lines.
- Period : 2017/11/6 0:00 - 2017/11/12 23:59
- Link

HW Rules

- Please write shell script to run your code.
- There should be hw2_seq2seq.sh
- Please follow the script usage below:
  - ./hw2_seq2seq.sh $1 $2 $3
  - $1: the data directory,
  - $2: test data output filename
  - $3: peer review output filename
- Ex: ./hw2_seq2seq.sh myData/ sample_output_testset.txt sample_output_peer_review.txt

HW Rules

- Please implement one **seq-to-seq model(or it's variant)** to fulfill the task
- Please also implement **attention** to fulfill the task
- Please use python with version >= 3.5
- Extra dataset is allowed to use.
- **Allowed packages include :**
  - PyTorch v0.2.0
  - Tensorflow r1.3 (Tensor layer forbidden) https://tensorlayer.readthedocs.io/en/latest/ (x)
  - Keras 2.0.7 (Tensorflow backend only)
  - MXNet 0.11.0
  - CNTK 2.2
  - Numpy
  - Pandas
  - Python Standard Lib

HW Rules

If you use other packages, please ask for permission first !!!

Grading

Grading Policy

I. Baseline (4%)
II. Peer review (4%)
III. Special mission (2%)
IV. Review other’s results (2%)
V. Report (6%)
VI. Notice

Grading Policy -- Baseline(4%)&Peer review(4%)

- Pass the baseline (4%)
  - Average bleu score should >= 0.25
- Peer review (4%) :For those passing the baseline, your score will be linearly graded, rounded to the 2nd decimal place.
  - Ex: if 100 people pass the baseline, you will get 3 points if you’re at 25th place.
- We will run your code to make sure your performance passes the baseline.

Grading Policy -- Review other's result(2%)

- Get 2% if you review other's result
- Rules will be announced after TAs successfully produce all the students' output.

Grading Policy -- Special Mission (2%)

- Get 2% if you have submitted the form and upload models to your github.

Grading Policy -- Report(6%)

- Do not exceed **4** pages and written in Chinese.
- Model description (2%)
  - Describe your seq2seq model
- Attention mechanism(2%)
  - How do you implement attention mechanism? (1%)
  - Compare and analyze the results of models with and without attention mechanism. (1%)
- How to improve your performance (1%)
  - Write down the method that makes you outstanding
  - Describe the model or technique (0.5%)
  - Why do you use it (0.5%)
- Experimental results and settings (1%)
  - parameter tuning, schedual sampling ... etc
- README : please specify library and the corresponding version in README

Grading Policy -- Bonus(2%)

- TAs will select about 5 persons, according to both **creativity** and **performance** (top 10%, by the score of peer review) for introducing your model during the class
- If you are chosen, you have to present in order to get the bonus.

Grading Policy -- Notice

- Please fill the late submission form first only if you will submit HW late
- Please push your code before you fill the form
- There will be 25% penalty per day for late submission, so you get 0% after four days
- You get 0% if the required script has bug.
    - If the error is due to the format issue, please come to fix the bug at the announced time, or you will get 10% penalty afterwards.

Submission Rules

Submission Rules

- Create hw2 directory under ADLxMLDS2017
- Under hw2, there should be:
  - report.pdf
  - **your_seq2seq_model**
  - hw2_seq2seq.sh // should run your RNN model
  - model_seq2seq.py and other necessary files
  - *In model_seq2seq.py should include your training codes.
- Please do not upload any dataset to Github (include external dataset)
- If your model are too big for github, upload to a cloud space and write it in your script to download the model
- Your script should be done within 10 mins (include preprocessing) excluding model donwloading

Deadline

Github code & report deadline: **2017/11/19 23:59 (GMT+8)**

FAQ

Q1: 使用的lib 限制

- **Allowed packages include :**
  - PyTorch v0.2.0
  - Tensorflow r1.3 (Tensor layer forbidden)
    https://tensorlayer.readthedocs.io/en/latest/ (x)
  - Keras 2.0.7 (Tensorflow backend only)
  - MXNet 0.11.0
  - CNTK 2.2
  - Numpy
  - Pandas
  - Python Standard Lib

If you use other packages, please ask for permission first !!!

Q2: 請問助教會跑training的程式嗎？

A:

不會。我們所規定的十分鐘只包含testing。除非我們認為有必要就會請你們來跑training的code。

Q3: 有推薦上傳model的平台嗎？

A:

dropbox, google drive都是大家常用的平台。不過推薦大家可以使用gitlab，操作方法與github類似，但是可以上傳大容量的檔案。

Q4: peer review 底下的資料夾怎麼是空的？

A :

屆時同學上傳model 後，在助教電腦上的資料夾才會有影片 及相對應得feature

Q5: test set 的答案怎麼一起給了？

A :

因為沒有Kaggle，方便大家validation 和測準確率，因此也給大家testset 的答案。

Q6: attention model助教也會跑嗎？

A :

不會的，這部分請同學自己實驗並寫在report裡，同學只需要交自己最好的model。

Q7: 助教會使用bleu_eval.py 來測是否有過baseline嗎？

A:

bleu_eval.py僅給同學參考用，在改的時候可能會再做修改，但計算average的方式會一樣的，請同學不要用程式的漏洞.....

Q8: peer review 的 video 有幾個呢？

A :

屆時助教在跑model時，會將所有的影片標示在peer_review_id.txt（助教的data資料夾底下），請同學利用這個檔案讀所有的video。

Eg : 1.avi

feature 位置：peer_review/feat/1.avi.npy

video 位置：peer_review/video/1.avi

Q9: data 裡的feature是怎麼抽的呢？

A:

pretrain在ILSVRC的VGG19。

80*4096維的feature，是指每個影片抽80個frame，每個frame有4096維feature。

Q10: Average bleu score 是怎麼算的呢？

A:

對於每個影片，你的答案會對他的所有的字幕都算一次bleu score，平均後得到關於這支影片的分數。

將所有影片的分數取平均後，就是你的總bleu score。

詳細演算法請見 bleu_eval.py

FAQ

- 有問題請利用TA hours、信箱或FB 社團，**請不要FB私訊助教！！**
- If you have other questions,
  - please contact TAs via adlxmlds@gmail.com
  - post your questions on facebook group
  - go to TA office hours
    - 李佳軒 Thu 16:00-17:30 (電二531)
    - 蔡哲平 Wed 10:30-12:00 (電二531) (11/8（三) 助教要期中考, 請假）
    - 林圓方 Fri 9:30-11:00 (博理527)