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 (generally) be Fridays 12:30pm to 1:20pm in Gates B03. (map (https://campus-map.stanford.edu/?id=07-450&lat=37.43011014&lng=-122.17341616&zoom=17&srch=gates%20computer%20science)) Check Piazza for any exceptions.

This is the syllabus for the **Spring 2019** iteration of the course. The syllabus for the 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 2	**Course Introduction** Computer vision overview Historical context Course logistics	[slides] (slides/2019/cs231n_2019_lecture01.pdf)
Lecture 2	Thursday April 4	**Image Classification** The data-driven approach K-nearest neighbor Linear classification I	[slides] (slides/2019/cs231n_2019_lecture02.pdf) [python/numpy tutorial] (http://cs231n.github.io/pytho [image classification notes] (http://cs231n.github.io/c [linear classification notes] (http://cs231n.github.io/lir
Discussion Section	Friday April 5	**Python / numpy / Google Cloud**	[notebook] (notebooks/python_numpy_tutorial.ipynb)
Lecture 3	Tuesday April 9	**Loss Functions and Optimization** Linear classification II Higher-level representations, image features Optimization, stochastic gradient descent	[slides] (slides/2019/cs231n_2019_lecture03.pdf) [linear classification notes] (http://cs231n.github.io/lir [optimization notes] (http://cs231n.github.io/optimiza
Lecture 4	Thursday April 11	**Introduction to Neural Networks** Backpropagation Multi-layer Perceptrons The neural viewpoint	[slides] (slides/2019/cs231n_2019_lecture04.pdf) [backprop notes] (http://cs231n.github.io/optimizatio [linear backprop example] (handouts/linear-backprop. [derivatives notes] (handouts/derivatives.pdf) (optiona [Efficient BackProp] (http://yann.lecun.com/exdb/pub (optional) related: [1] (http://colah.github.io/posts/2015-08-Back (http://neuralnetworksanddeeplearning.com/chap2.ht (https://www.youtube.com/watch?v=q0pm3BrIUFo) (
Discussion Section	Friday April 12	**Guidelines for Picking a Project**	[slides] (slides/2019/cs231n_2019_section02.pdf)
Lecture 5	Tuesday April 16	**Convolutional Neural Networks** History Convolution and pooling ConvNets outside vision	[slides] (slides/2019/cs231n_2019_lecture05.pdf) ConvNet notes (http://cs231n.github.io/convolutional
A1 Due	Wednesday April 17	**Assignment #1 due** kNN, SVM, SoftMax, two-layer network	[Assignment #1] (http://cs231n.github.io/assignments
Lecture 6	Thursday April 18	**Deep Learning Hardware and Software** CPUs, GPUs, TPUs PyTorch, TensorFlow Dynamic vs Static computation graphs	[slides] (slides/2019/cs231n_2019_lecture06.pdf)

Discussion Section	Friday April 19	**Intro to Pytorch and Tensorflow** 12:30-13:50 at Thornton 102 (https://campus-map.stanford.edu/?id=04-720&lat=37.4255553&lng=-122.17370443&zoom=17&srch=thornton102)	[PyTorch notebook] (notebooks/pytorch_tutorial.ipynb [TensorFlow notebook] (notebooks/CS231N_TensorF [gradio slides] (https://docs.google.com/presentation/d/15EGMDqY hRrMY34Wora42jCDfFcY/edit?usp=sharing) [gradio n (https://colab.research.google.com/drive/1zb1ox2wC #scrollTo=hA6BTuNtELa9)
Lecture 7	Tuesday April 23	**Training Neural Networks, part I**	[slides] (slides/2019/cs231n_2019_lecture07.pdf) Neural Nets notes 1 (http://cs231n.github.io/neural-ne Neural Nets notes 2 (http://cs231n.github.io/neural-ne Neural Nets notes 3 (http://cs231n.github.io/neural-ne tips/tricks: [1] (http://research.microsoft.com/pubs/1 (http://yann.lecun.com/exdb/publis/pdf/lecun-98b.pd (http://arxiv.org/pdf/1206.5533v2.pdf) (optional) Deep Learning [Nature] (http://www.nature.com/nature/journal/v521/n7553/f (optional)
Proposal due	Wednesday April 24	Project Proposal due	[proposal description] (http://cs231n.stanford.edu/pro
Lecture 8	Thursday April 25	**Training Neural Networks, part II** Update rules, ensembles, data augmentation, transfer learning	[slides] (slides/2019/cs231n_2019_lecture08.pdf) Neural Nets notes 3 (http://cs231n.github.io/neural-ne
Discussion Section	Friday April 26	**Backpropagation**	
Lecture 9	Tuesday April 30	**CNN Architectures** AlexNet, VGG, GoogLeNet, ResNet, etc	[slides] (slides/2019/cs231n_2019_lecture09.pdf) AlexNet (https://papers.nips.cc/paper/4824-imagenet convolutional-neural-networks.pdf), VGGNet (https://a GoogLeNet (https://arxiv.org/abs/1409.4842), ResNet (https://arxiv.org/abs/1512.03385)
A2 Due	Wednesday May 1	**Assignment #2 due** Neural networks, ConvNets	[Assignment #2] (http://cs231n.github.io/assignments
Lecture 10	Thursday May 2	**Recurrent Neural Networks** RNN, LSTM, GRU Language modeling Image captioning, visual question answering Soft attention	[slides] (slides/2019/cs231n_2019_lecture10.pdf) DL book RNN chapter (http://www.deeplearningbook.((optional) min-char-rnn (https://gist.github.com/karpathy/d4dee (https://github.com/karpathy/char-rnn), neuraltalk2 (https://github.com/karpathy/neuraltalk2)
Discussion Section	Friday May 3	**Midterm Review**	
Midterm	Tuesday May 7	**In-class midterm** Location: TBA	
Lecture 11	Thursday May 9	**Generative Models**	[slides] (slides/2019/cs231n_2019_lecture11.pdf)
Lecture 12	Tuesday May 14	**Detection and Segmentation**	[slides] (slides/2019/cs231n_2019_lecture12.pdf)
Milestone	Wednesday May 15	Project Milestone due	
Lecture 13	Thursday May 16	**Visualizing and Understanding** Feature visualization and inversion Adversarial examples DeepDream and style transfer	[slides] (slides/2019/cs231n_2019_lecture13.pdf) DeepDream (https://github.com/google/deepdream) neural-style (https://github.com/jcjohnson/neural-styl fast-neural-style (https://github.com/jcjohnson/fast-n
Lecture 14	Tuesday May 21	**Deep Reinforcement Learning** Policy gradients, hard attention Q-Learning, Actor-Critic	[slides] (slides/2019/cs231n_2019_lecture14.pdf)

A3 Due	Wednesday May 22	**Assignment #3 due** RNNs, LSTMs, Network Visualization, Style Transfer, GANs	[Assignment #3] (http://cs231n.github.io/assignments
Lecture 15 Guest Lecture	Thursday May 23	**Fairness Accountability Transparency and Ethics in AI** With a focus on Computer Vision **Timnit Gebru (http://ai.stanford.edu/~tgebru/)**	
Discussion Section	Friday May 24	**Midterm Q&A**	
Lecture 16 Guest Lecture	Tuesday May 28	**Neuroscience and AI** **Nick Haber (https://neuroailab.stanford.edu)**	
Lecture 17	Thursday May 30	**Human-Centered AI**	[slides] (slides/2019/cs231n_2019_lecture17.pdf)
Final Project Due	Tuesday June 4	Project Report due	
Poster Session	Tuesday June 11	Arrillaga Alumni Center 12:00 pm to 3:30 pm	