(http://nlp.stanford.edu/)

CS224d: Deep Learning for Natural Language Processing

(index.html)

Schedule and Syllabus

Unless otherwise specified the course lectures and meeting times are:

Tuesday, Thursday 3:00-4:20
Location: Gates B1

Event	Date	Description	Course Materials
Lecture	Mar 29	Intro to NLP and Deep Learning	Suggested Readings: 1. [Linear Algebra Review (http://cs229.stanford.edu/section/cs229-linalg.pdf)] 2. [Probability Review (http://cs229.stanford.edu/section/cs229-prob.pdf)] 3. [Convex Optimization Review (http://cs229.stanford.edu/section/cs229-cvxopt.pdf)] 4. [More Optimization (SGD) Review (http://cs231n.github.io/optimization-1/)] 5. [From Frequency to Meaning: Vector Space Models of Semantics (http://www.jair.org/media/2934/live-2934-4846-jair.pdf)] [Lecture Notes 1 (lecture_notes/notes1.pdf)] [python tutorial (http://cs231n.github.io/python-numpy-tutorial/)] [slides (lectures/CS224d-Lecture1.pdf)]
Lecture	Mar 31	Simple Word Vector representations: word2vec, GloVe	Suggested Readings: 1. [Distributed Representations of Words and Phrases and their Compositionality (http://papers.nips.cc/paper/5021-distributed-representations-of-words-and-phrases-and-their-compositionality.pdf)] 2. [Efficient Estimation of Word Representations in Vector Space (http://arxiv.org/pdf/1301.3781.pdf)] [slides (lectures/CS224d-Lecture2.pdf)]
A1 released	Apr 4	**Pset #1 released**	[Pset 1 (assignment1/index.html)] [Pset 1 Solutions (assignment1/assignment1_soln)] [Pset 1 Solutions Code (assignment1/assignment1_sol.zip)]

Lecture	Apr 5	Advanced word vector representations: language models, softmax, single layer networks	Suggested Readings: 1. [GloVe: Global Vectors for Word Representation (http://nlp.stanford.edu/pubs/glove.pdf)] 2. [Improving Word Representations via Global Context and Multiple Word Prototypes (http://www.aclweb.org/anthology/P12-1092)] [Lecture Notes 2 (lecture_notes/notes2.pdf)] [slides (lectures/CS224d-Lecture3.pdf)]
Lecture	Apr 7	Neural Networks and backpropagation -- for named entity recognition	Suggested Readings: 1. [UFLDL tutorial (http://ufldl.stanford.edu/wiki/index.php/Backpropagation_Algorithm)] 2. [Learning Representations by Backpropogating Errors (http://www.iro.umontreal.ca/~vincentp/ift3395/lectures/backprop_old.pdf)] [Lecture Notes 3 (lecture_notes/notes3.pdf)] [slides (lectures/CS224d-Lecture4.pdf)]
Lecture	Apr 12	Project Advice, Neural Networks and Back-Prop (in full gory detail)	Suggested Readings: 1. [Natural Language Processing (almost) from Scratch (http://arxiv.org/pdf/1103.0398v1.pdf)] 2. [A Neural Network for Factoid Question Answering over Paragraphs (https://cs.umd.edu/~miyyer/pubs/2014_qb_rnn.pdf)] 3. [Grounded Compositional Semantics for Finding and Describing Images with Sentences (http://nlp.stanford.edu/~socherr/SocherKarpathyLeManningNg_TACL2013.pdf)] 4. [Deep Visual-Semantic Alignments for Generating Image Descriptions (http://cs.stanford.edu/people/karpathy/deepimagesent/devisagen.pdf)] 5. [Recursive Deep Models for Semantic Compositionality Over a Sentiment Treebank (http://nlp.stanford.edu/~socherr/EMNLP2013_RNTN.pdf)] [slides (lectures/CS224d-Lecture5.pdf)]
Lecture	Apr 14	Practical tips: gradient checks, overfitting, regularization, activation functions, details	Suggested Readings: 1. [Practical recommendations for gradient-based training of deep architectures (http://arxiv.org/abs/1206.5533)] 2. [UFLDL page on gradient checking (http://ufldl.stanford.edu/wiki/index.php/Gradient_checking_and_advanced_optimization)] [slides (lectures/CS224d-Lecture6.pdf)]
A1 Due	Apr 19	**Pset #1 due**	

Lecture	Apr 19	Introduction to Tensorflow	Suggested Readings: 1. [TensorFlow: Large-Scale Machine Learning on Heterogeneous Distributed Systems (http://download.tensorflow.org/paper/whitepaper2015.pdf)] [slides (lectures/CS224d-Lecture7.pdf)] [AWS Tutorial (supplementary/aws-tutorial-2.pdf)] [AWS Tutorial Supplementary (lectures/CS224D-Lecture7-2.pdf)] [AWS Tutorial Video (https://youtu.be/zdnMXKHP-m4)]
A2 released	Apr 20	**Pset #2 released**	[Pset 2 (assignment2/index.html)][Pset 2 Solutions (assignment2/assignment2_sol.pdf)] [Pset 2 Solutions Code (assignment2/assignment2_dev.zip)]
Lecture	Apr 21	Recurrent neural networks -- for language modeling and other tasks	Suggested Readings: 1. [Recurrent neural network based language model (http://www.fit.vutbr.cz/research/groups/speech/publi/2010/mikolov_interspeech2010_IS100722.pdf)] 2. [Extensions of recurrent neural network language model (http://www.fit.vutbr.cz/research/groups/speech/publi/2011/mikolov_icassp2011_5528.pdf)] 3. [Opinion Mining with Deep Recurrent Neural Networks (http://www.cs.cornell.edu/~oirsoy/drnt.htm)] [slides (lectures/CS224d-Lecture8.pdf)] [minimal net example (karpathy) (http://cs231n.github.io/neural-networks-case-study/)] [vanishing grad example (notebooks/vanishing_grad_example.html)] [vanishing grad notebook (notebooks/vanishing_grad_example.ipynb)] [Lecture Notes 4 (lecture_notes/notes4.pdf)]
Lecture	Apr 26	GRUs and LSTMs -- for machine translation	Suggested Readings: 1. [Long Short-Term Memory (http://web.eecs.utk.edu/~itamar/courses/ECE-692/Bobby_paper1.pdf)] 2. [Gated Feedback Recurrent Neural Networks (http://arxiv.org/pdf/1502.02367v3.pdf)] 3. [Empirical Evaluation of Gated Recurrent Neural Networks on Sequence Modeling (http://arxiv.org/pdf/1412.3555v1.pdf)] [slides (lectures/CS224d-Lecture9.pdf)]
Proposal due	**Apr 28**	**Course Project Proposal due**	[proposal description (project.html#proposal)]

