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

CS224n: Natural Language Processing with Deep Learning

(index.html)

Schedule and Syllabus

Unless otherwise specified the course lectures and meeting times are:

Tuesday, Thursday 4:30-5:50
Location: NVIDIA Auditorium (https://campus-map.stanford.edu/?srch=NVIDIA+Auditorium)

Event	Date	Description	Course Materials
Lecture	Jan 9	Introduction to NLP and Deep Learning [slides (lectures/lecture1.pdf)]	Suggested Readings: 1. [Linear Algebra Review (./readings/cs229-linalg.pdf)] 2. [Probability Review (./readings/cs229-prob.pdf)] 3. [Convex Optimization Review (./readings/cs229-cvxopt.pdf)] 4. [More Optimization (SGD) Review (http://cs231n.github.io/optimization-1/)]
Lecture	Jan 11	Word Vectors 1 [slides (lectures/lecture2.pdf)]	Suggested Readings: 1. [Word2Vec Tutorial - The Skip-Gram Model (http://mccormickml.com/2016/04/19 tutorial-the-skip-gram-model/)] 2. [Distributed Representations of Words and Phrases and their Compositionality (http://papers.nips.cc/paper/5021-distributed-representations-of-words-and-phra compositionality.pdf)] 3. [Efficient Estimation of Word Representations in Vector Space (http://arxiv.org/pdf/1301.3781.pdf)]
A1 released	Jan 11	**Assignment #1 released**	[Assignment #1 (assignment1/index.html)][Written Solutions (assignment1/assignmer solution.pdf)]
Lecture	Jan 16	Word Vectors 2 [slides (lectures/lecture3.pdf)]	Suggested Readings: 1. [GloVe: Global Vectors for Word Representation (http://nlp.stanford.edu/pubs/glo 2. [Improving Distributional Similarity with Lessons Learned fromWord Embeddings (http://www.aclweb.org/anthology/Q15-1016)] 3. [Evaluation methods for unsupervised word embeddings (http://www.aclweb.org/anthology/D15-1036)]
Lecture	Jan 18	Neural Networks [slides (lectures/lecture4.pdf)]	Suggested Readings: 1. cs231n notes on [backprop (http://cs231n.github.io/optimization-2/)] and [networ architectures (http://cs231n.github.io/neural-networks-1/)] 2. [Review of differential calculus (readings/review-differential-calculus.pdf)] 3. [Natural Language Processing (almost) from Scratch (https://arxiv.org/pdf/1103.(4. [Learning Representations by Backpropagating Errors (http://www.iro.umontreal.ca/~vincentp/ift3395/lectures/backprop_old.pdf)]
Review	Jan 19	Python Refresher	[slides (lectures/python-review.pdf)]
Lecture	Jan 23	Backpropagation and Project Advice [slides (lectures/lecture5.pdf)] [lecture notes (readings/gradient-notes.pdf)]	Suggested Readings: 1. [Derivatives, Backpropagation, and Vectorization (http://cs231n.stanford.edu/handouts/derivatives.pdf)] 2. [Yes you should understand backprop (https://medium.com/@karpathy/yes-you-s understand-backprop-e2f06eab496b)]
Lecture	Jan 25	Introduction to TensorFlow [slides (lectures/lecture6.pdf)] [lecture code (readings/tensorflow_tutorial_code.zip)]	Suggested Readings: 1. [TensorFlow Basic Usage (https://www.tensorflow.org/get_started/basic_usage)]
A1 Due	Jan 25	**Assignment #1 due**	
A2 Released	Jan 25	**Assignment #2 released**	[Assignment #2 (assignment2/index.html)] [Written Solutions (assignment2/assignme

