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Exercise 2
Theory III
Theory IV
A Deep Net
TensorBoard

Building and Training a Deep Learning Network

Deep Learning — Unit 3

Dr. Jon Krohn
jon@untapt.com

Slides available at jonkrohn.com/talks

March 10th, 2017

NYC DATA SCIENCE ACADEMY

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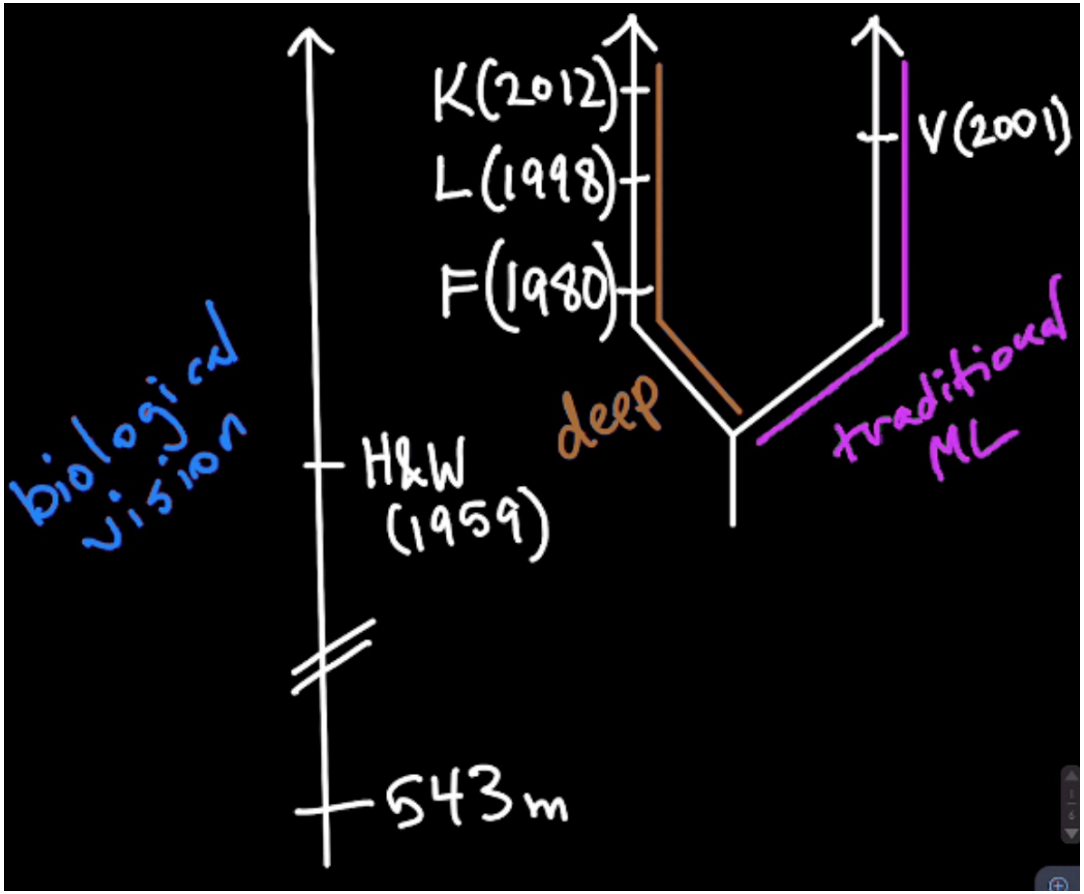
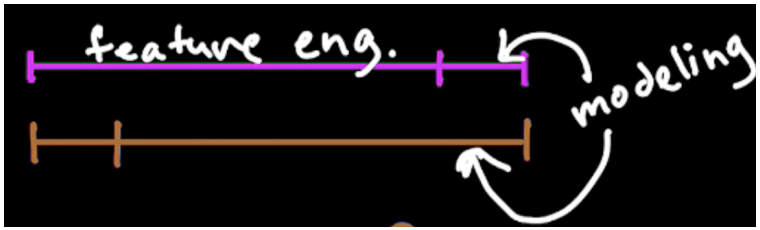
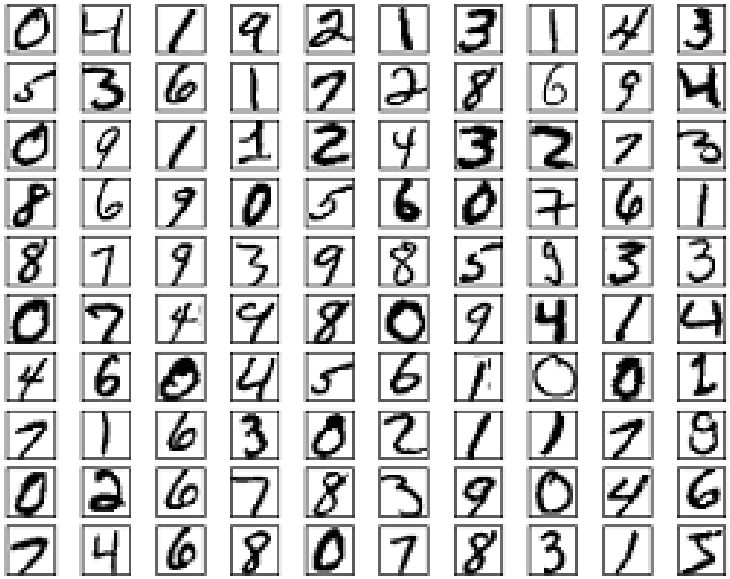

