

Lecture Notes for **Machine Learning in Python**



Professor Eric Larson
An Ongoing History of Convolutional Networks

Class logistics and Agenda

- Wide/Deep Lab (late turn in)
- Agenda:
 - CNN Demo
 - CNN Town Hall
 - History of CNNs
 - with Modern CNN Architectures
- Next Time:
 - Transformers

Class Overview, by topic

Table Data
Visualization

Numpy, Pandas, Seaborn
Overviews with some in-depth discussion

Dimension
Reduction and
Image Processing

Scikit-learn, Scikit Image,
Intuition only, Some mathematics

Linear and
Logistic
Regression

Numpy, Recreate API for Scikit-learn
Detailed mathematics for simple optimization
intuition for advanced optimization

Neural Networks
and Back Prop.

Numpy
Detailed mathematics for NN operations

Wide and Deep
Networks

Convolutional
Networks

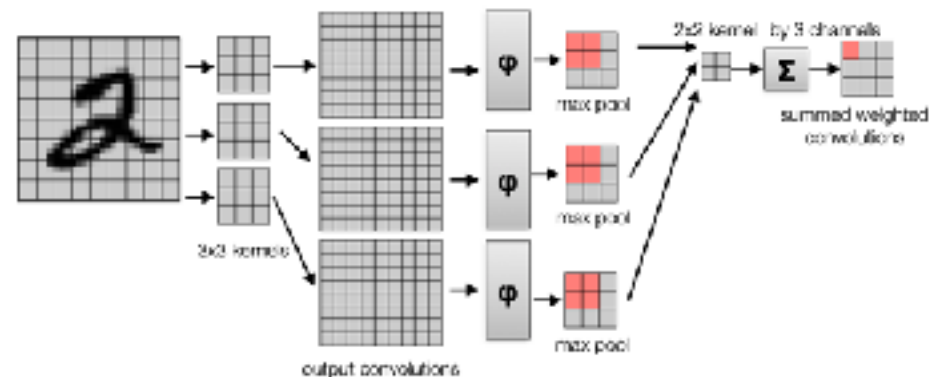
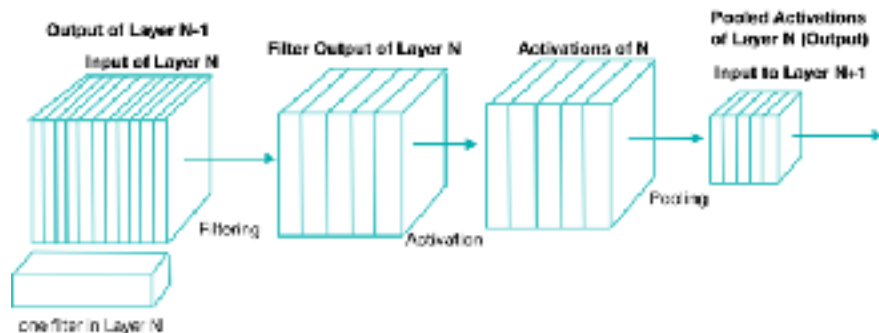
Recurrent
Networks

Keras, Tensorflow
Intuition, Detailed implement.

