Schedule and Syllabus

Unless otherwise specified the lectures are Tuesday and Thursday 12pm to 1:20pm in the NVIDIA Auditorium in the Huang Engineering Center. (map (https://campus-map.stanford.edu/?id=04-080&lat=37.42787956&lng=-122.17429865&zoom=17&srch=nvidia%20auditorium))

Discussion sections will be Fridays 12:30pm to 1:20pm in Skilling Auditorium. (map (https://campus-map.stanford.edu/?id=04-550&lat=37.42713104&lng=-122.17284632&zoom=17&srch=skilling%20auditorium))

This is the syllabus for the **Spring 2018** iteration of the course. The syllabus for the 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 3	**Course Introduction** Computer vision overview Historical context Course logistics	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture01.pdf)
Lecture 2	Thursday April 5	**Image Classification** The data-driven approach K-nearest neighbor Linear classification I	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture02.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 6	**Python / numpy / Google Cloud**	[python/numpy notebook] (notebooks/python_numpy_tutorial.ipynb)
Lecture 3	Tuesday April 10	**Loss Functions and Optimization** Linear classification II Higher-level representations, image features Optimization, stochastic gradient descent	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture03.pdf) [linear classification notes] (http://cs231n.github.io/linear-classify) [optimization notes] (http://cs231n.github.io/optimization-1)
Lecture 4	Thursday April 12	**Introduction to Neural Networks** Backpropagation Multi-layer Perceptrons The neural viewpoint	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture04.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 13	**Backpropagation**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_ds02.pdf)
Lecture 5	Tuesday April 17	**Convolutional Neural Networks** History Convolution and pooling ConvNets outside vision	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture05.pdf) ConvNet notes (http://cs231n.github.io/convolutional-networks/)
A1 Due	Wednesday April 18	**Assignment #1 due** kNN, SVM, SoftMax, two-layer network	[Assignment #1] (http://cs231n.github.io/assignments2018/assignment1/)

Lecture 6	Thursday April 19	**Training Neural Networks, part I** Activation functions, initialization, dropout, batch normalization	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture06.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)
Discussion Section	Friday April 20	**Tips and tricks for tuning NNs**	[slides] (https://docs.google.com/presentation/d/183aCHcSq-YsaokZrqI3khuy_zPbehG-XgkyA6L5W4t4/edit?usp=sharing)
Lecture 7	Tuesday April 24	**Training Neural Networks, part II** Update rules, ensembles, data augmentation, transfer learning	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture07.pdf) Neural Nets notes 3 (http://cs231n.github.io/neural-networks-3/)
Proposal due	Wednesday April 25	Project Proposal due	[proposal description] (http://cs231n.stanford.edu/project.html)
Lecture 8	Thursday April 26	**Deep Learning Hardware and Software** CPUs, GPUs, TPUs PyTorch, TensorFlow Dynamic vs Static computational graphs	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture08.pdf)
Discussion Section	Friday April 27	**PyTorch / Tensorflow**	[pytorch notebook] (notebooks/pytorch_tutorial.ipynb)
Lecture 9	Tuesday May 1	**CNN Architectures** AlexNet, VGG, GoogLeNet, ResNet, etc	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture09.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 2	**Assignment #2 due** Neural networks, ConvNets	[Assignment #2] (http://cs231n.github.io/assignments2018/assignment2/)
Lecture 10	Thursday May 4	**Recurrent Neural Networks** RNN, LSTM, GRU Language modeling Image captioning, visual question answering Soft attention	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture10.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 4	**Midterm Review**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_midterm_review.pdf)
Midterm	Tuesday May 8	**In-class midterm** Location: Various (see Piazza (https://piazza.com/class/jdmurnqexkt47x?cid=1245) for more details).	SCPD Midterm Info (https://piazza.com/class/jdmurnqexkt47x?cid=43)
Lecture 11	Thursday May 10	**Detection and Segmentation** Semantic segmentation Object detection Instance segmentation	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture11.pdf)
Discussion Section	Friday May 11	**Practical Object Detection and Segmentation**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_ds06.pdf)
Lecture 12	Tuesday May 15	**Generative Models** PixelRNN/CNN Variational Autoencoders Generative Adversarial Networks	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture12.pdf)
Milestone	Wednesday May 16	Project Milestone due	

Lecture 13	Thursday May 17	**Visualizing and Understanding** Feature visualization and inversion Adversarial examples DeepDream and style transfer	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture13.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)
Lecture 14	Tuesday May 22	**Deep Reinforcement Learning** Policy gradients, hard attention Q-Learning, Actor-Critic	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture14.pdf)
A3 Due	Wednesday May 23	**Assignment #3 due**	[Assignment #3] (http://cs231n.github.io/assignments2018/assignment3/)
Lecture 15 Guest Lecture	Thursday May 24	**Invited Talk: Andrej Karpathy (https://cs.stanford.edu/people/karpathy/)**	[slides]
Discussion Section	Friday May 25	**Weak Supervision**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_ds07.pdf)
Lecture 16 Guest Lecture	Tuesday May 29	**Invited Talk: Jitendra Malik (https://people.eecs.berkeley.edu/~malik/)**	[slides]
Lecture 17	Thursday May 31	Student spotlight talks, conclusions	[slides]
Discussion Section	Friday June 1	**Video Understanding**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_ds08.pdf)
Final Project Due	Thursday June 7	Project Report due	
Poster Session	Tuesday June 12	Jen-Hsun Huang Engineering Center (https://engineering.stanford.edu/location) 12:00 pm to 3:15 pm	