K(2012)
L(1998)
F(1980)
V(2001)
biological vision
H&W (1959)
deep
traditional ML
543m


feature eng.
modeling

MNIST Digits & LeNet-5

LeCun, Boutou, Bengio & Haffner (1998)



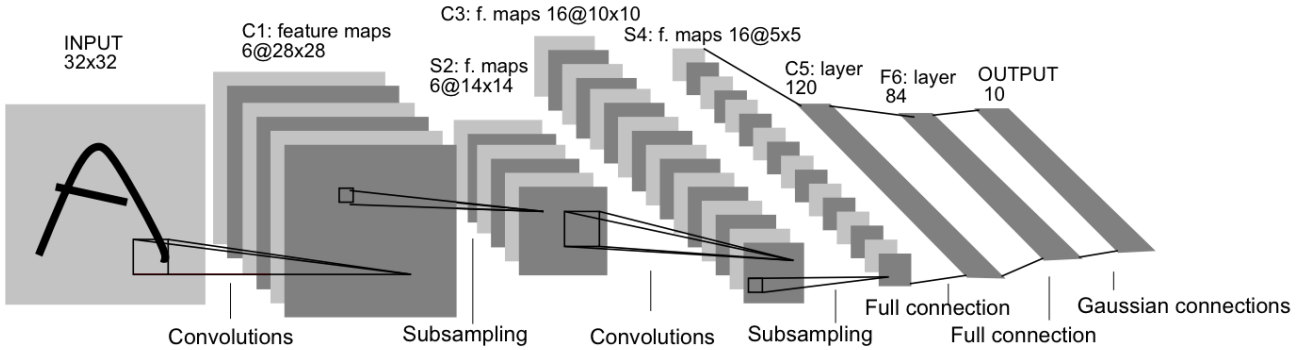


Fig. 2. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

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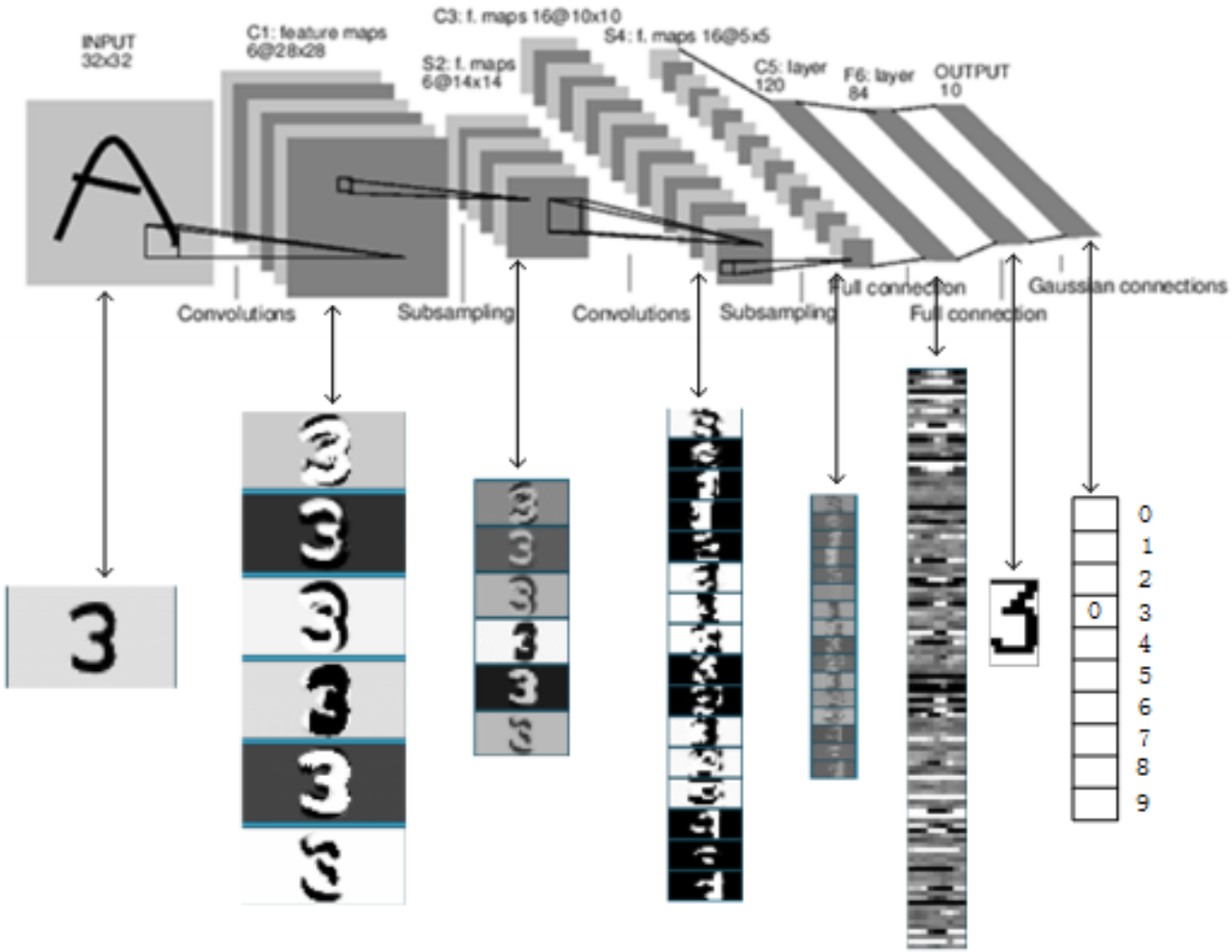
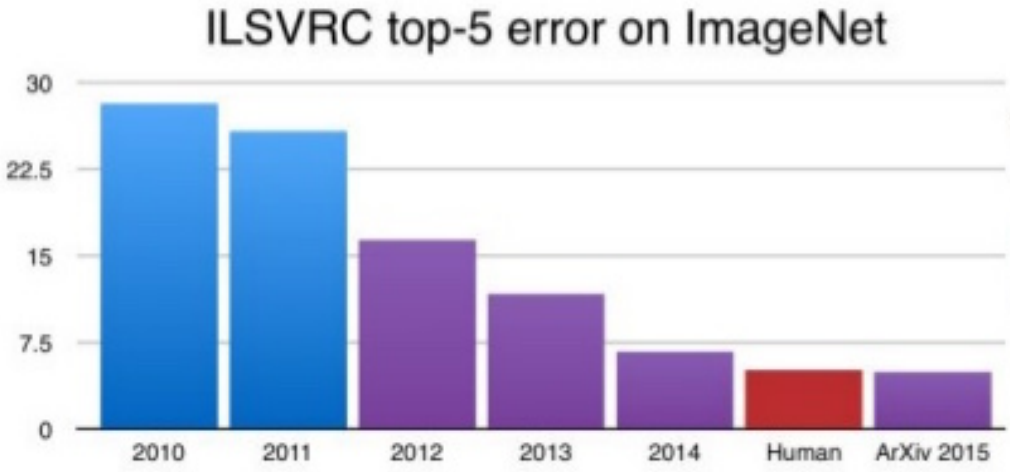
LeNet-5

LeCun, Boutou, Bengio & Haffner (1998)