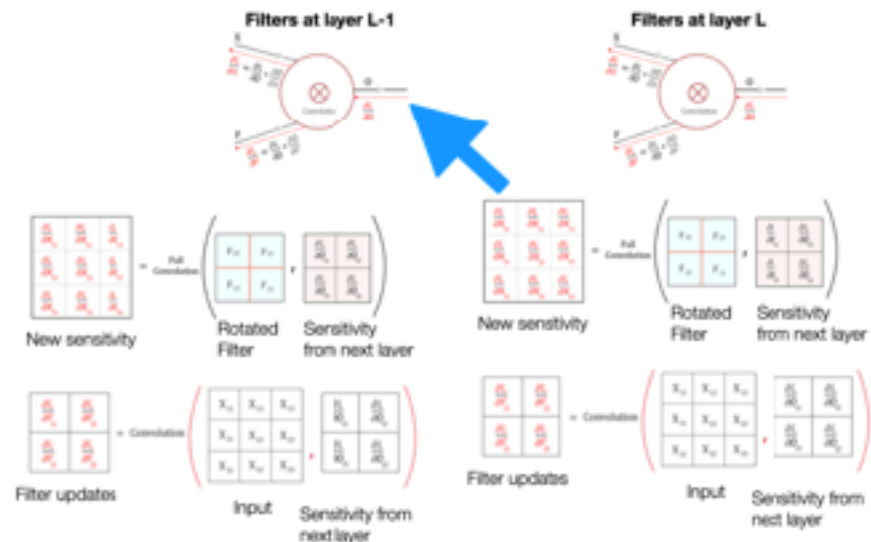
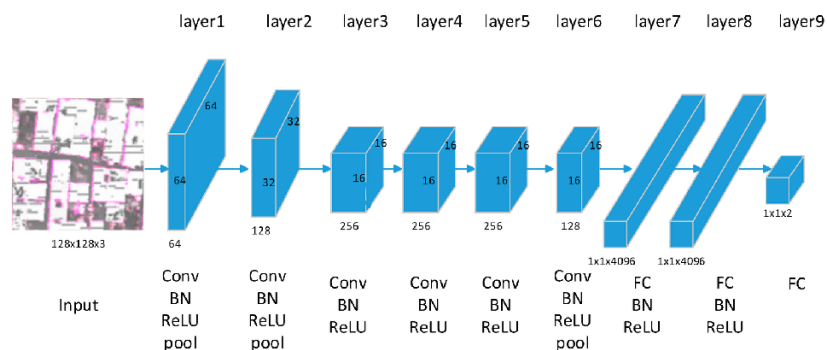
Ethics in
Language Models

ConceptNet
Case studies

Last Time:



Structure of Each Tensor: Channels x Rows x Columns



TensorFlow and Basic CNNs

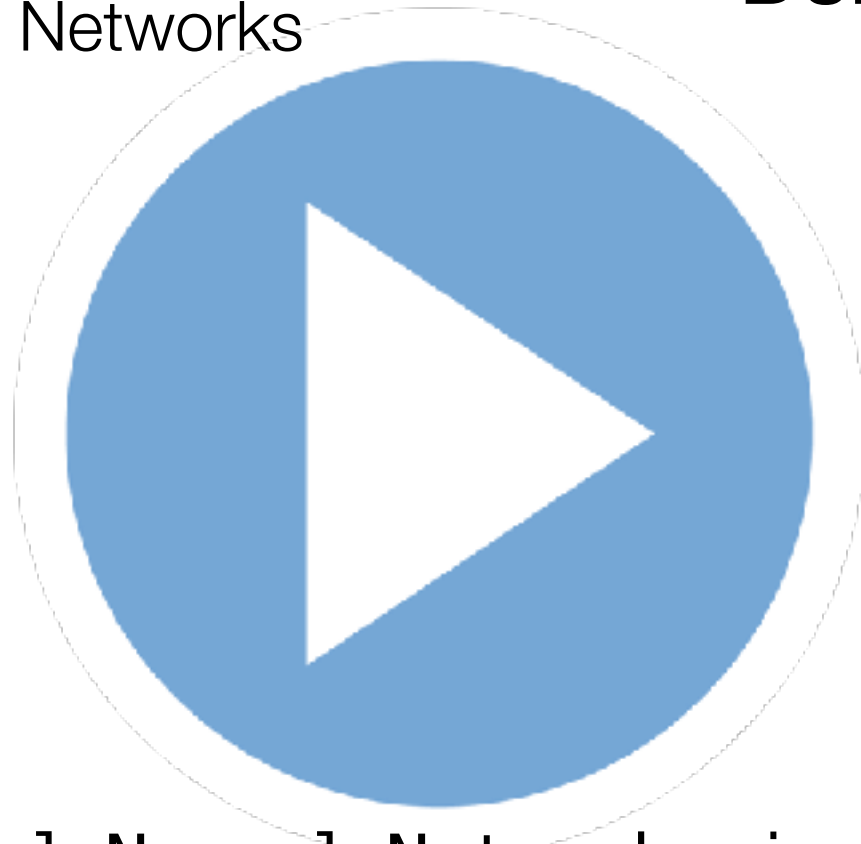
**Last
Time!**

Convolutional Neural Networks
in TensorFlow
with Keras

with Sequential API!

