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CS231n: Convolutional Neural Networks for Visual Recognition

(index.html)

Schedule and Syllabus

The Spring 2020 iteration of the course will be taught virtually for the entire duration of the quarter. (more information available here (https://healthalerts.stanford.edu/2020/03/19/stanford-update-for-thursday-evening-march-19-new-information-on-spring-quarter/))

Unless otherwise specified the lectures are Tuesday and Thursday 12pm to 1:20pm.
Discussion sections will (generally) be Fridays 12:30pm to 1:20pm. Check Piazza for any exceptions.
Lectures and discussion sections will be both on Zoom, and they will be recorded for later access from Canvas.

This is the syllabus for the **Spring 2020** iteration of the course. The syllabus for the Spring 2019 (http://cs231n.stanford.edu/2019/syllabus), Spring 2018 (http://cs231n.stanford.edu/2018/syllabus), Spring 2017 (http://cs231n.stanford.edu/2017/syllabus), Winter 2016 (http://cs231n.stanford.edu/2016/syllabus) and Winter 2015 (http://cs231n.stanford.edu/2015/syllabus) iterations of this course are still available.

Event Type	Date	Description	Course Materials
Lecture 1	Tuesday April 7	**Course Introduction** Computer vision overview Historical context Course logistics	[Course Overview] (slides/2020/lecture_1_ranjay.pdf) [History of Computer Vision] (slides/2020/lecture_1_feifei.pdf)
Lecture 2	Thursday April 9	**Image Classification** The data-driven approach K-nearest neighbor Linear classification I	[slides] (slides/2020/lecture_2.pdf) [python/numpy tutorial] (http://cs231n.github.io/python-numpy-tutorial) [image classification notes] (http://cs231n.github.io/classification) [linear classification notes] (http://cs231n.github.io/linear-classify)
Discussion Section	Friday April 10	**Python / numpy / Google Cloud**	[python/numpy tutorial] (http://cs231n.github.io/python-numpy-tutorial) [Google Cloud tutorial] (https://github.com/cs231n/gcloud)
Lecture 3	Tuesday April 14	**Loss Functions and Optimization** Linear classification II Higher-level representations, image features Optimization, stochastic gradient descent	[slides] (slides/2020/lecture_3.pdf) [linear classification notes] (http://cs231n.github.io/linear-classify) [optimization notes] (http://cs231n.github.io/optimization-1)
Lecture 4	Thursday April 16	**Neural Networks and Backpropagation** Backpropagation Multi-layer Perceptrons The neural viewpoint	[slides] (slides/2020/lecture_4.pdf) [backprop notes] (http://cs231n.github.io/optimization-2) [linear backprop example] (handouts/linear-backprop.pdf) [derivatives notes] (handouts/derivatives.pdf) (optional) [Efficient BackProp] (http://yann.lecun.com/exdb/publis/pdf/lecun-98b.pdf) (optional) related: [1] (http://colah.github.io/posts/2015-08-Backprop/), [2] (http://neuralnetworksanddeeplearning.com/chap2.html), [3] (https://www.youtube.com/watch?v=q0pm3BrIUFo) (optional)
Discussion Section	Friday April 17	**Backprop tutorial**	[slides] (slides/2020/section_2_backprop.pdf) [annotated slides] (slides/2020/section_2_annotated.pdf)
Lecture 5	Tuesday April 21	**Convolutional Neural Networks** History Convolution and pooling ConvNets outside vision	[slides] (slides/2020/lecture_5.pdf) ConvNet notes (http://cs231n.github.io/convolutional-networks/)
A1 Due	Wednesday April 22	**Assignment #1 due** kNN, SVM, SoftMax, two-layer network	[Assignment #1] (https://cs231n.github.io/assignments2020/assignment1/)