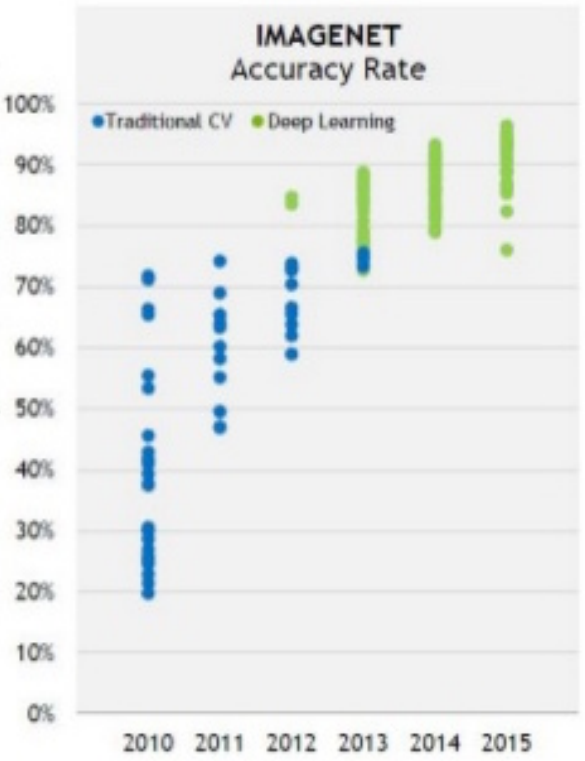


ImageNet Classification Error

ILSVRC: 1.4m, 1k object classes



- Blue: Traditional CV
- Purple: Deep Learning