If needed:

**Finish
Demo**



11. Convolutional Neural Networks.ipynb

Image Data Augmentation

```
cnn = Sequential()  
  
# add in augmentations directly  
cnn.add( RandomFlip("horizontal") ) # flip horizontally  
cnn.add( RandomRotation(0.05) ) # rotate by 5%  
cnn.add( RandomTranslation(height_factor=0.1, width_factor=0.1) )  
cnn.add( RandomBrightness(factor=0.1, value_range=(0.0, 1.0)) ) #  
cnn.add( RandomContrast(0.1) ) # add or decrease contrast
```



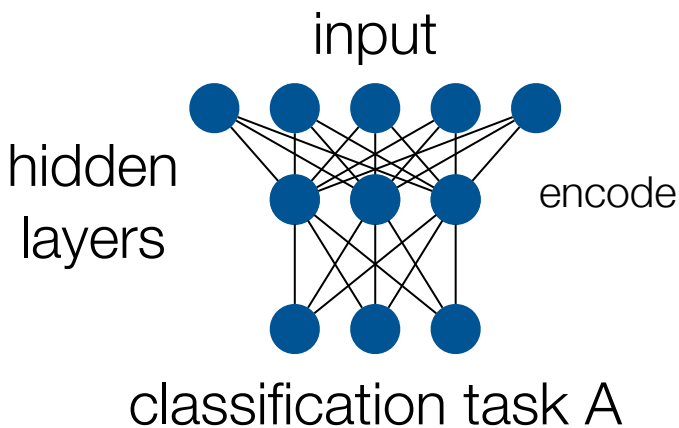
**Image
Augmentation**

RandomRotation()

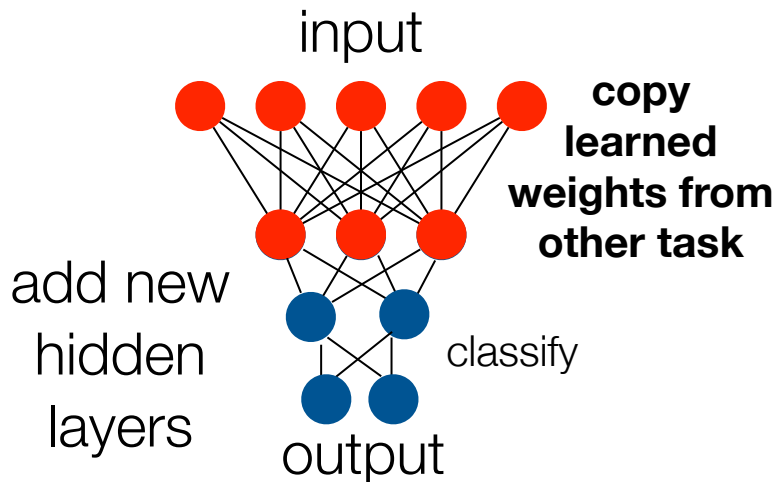
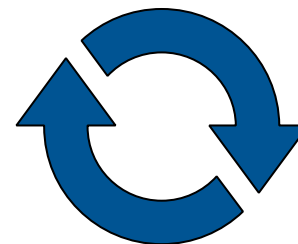


Transfer Learning

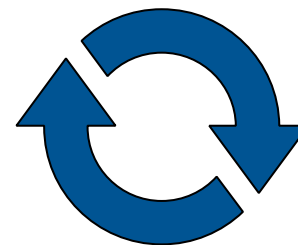
- transfer learning: a basic primer



train with lots of
data (like ImageNet)



train with fewer
labeled data (new task)



Many Pre-trained Models to choose from!

AlexNet

A landmark in computer vision, this 2012 winner of ImageNet has over 50,000 citations.



AlexNet (Places)

The same architecture as the classic AlexNet model, but trained on the Places365 dataset.



Inception v1

Also known as GoogLeNet, this network set the state of the art in ImageNet classification in 2014.



Inception v1 (Places)

The same architecture as the classic Inception v1 model, but trained on the Places365 dataset.



VGG 19

Introduced in 2014, this network is simpler than Inception variants, using only 3x3 convolutions and no branches.



Inception v3

Released in 2015, this iteration of the Inception architecture improved performance and efficiency.



Inception v4

Released in 2016, this is the fourth iteration of the Inception architecture, focusing on uniformity.



ResNet v2 50

ResNets use skip connections to enable stronger gradients in much deeper networks. This variant has 50 layers.





CNN Town Hall

Thanks to machine-learning algorithms,
the robot apocalypse was short-lived.