Lecture	Apr 28	Recursive neural networks -- for parsing	Suggested Readings: 1. [Parsing with Compositional Vector Grammars (http://nlp.stanford.edu/pubs/SocherBauerManningNg_ACL2013.pdf)] 2. [Subgradient Methods for Structured Prediction (http://repository.cmu.edu/cgi/viewcontent.cgi?article=1054&context=robotics)] 3. [Parsing Natural Scenes and Natural Language with Recursive Neural Networks (http://www-nlp.stanford.edu/pubs/SocherLinNgManning_ICML2011.pdf)] [Lecture Notes 5 (lecture_notes/LectureNotes5.pdf)] [slides (lectures/CS224d-Lecture10.pdf)]
Lecture	May 3	Recursive neural networks -- for different tasks (e.g. sentiment analysis)	Suggested Readings: 1. [Recursive Deep Models for Semantic Compositionality Over a Sentiment Treebank (http://nlp.stanford.edu/~socherr/EMNLP2013_RNTN.pdf)] 2. [Dynamic Pooling and Unfolding Recursive Autoencoders for Paraphrase Detection (http://papers.nips.cc/paper/4204-dynamic-pooling-and-unfolding-recursive-autoencoders-for-paraphrase-detection.pdf)] 3. [Improved Semantic Representations From Tree-Structured Long Short-Term Memory Networks (http://arxiv.org/pdf/1503.00075v2.pdf)] [slides (lectures/CS224d-Lecture11.pdf)]
A2 Due	**May 5**	**Pset #2 Due date**	
Lecture	May 5	Review Session for Midterm	Suggested Readings: N/A [slides (lectures/CS224d-Lecture12.pdf)]
Midterm	May 10	In-class midterm	[midterm solutions (midterm/midterm_solutions.pdf)]
A3 released	May 12	**Pset #3 released**	[Pset 3 (assignment3/index.html)] [Pset 3 Solutions (assignment3/pset3_soln.pdf)] [Pset 3 Solutions Code (assignment3/pset3_code.zip)]
Lecture	May 12	Convolutional neural networks -- for sentence classification	Suggested Readings: 1. [A Convolutional Neural Network for Modelling Sentences (http://nal.co/papers/Kalchbrenner_DCNN_ACL14)] [slides (lectures/CS224d-Lecture13.pdf)]
Milestone	**May 15**	Course Project Milestone	[milestone description (project.html#milestone)]

Lecture	May 17	Guest Lecture with Andrew Maas (http://ai.stanford.edu/~amaas/): Speech recognition	Suggested Readings: 1. [Deep Neural Networks for Acoustic Modeling in Speech Recognition (papers/maas_paper.pdf)] [slides (lectures/CS224d-Lecture14.pdf)]
Lecture	May 19	Guest Lecture with Thang Luong (http://stanford.edu/~lmthang/): Machine Translation	Suggested Readings: 1. [Achieving Open Vocabulary Neural Machine Translation with Hybrid Word-Character Models (papers/achieving.pdf)] 2. [Addressing the Rare Word Problem in Neural Machine Translation (papers/addressing.pdf)] 3. [Advances in natural language processing (papers/advances.pdf)] 4. [Neural machine translation by jointly learning to align and translate (papers/neural_machine.pdf)] [slides (lectures/CS224d-Lecture15.pdf)]
A3 Due	May 21	**Pset #3 Due date**	
Lecture	May 24	Guest Lecture with Quoc Le (http://cs.stanford.edu/~quocle/): Seq2Seq and Large Scale DL	Suggested Readings: 1. [Sequence to Sequence with Neural Networks (papers/seq2seq.pdf)] 2. [Neural Machine Translation by Jointly Learning to Align and Translate (papers/nmt.pdf)] 3. [A Neural Conversation Model (papers/ancm.pdf)] 4. [Neural Programmer: Include Latent Programs with Gradient Descent (papers/npil.pdf)] [slides (lectures/CS224d-Lecture16.pdf)]
Lecture	May 26	The future of Deep Learning for NLP: Dynamic Memory Networks	Suggested Readings: 1. [Ask me anthing: Dynamic Memory Networks for NLP (http://arxiv.org/abs/1506.07285)] [slides (lectures/CS224d-Lecture17.pdf)]
Poster Presentation	June 1	Final project poster presentations: 2-5 pm, Gates patio	
Final Project Due	**Jun 3**	Final course project due date	[project description]