- Red: Human



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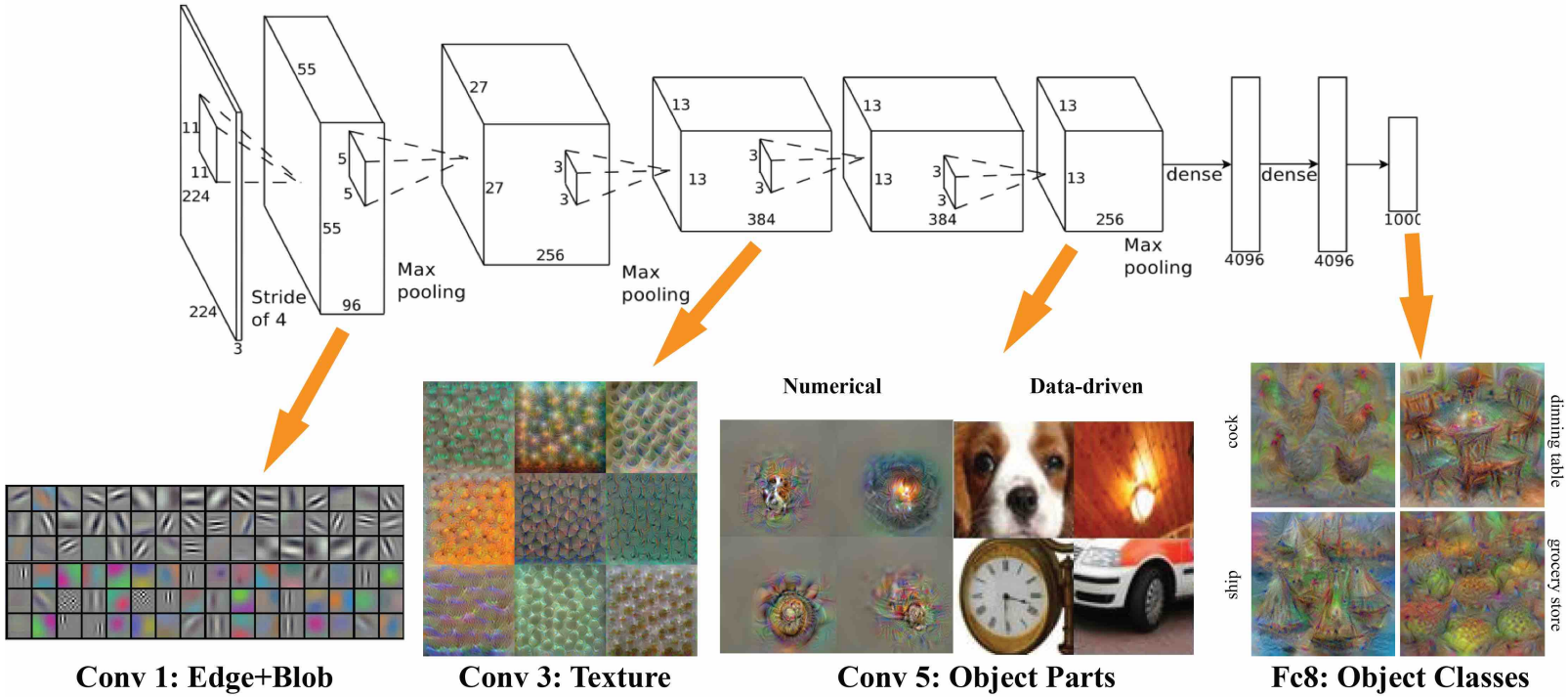
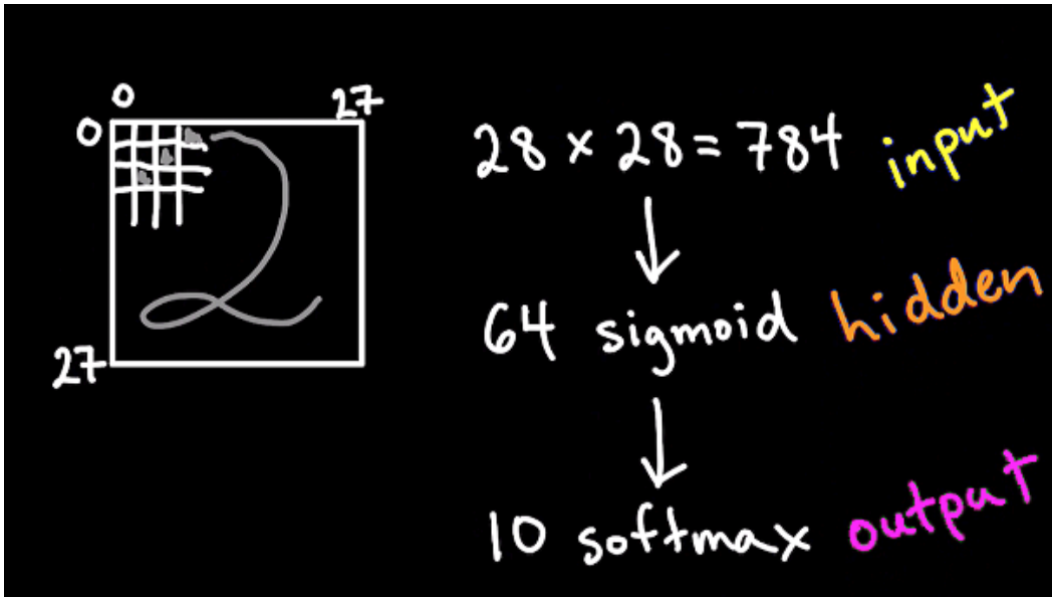
AlexNet

