

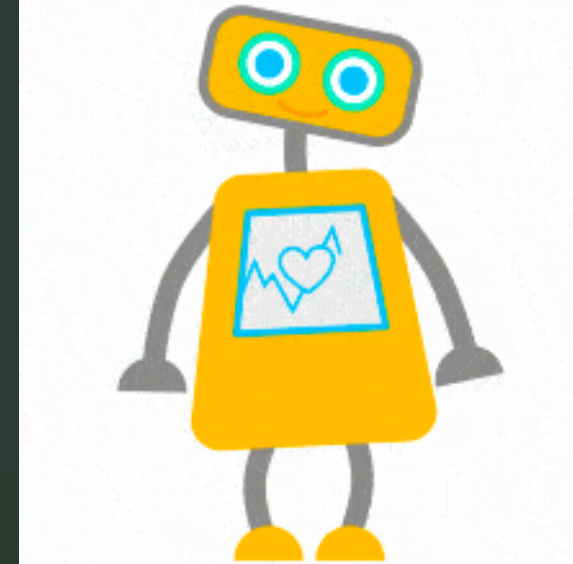
The SmartChatBot




Pranoy Kovuri

Motivation

- **U.S. health care spending** grew 5.8 percent in 2015, reaching \$3.2 trillion or \$9,990 per person.
 - For Mental health alone is a 200 Billion dollar industry, this shows the potential for NLP here
 - Almost 50% percent of college students self report symptoms of depression and anxiety, and there are long wait times for counselling service in universities.
 - NLP could help here create anti-depression chat bots like Woebot



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- Also there are other reasons:
 - Wouldn't it be wonderful when someone can answer any question you have on the essay you are reading or wiki article you want to understand?
 - It would be similar to our friend who has mastered a topic and tell us answers for our questions
 - Imagine the boost in productivity once we will have access to expert systems for any given topic.

Example Task on Babi Synthetic Data Set from Facebook

QA Examples

One Supporting Fact

I: Mary walked to the bathroom.

I: Sandra went to the garden.

I: Daniel went back to the garden.

I: Sandra took the milk there.

Q: Where is the milk?

A: garden

I: Everybody is happy.

Q: What's the sentiment?

A: positive

QA Examples

I: Jane has a baby in Dresden.

Q: What are the named entities?

A: Jane - person, Dresden - location

I: Jane has a baby in Dresden.

Q: What are the POS tags?

A: NNP VBZ DT NN IN NNP .

I: I think this model is incredible

Q: In French?

A: Je pense que ce modèle est incroyable.

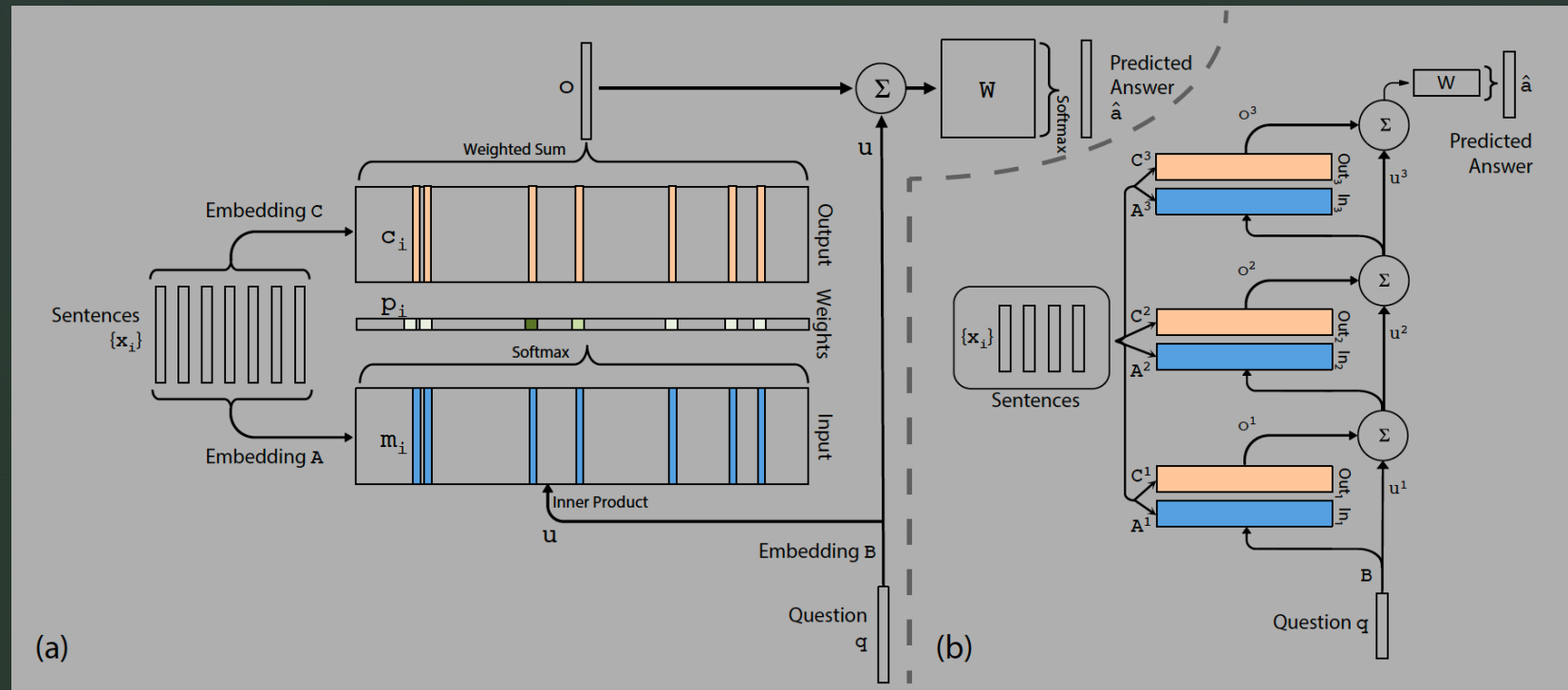
2 and N supporting facts Type Questions

```
['76:', 'Mary', 'moved', 'to', 'the', 'kitchen', '.'],  
['77:', 'Mary', 'went', 'to', 'the', 'office', '.'],  
['78:', 'Sandra', 'grabbed', 'the', 'football', 'there', '.'],  
['79:', 'Sandra', 'discarded', 'the', 'football', '.'],  
['81:', 'Daniel', 'took', 'the', 'football', 'there', '.'],  
['82:', 'Daniel', 'put', 'down', 'the', 'apple', 'there', '.'],  
['84:', 'Daniel', 'took', 'the', 'apple', 'there', '.'],  
['85:', 'Daniel', 'travelled', 'to', 'the', 'hallway', '.'],  
['87:', 'Sandra', 'journeyed', 'to', 'the', 'bathroom', '.'],  
['88:', 'Daniel', 'left', 'the', 'milk', 'there', '.'],  
['90:', 'Daniel', 'went', 'to', 'the', 'kitchen', '.'],  
['91:', 'Daniel', 'went', 'back', 'to', 'the', 'bathroom', '.']],  
['Where', 'is', 'the', 'milk', '?'],  
'hallway')
```

