# MLDS HW4

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## Environment

OS Ubuntu 16.04
CPU Intel® Core™ i7-3770K CPU @ 3.50GHz
GPU GeForce GTX 1080
Memory 32GB

## Model Description

本次作業與HW2非常相似，都需要從input sequence中做attention，並decode出另一個sequence作為output。首先是在encode階段，將input的詞依序經過RNN之後保留每一個step的以供後續進行attention，接著在decode階段利用將attention後的結果與前一個step輸出經過RNN產生下一個word。

在藉由上述seq2seq的方式pretrain出一個model後，再利用此model進行對output作sample，並將sample後結果給定一個reward，透過reward重新回到model中將loss乘上reward來update model，即是RL的training。

attention的model部分使用[1]中所用的attention function，其他參數設定如下:

- RNN cell：雙層LSTM
- vocab_size：25000
- word embedding：1024
- Loss：crossentropy with 512 sample

### Pretrain

pre train model的作法就如同model discription所說，和hw2非常類似，但做出來的結果卻比想像中的還要理想，本來還想要再加入beam search，但因為時間的關係，沒有多在pre train model上琢磨。

### RL

在pretrain後產生許多難以讓人回答的句子，我們另外pre-train一個ease of answering model來做衡量reward的標準. 把pre-train產生的response丟入這個model，產生回答後和dummy dialogue比較log probability，再乘上負號產生reward，做出來的結果好像有比較好一點，另外，我們也有pre train 一個 semantic coherence model 來給reward，不過因為pre-train這個model的結果不是很好，所以使用這個model給予reward最後結果不甚理想，最後回答都會產生一些沒有意義的字，所以我們後來只用ease of answering model來給予reward

### Reward Function

原始paper訂的reward是如上課所說用ease of answering、semantic coherence、imformation flow三者相加但在考慮了這次的work主要是做single-turn的chatbot，因此在semantic coherence的部份我們只取了given answer產生question的那項，

### SeqGAN

原本的SeqGAN[2]會有conditional input $x$ 作為RNN的initial value，經過Generator產生一句新的句子，利用Discriminator分辨是否由Generator產生的。在我們的架構中，我們的input是一個句子所轉成的word index，經過一個RNN encoder變成hidden state（如果需要，也可以加上attention），將這個hidden state當作我們的conditional input。

Generator的部分，如上所述，我們已RNN作為encoder和decoder；而Discriminator我們則利用CNN去embed之真實和generate的data，並透過inner produce作為score

在training的時候，我們採用跟原始paper一樣的training方式，以1:1的更新次數update generator和discriminator。

## Results

### S2S

| | |
|---|---|
| nice to meet you. | nice to meet you . |
| how are you? | all right , son . |
| suck my dick. | shut up ! |
| fuck you. | i'm serious . that's the wrong one . |
| good night! | good night . |
| where are you? | i'm here . |
| how old are you? | well i'll be born in twentyfive minutes . |
| are you a human? | i've given you long enough to breathe today . |
| I'm drunk. | i'll get you some coffee . |
| come to my room. | and what would you do ? |
| be careful. | i always am . |
| Why didn't you tell me? | i was trying to protect you from this |
| How many people go here? | couple thousand . most of them evil |
| What'd you do to her? | i hit her with hit the national bridge . |

### RL

| | |
|---|---|
| nice to meet you. | nice to meet you . |
| how are you? | fine . |
| suck my dick. | now shut the fuck away . |
| fuck you. | fuck me ? fuck you ! ! fuck ! |
| good night! | good night , daddy |
| where are you? | we're by ozone |
| how old are you? | i am i am look who i am . |
| are you a human? | i don't think so |
| I'm drunk. | i'll bring it . |
| come to my room. | how shall i help ? |
| be careful. | of course , i'll take it . |
| Why didn't you tell me? | you said you were talking about him . |
| How many people go here? | umm , most of us are at seven . |
| What'd you do to her? | i hit her . |

### SeqGAN

| | |
|---|---|
| What is Mr. Brown doing | He is she. |
| It's working, oh doctor | Is this doctor |
| Doctor, look! | It's down there. |
| Wait! | Sir ? |
| All right give it to him | Are u serious? |

## Team Division

- 陳奕安（R05921035）: implement model
- 林哲賢（R05921043）: implement model
- 劉叡聲（R05921043）: implement model
- 吳侑學（R05548020）: implement model

## Reference

[1]: https://arxiv.org/pdf/1412.7449.pdf (https://arxiv.org/pdf/1412.7449.pdf) “Grammar as a Foreign Language”
[2]: https://arxiv.org/pdf/1609.05473.pdf (https://arxiv.org/pdf/1609.05473.pdf) “SeqGAN: Sequence Generative Adversarial Nets with Policy Gradient”