Lecture	Jan 30	Dependency Parsing [slides (lectures/lecture7.pdf)]	Suggested Readings: 1. Joakim Nivre. 2004. Incrementality in Deterministic Dependency Parsing (https://www.aclweb.org/anthology/W/W04/W04-0308.pdf). Workshop on Increm Parsing. 2. Danqi Chen and Christopher D. Manning. 2014. A Fast and Accurate Dependency Neural Networks (http://cs.stanford.edu/people/danqi/papers/emnlp2014.pdf). E 3. Sandra Kübler, Ryan McDonald, Joakim Nivre. 2009. Dependency Parsing (http://www.morganclaypool.com/doi/abs/10.2200/S00169ED1V01Y200901HLT and Claypool. [Free access from Stanford campus, only!] 4. Daniel Andor, Chris Alberti, David Weiss, Aliaksei Severyn, Alessandro Presta, Kuzr Slav Petrov, and Michael Collins. 2016. Globally Normalized Transition-Based Neu (https://arxiv.org/pdf/1603.06042.pdf). ACL 2016. 5. Marie-Catherine de Marneffe, Timothy Dozat, Natalia Silveira, Katri Haverinen, Filip Joakim Nivre, and Christopher D. Manning. 2014. Universal Stanford Dependencie linguistic typology. Proceedings of the Ninth International Conference on Languag and Evaluation (LREC-2014). Revised version for UD v1. (http://nlp.stanford.edu/~manning/papers/USD_LREC14_UD_revision.pdf) 6. Universal Dependencies website (http://universaldependencies.org/)
Lecture	Feb 1	Recurrent Neural Networks and Language Models [slides (lectures/lecture8.pdf)]	Suggested Readings: [N-gram Language Models and Perplexity (https://web.stanford.edu/~jurafsky/slp3/4.p [The Unreasonable Effectiveness of Recurrent Neural Networks (http://karpathy.github.io/2015/05/21/rnn-effectiveness/)] [Recurrent Neural Networks Tutorial (http://www.wildml.com/2015/09/recurrent-neural tutorial-part-1-introduction-to-rnns/)] [Sequence Modeling: Recurrent and Recursive Neural Nets (http://www.deeplearningbook.org/contents/rnn.html)]
DFP Released	Feb 1	**Default Final Project released**	
Lecture	Feb 6	Vanishing Gradients, Fancy RNNs [slides (lectures/lecture9.pdf)]	Suggested Readings: [Understanding LSTM Networks (http://colah.github.io/posts/2015-08-Understanding-L [Vanishing Gradients Example (http://web.stanford.edu/class/cs224n/archive/WWW_1617/lectures/vanishing_grad_e
Review	Feb 8	Midterm Review [slides (lectures/midterm-review.pdf)]	This year's midterm will be most similar to practice midterm 3 (the first two are from cs [practice midterm 1 (./practice_midterms/cs224n-practice-midterm-1.pdf)] [with solutio (./practice_midterms/cs224n-practice-midterm-1-sol.pdf)] [practice midterm 2 (./practice_midterms/cs224n-practice-midterm-2.pdf)] [with solutio (./practice_midterms/cs224n-practice-midterm-2-sol.pdf)] [practice midterm 3 (./practice_midterms/cs224n-practice-midterm-3.pdf)] [with solutio (./practice_midterms/cs224n-practice-midterm-3-sol.pdf)]
Project Proposal Due	Feb 8	**Final Project proposal due**	Final Project Proposal (./project_proposal/index.html)
A2 Due	Feb 8	**Assignment #2 due**	
Alternate Midterm	Feb 9	**Alternate Midterm**	
A3 Released	Feb 13	**Assignment #3 released**	Assignment #3 (assignment3/index.html) [Written Solutions (assignment3/assignmen
Midterm	Feb 13	**In-class midterm**	Location: Memorial Auditorium, Time: 4:30 - 5:50pm [Midterm (midterm/cs224n-midterm-2018.pdf)] [Midterm Solutions (midterm/cs224n-midterm-2018-solution.pdf)]

