Deep Learning Projects

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Deep Learning Projects

Overview

- 25% of your grade
- Groups of 3 students
- Applying deep learning techniques to real-world data
- Very open-ended…

Course Projects

Important dates

- March 23: Proposal Due
- May 1: Presentations
- May 3: Presentations
- May 14: Final Reports Due

Project Proposal

Project Proposal (due Mar 23)

- 1-2 pages
  - Who is in your group?
  - What dataset(s) do you plan to use?
  - What deep learning tasks?
  - What techniques do you plan to employ?
- 10% your project grade

Presentation

- 12-13 minute oral overview of the project
  - Problem addressed
  - Approaches used
  - Evaluation measures
  - Resulting performances
  - Lessons learned?
- 2-3 minute question and answer
- 30% project grade

Final Report

- Final Report
  - Use the Latex or WORD template from https://nips.cc/Conferences/2015/PaperInformation/StyleFiles
  - Max number of pages: eight (8), including figures and tables but excluding references.
  - One additional ninth page containing only the cited references is allowed.
  - At least 4 pages (excluding reference) recommended
  - Summary of problem, approach, evaluation, results
  - What did you learn from this project?
  - 60% project grade **(NOT the longer report the better!)**

Data Data Data

- Success depends on finding lots of data
  - Can't learn something if you have no relevant data
- 30 Amazing (And Free) Public Data Sources For 2018

https://www.forbes.com/sites/bernardmarr/2018/02/26/big-data-and-ai-30-amazing-and-free-public-data-sources-for-2018/#728a29985f8a

- Other sources
  - UIC projects (if you have data)
  - Kaggle.com
  - mldata.org
  - CORGIS Datasets (https://think.cs.vt.edu/corgis/)
  - US Census bureau (time use data)
  - Microsoft Research GPS dataset
  - Divvy!

Evaluation

- Partially based on results
  - Does approach work well for problem?
- Partially based on effort
  - Did you put effort into evaluating different techniques, exploring the features used, etc.?
- Can I just implement an algorithm from a paper?
  - Yes, as long as the algorithm is not too trivial and you add your own insights.
- Can I use the code of other authors? Yes, but more in other aspects
- Can I try something that's not covered in the course? Sure
- Can I writeup my own code? Sure
- Can I do a mathematical project – Yes!

Implementation of algorithm + experiment on (big) dataset + insights from it + mathematical analysis

Example Projects

- Entropy-SGD optimization with applications to Fourier domain convolution
- Improved Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks
- Question-Answer Matching using Deep Learning Models
- Natural Language Question Answering with Memory Networks: A Comparative Analysis
- Deep residual learning for large amount classes classification problem
- Keyphrase Extraction Using Deep Recurrent Neural Networks on Twitter
- Semantic Image Inpainting with Context Encoders
- Recurrent Attention Model on Sentiment Analysis
- Representation and regularization study of deep and wide neural network for image recognition

Math project

- Novelties on the mathematical side are surely more related with theory rather than application. So a mathematical project on deep learning is likely to explore some unsolved mathematical problems.
- Examples include deriving new invariance convolution networks (e.g. link), or prove recovery guarantees (e.g. link), or improved optimization guarantees such as escaping saddle points (e.g. link). Obviously these papers themselves are way more than a course project. However, based on them some extensions could make good topics. For example
- 1. Verify whether assumptions made in those theoretical papers actually hold on real datasets. For example, the local strongly convex assumption in link, the independence assumptions made in link.
- 2. Make improvements in some aspects on the existing algorithms, and give solid mathematical justifications. For example: Entropy-SGD as improvements to SGD/ADAM, and computing pooling in frequency domain as in link, improving upon the standard spatial domain pooling (after all, Fourier transform has been used extensively in convolutional neural networks [link]).

Questions?