Lecture 6	Thursday April 23	**Deep Learning Hardware and Software** CPUs, GPUs, TPUs PyTorch, TensorFlow Dynamic vs Static computation graphs	[slides] (slides/2020/lecture_6.pdf)
Discussion Section	Friday April 24	**Projects**	[proposal description] (http://cs231n.stanford.edu/project.html) [slides] (slides/2020/section_3_project.pdf)
Lecture 7	Tuesday April 28	**Training Neural Networks, part I** Activation functions, data processing Batch Normalization, Transfer learning	[slides] (slides/2020/lecture_7.pdf) Neural Nets notes 1 (http://cs231n.github.io/neural-networks-1/) Neural Nets notes 2 (http://cs231n.github.io/neural-networks-2/) Neural Nets notes 3 (http://cs231n.github.io/neural-networks-3/) tips/tricks: [1] (http://research.microsoft.com/pubs/192769/tricks-2012.pdf), [2] (http://yann.lecun.com/exdb/publis/pdf/lecun-98b.pdf), [3] (http://arxiv.org/pdf/1206.5533v2.pdf) (optional) Deep Learning [Nature] (http://www.nature.com/nature/journal/v521/n7553/full/nature14539.html) (optional)
Proposal due	Monday April 27	Project Proposal due	
Lecture 8	Thursday April 30	**Training Neural Networks, part II** Update rules, hyperparameter tuning, Learning rate scheduling, data augmentation	[slides] (slides/2020/lecture_8.pdf) Neural Nets notes 3 (http://cs231n.github.io/neural-networks-3/)
Discussion Section	Friday May 1	**Intro to Pytorch and Tensorflow**	[PyTorch Colab Walkthrough] (https://pytorch.org/tutorials/beginner/finetuning_torchvision_models_tutorial.html) (See Canvas for recording)
Lecture 9	Tuesday May 5	**CNN Architectures** AlexNet, VGG, GoogLeNet, ResNet, etc	[slides] (slides/2020/lecture_9.pdf) AlexNet (https://papers.nips.cc/paper/4824-imagenet-classification-with-deep-convolutional-neural-networks.pdf), VGGNet (https://arxiv.org/abs/1409.1556), GoogLeNet (https://arxiv.org/abs/1409.4842), ResNet (https://arxiv.org/abs/1512.03385)
A2 Due	Wednesday May 6	**Assignment #2 due** Neural networks, ConvNets	[Assignment #2] (https://cs231n.github.io/assignments2020/assignment2/)
Lecture 10	Thursday May 7	**Recurrent Neural Networks** RNN, LSTM Language modeling Image captioning, Vision + Language Attention	[slides] (slides/2020/lecture_10.pdf) DL book RNN chapter (http://www.deeplearningbook.org/contents/rnn.html) (optional) min-char-rnn (https://gist.github.com/karpathy/d4dee566867f8291f086), char-rnn (https://github.com/karpathy/char-rnn), neuraltalk2 (https://github.com/karpathy/neuraltalk2)
Discussion Section	Friday May 8	**Midterm Review**	[slides] (slides/2020/section_5_midterm.pdf)
Midterm	Tuesday May 12	**Take-home midterm**	
Lecture 11	Thursday May 14	**Generative Models** PixelRNN/PixelCNN Variational auto-encoders Generative adversarial networks	[slides] (slides/2020/lecture_11.pdf) VAE Notes (https://deepgenerativemodels.github.io/notes/vae/) NeurIPS 2016 GAN Tutorial (https://arxiv.org/pdf/1701.00160.pdf)
Discussion Section	Friday May 15	**Tensorflow Tutorial**	[Colab Link] (https://www.tensorflow.org/tutorials/images/transfer_learning)

Lecture 12	Tuesday May 19	**Detection and Segmentation** Semantic segmentation Object detection Instance segmentation	[slides] (slides/2020/lecture_12.pdf)
Milestone	Wednesday May 20	Project Milestone due	
Lecture 13	Thursday May 21	**Visualizing and Understanding** Feature visualization and inversion Adversarial examples DeepDream and style transfer	[slides] (slides/2020/lecture_13.pdf) DeepDream (https://github.com/google/deepdream) neural-style (https://github.com/jcjohnson/neural-style) fast-neural-style (https://github.com/jcjohnson/fast-neural-style)
Discussion Section	Friday May 22	**Detection Software**	[slides] (slides/2020/section_7_detection.pdf)
Lecture 14 Guest Lecture	Tuesday May 26	**Fairness Accountability Transparency and Ethics in AI** **Timnit Gebru (http://ai.stanford.edu/~tgebru/),** **Emily Denton (https://cephaloponderer.com/)**	[slides] (slides/2020/lecture_14.pdf)
A3 Due	Wednesday May 27	**Assignment #3 due** RNNs, LSTMs, Network Visualization, Style Transfer, GANs	[Assignment #3] (https://cs231n.github.io/assignments2020/assignment3/)
Lecture 15	Thursday May 28	**Human-Centered Artificial Intelligence** **Fei-Fei Li (https://profiles.stanford.edu/fei-fei-li)**	
Discussion Section	Friday May 29	**Learning on Videos**	
Lecture 16 Guest Lecture	Tuesday June 2	**3D Vision** **Hao Su (https://cseweb.ucsd.edu/~haosu/)**	
Lecture 17	Thursday June 4	**Deep Reinforcement Learning** Policy gradients, hard attention Q-Learning, Actor-Critic	
Final Project Due	Friday June 5	Project Report + Video Presentation due	
Lecture 18	Tuesday June 9	**Scene Graphs** Visual Relationships Graph Neural Networks	
Lecture 19	Thursday June 11	**TBD**	