Goal

- A joint model for general QA

- Memory Networks is the state of the Art in Language Tasks, they help in common architecture for many different tasks. Although common models for all tasks is still a struggle.
- Motivation from the hippocampus function in the brain. It is able to retrieve temporal state that are triggered by some response like a sound or a sight. This can be related to database queries



Results

Two Supporting Fact 85.3% Accuracy

Single Supporting Fact 99.6% Accuracy

Train on 10000 samples, validate on 1000 samples

Epoch 1/4

0s - loss: 0.3701 - acc: 0.8794 - val_loss: 2.2982e-04 - val_acc: 1.0000

Epoch 2/4

0s - loss: 0.0055 - acc: 0.9979 - val_loss: 0.1486 - val_acc: 0.9750

Epoch 3/4

0s - loss: 0.0062 - acc: 0.9986 - val_loss: 5.0378e-06 - val_acc: 1.0000

Epoch 4/4

0s - loss: 0.0140 - acc: 0.9976 - val_loss: 0.0265 - val_acc: 0.9960

Train on 10000 samples, validate on 1000 samples

Epoch 1/8

3s - loss: 0.4705 - acc: 0.8839 - val_loss: 0.5539 - val_acc: 0.8550

Epoch 2/8

3s - loss: 0.4688 - acc: 0.8830 - val_loss: 0.7327 - val_acc: 0.8140

Epoch 3/8

3s - loss: 0.4329 - acc: 0.8937 - val_loss: 0.6062 - val_acc: 0.8500

Epoch 4/8

3s - loss: 0.4511 - acc: 0.8917 - val_loss: 0.5956 - val_acc: 0.8540

Epoch 5/8

3s - loss: 0.4605 - acc: 0.8877 - val_loss: 0.5157 - val_acc: 0.8750

Epoch 6/8

3s - loss: 0.4485 - acc: 0.8902 - val_loss: 0.5607 - val_acc: 0.8520

Epoch 7/8

3s - loss: 0.4437 - acc: 0.8905 - val_loss: 0.6600 - val_acc: 0.8430

Epoch 8/8

3s - loss: 0.4750 - acc: 0.8847 - val_loss: 0.5902 - val_acc: 0.8530

Other more advanced methods

- End to End Memory Networks
- Dynamic Memory Networks, Currently I am working on this model.
- Neural Turing Machine
- Differentiable Neural Computer
- Recurrent Entity Networks
- Dynamic Coattention Networks

Terminology

- Git
- Dynamic Memory Networks
- LSTMs
- Deep Learning
- NLP
- Attention Networks

Currently Working on Stanford SQUAD DataSet

In meteorology, precipitation is any product of the condensation of atmospheric water vapor that falls under **gravity**. The main forms of precipitation include drizzle, rain, sleet, snow, **graupel** and hail... Precipitation forms as smaller droplets coalesce via collision with other rain drops or ice crystals **within a cloud**. Short, intense periods of rain in scattered locations are called "showers".

What causes precipitation to fall?

gravity

What is another main form of precipitation besides drizzle, rain, snow, sleet and hail?

graupel

Where do water droplets collide with ice crystals to form precipitation?

within a cloud

Figure 1: Question-answer pairs for a sample passage in the SQuAD dataset. Each of the answers is a segment of text from the passage.

Online Implementation in JavaScript

- <http://yerevann.com/dmn-ui/#/>.
- <https://ethancaballero.pythonanywhere.com/>



Questions?