Lecture	Feb 15	Machine Translation, Seq2Seq and Attention [slides (lectures/lecture10.pdf)]	Suggested Readings: [Statistical Machine Translation slides (see lectures 2/3/4) (https://web.stanford.edu/class/archive/cs/cs224n/cs224n.1162/syllabus.shtml)] [Statistical Machine Translation Book (http://www.statmt.org/book/)] [BLEU metric (https://www.aclweb.org/anthology/P02-1040.pdf)] [Original sequence-to-sequence NMT paper (also describes beam search) (https://arxiv.org/pdf/1409.3215.pdf)] [Earlier sequence-to-sequence speech recognition paper (includes detailed beam searcl (https://arxiv.org/pdf/1211.3711.pdf)] [Original sequence-to-sequence + attention paper (https://arxiv.org/pdf/1409.0473.pdf)] [Guide to attention and other RNN augmentations (https://distill.pub/2016/augmented- [Massive Exploration of Neural Machine Translation Architectures (https://arxiv.org/pdf/1703.03906.pdf)]
Lecture	Feb 20	Advanced Attention [slides (lectures/lecture11.pdf)]	Suggested Readings: [A Deep Reinforced Model for Abstractive Summarization (https://arxiv.org/abs/1705.04 [Get To The Point: Summarization with Pointer-Generator Networks (https://arxiv.org/abs/1704.04368)] [BlackOut: Speeding up Recurrent Neural Network Language Models with very Large Vo (https://arxiv.org/abs/1511.06909)] [Achieving Open Vocabulary Neural Machine Translation with Hybrid Word-Character M (https://arxiv.org/abs/1604.00788)] [Quasi-Recurrent Neural Networks (https://arxiv.org/abs/1611.01576)]
Lecture	Feb 22	Transformer Networks and CNNs [slides (lectures/lecture12.pdf)]	Suggested Readings: [Attention Is All You Need (https://arxiv.org/abs/1706.03762)] [Layer Normalization (https://arxiv.org/pdf/1607.06450.pdf)] [Convolutional Neural Networks for Sentence Classification (https://arxiv.org/abs/1408. [Improving neural network3s by preventing co-adaptation of feature detectors (https://arxiv.org/abs/1207.0580)] [A Convolutional Neural Network for Modelling Sentences (https://arxiv.org/pdf/1404.21
Lecture	Feb 27	Coreference Resolution [slides] (./lectures/lecture13.pdf)	Suggested Readings: [Learning Anaphoricity and Antecedent Ranking Features for Coreference Resolution (http://people.seas.harvard.edu/~srush/acl15.pdf)] [Improving Coreference Resolution by Learning Entity-Level Distributed Representations (https://cs.stanford.edu/~kevclark/resources/clark-manning-acl16-improving.pdf)] [End-to-end Neural Coreference Resolution (https://arxiv.org/pdf/1707.07045.pdf)] [Coreference Demo (https://huggingface.co/coref/)]
A3 Due	Feb 27	Assignment #3 due	
Milestone Due	Feb 28	Final project milestone due	Project Milestone (./project_milestone/index.html)
Lecture	Mar 1	Tree Recursive Neural Networks and Constituency Parsing [slides (./lectures/lecture14.pdf)]	
Lecture	Mar 6	Advanced Architectures and Memory Networks [slides (./lectures/lecture15.pdf)]	
Lecture	Mar 8	Reinforcement Learning for NLP Guest Lecture [slides (./lectures/lecture16-guest.pdf)]	Suggested Readings: [A Deep Reinforced Model for Abstractive Summarization (https://arxiv.org/abs/1705.04 [DCN+: Mixed Objective and Deep Residual Coattention for Question Answering (https://arxiv.org/abs/1711.00106)] [Deep Reinforcement Learning for Dialogue Generation (https://arxiv.org/pdf/1606.0154
Lecture	Mar 13	Semi-supervised Learning for NLP [slides (./lectures/lecture17.pdf)]	Suggested Readings: [Semi-Supervised Sequence Learning (https://arxiv.org/abs/1511.01432)] [Learned in Translation: Contextualized Word Vectors (https://arxiv.org/pdf/1708.00107 [Deep Contextualized Word Representations (https://arxiv.org/pdf/1802.05365.pdf)] [Adversarial Training Methods for Semi-Supervised Text Classification (https://arxiv.org/pdf/1605.07725.pdf)]
Lecture	Mar 15	Future of NLP Models, Multi-task Learning and QA Systems [slides (./lectures/lecture18.pdf)]	
Final Project Due	Mar 18	Final project due	

Poster Presentation	Mar 21	Final project poster presentations	5:30-8:30 McCaw Hall at the Alumni Center McCaw Hall at the Alumni Center (https://alumni.stanford.edu/get/page/resources/alumnicenter/directions) More Details (./poster_session/index.html)