

Homework #4 – Deep Learning Applications

CAP 5619, Deep & Reinforcement Learning (Fall 2018), Department of Computer Science, Florida State University

Points: 80

Due: Beginning of the class (9:30am) on Wednesday, November 7th, 2018

Submission: You need to submit electronically via Canvas by uploading a pdf file (named “hw4-Firstname-Lastname.pdf”) for your answers to the questions. Here replace “Firstname” using your first name and replace “Lastname” using your last name in the file names

The main purpose of this assignment is to have a better understanding the ranges and effectiveness of deep learning applications.

Problem 1 (20 points) Read the following paper “Squeeze-and-Excitation Networks” (available from <https://arxiv.org/pdf/1709.01507.pdf>). Summarize the novel features in its deep learning model and explain the main features that are used in the paper to improve the generalization performance of the system.

Problem 2 (20 points) The neural networks used for the Microsoft 2017 conversational speech recognition system is described in https://www.microsoft.com/en-us/research/uploads/prod/2018/04/ms_swbd17_icassp18.pdf. Explain the main deep neural network features in the system. A particular challenge to speech recognition is how to adapt to different accents. Explain how you would enhance the Microsoft system to cope with different accents.

Problem 3 (20 points) One of the outstanding challenges in natural language processing is to have models that can capture the semantics (i.e., the meanings) of sentences. Based on the paper “Recursive Neural Networks Can Learn Logical Semantics” (available from <http://www.aclweb.org/anthology/W15-4002>), answer the following questions.

- (1) Explain in your words how meanings are encoded in sentences.
- (2) How could we represent the meanings of sentences using deep learning models?
- (3) Explain the architectural features in the paper.
- (4) Do you think that you could build a natural language understanding system based on the method in the paper? Justify your answer by explaining whether the method could capture the meanings in sentences.

Problem 4 (20 points) One of the successful deep learning applications is neural machine translation. Based on the paper “Neural Machine Translation by Jointly Learning to Align and Translate” (available from <https://arxiv.org/pdf/1409.0473.pdf>), answer the following questions.

- (1) How are words and sentences encoded in the proposed system?
- (2) Compared to the encoder-decoder RNN architecture in Figure 10.12 in the textbook, what are the new features in the encoder and what are the new features in the decoder, and how do these features help improve the translation accuracy?
- (3) Why is the proposed model better at translating long sentences?
- (4) Give two additional situations that the attention mechanism proposed in the paper can be helpful. (Note that it has been used in a number of studies and you can find hints in those papers.)

Extra Credit Problem

Problem 5 (8 points) LeCun, the Creator of the Convolutional Neural Networks, gave a talk titled “What's Wrong With Deep Learning?” (which can be found at <http://www.pamitc.org/cvpr15/files/lecun-20150610-cvpr-keynote.pdf>). Summarize the wrong/missing components in deep learning in the talk and give a brief justification of your own position on each of the issues.