Convolutional Neural Networks for Visual Recognition

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Schedule and Syllabus

Video lectures: [YouTube] (https://www.youtube.com/playlist?list=PL3FW7Lu3i5JvHM8ljYj-zLfQRF3EO8sYv)

Event Type	Date	Description	Course Materials
Lecture 1	Tuesday July 17	**Course Introduction** Computer vision overview Historical context Course logistics	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture01.pdf)
Lecture 2	Wednesday July 18	**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)
Additional Reading		**Python / numpy / Google Cloud**	[python/numpy notebook] (http://cs231n.stanford.edu/notebooks/python_numpy_tutorial.ipynb)
Lecture 3	Thursday July 19	**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	Friday July 20	**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] (http://cs231n.stanford.edu/handouts/linear-backprop.pdf) [derivatives notes] (http://cs231n.stanford.edu/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)
Additional Reading		**Backpropagation**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_ds02.pdf)
Lecture 5	Monday July 23	**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	Monday July 23	**Assignment #1 due** kNN, SVM, SoftMax, two-layer network	[Assignment #1] (http://cs231n.github.io/assignments2018/assignment1/)
Lecture 6	Tuesday July 24	**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)
Additional reading		**Tips and tricks for tuning NNs**	[slides] (https://docs.google.com/presentation/d/183aCHcSq-YsaokZrqI3khuy_zPbehG-XgkyA6L5W4t4/edit?usp=sharing)

Lecture 7	Wednesday July 25	**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/)
Lecture 8	Thursday July 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)
Additional Reading		**PyTorch / Tensorflow**	[pytorch notebook] (http://cs231n.stanford.edu/notebooks/pytorch_tutorial.ipynb)
Lecture 9	Friday July 27	**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	Monday July 30	**Assignment #2 due** Neural networks, ConvNets	[Assignment #2] (http://cs231n.github.io/assignments2018/assignment2/)
Lecture 10	Monday July 30	**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)
Lecture 11	Tuesday July 31	**Detection and Segmentation** Semantic segmentation Object detection Instance segmentation	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture11.pdf)

Additional Reading		**Practical Object Detection and Segmentation**	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_ds06.pdf)
Lecture 12	Wednesday August 1	**Generative Models** PixelRNN/CNN Variational Autoencoders Generative Adversarial Networks	[slides] (http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture12.pdf)
Lecture 13	Thursday August 2	**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)
A3 Due	Monday August 6	**Assignment #3 due**	[Assignment #3] (http://cs231n.github.io/assignments2018/assignment3/)