Krizhevsky, Sutskever & Hinton (2012)



A Shallow Neural Network



[shallow notebook]

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Interactive ANN Visualization

- sigmoid neuron
- tanh neuron
- ReLU

- weight
- bias
- cost function
- gradient descent

- input layer
- hidden layer
- dense/FC layer
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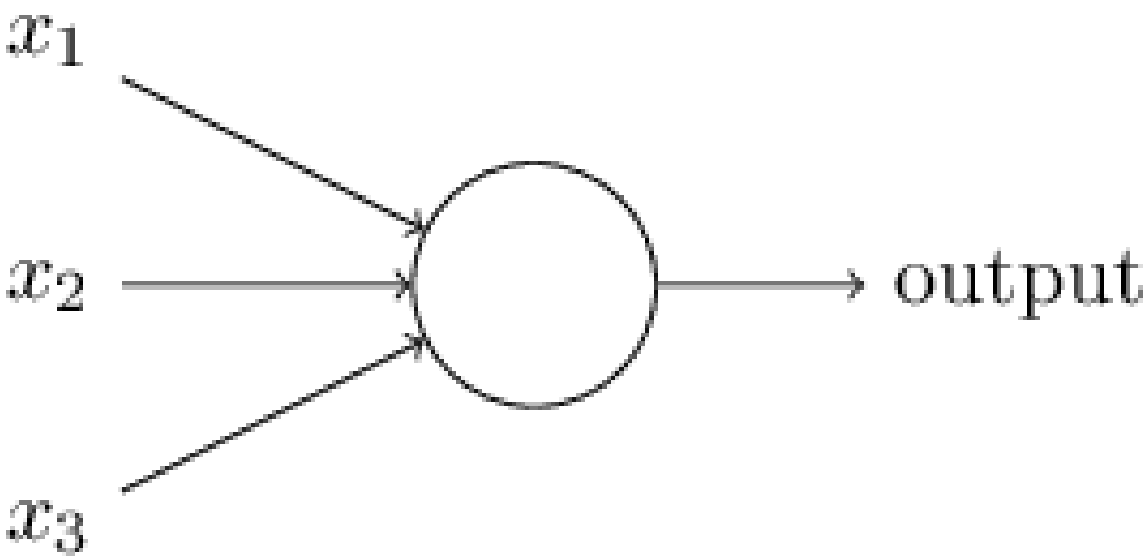
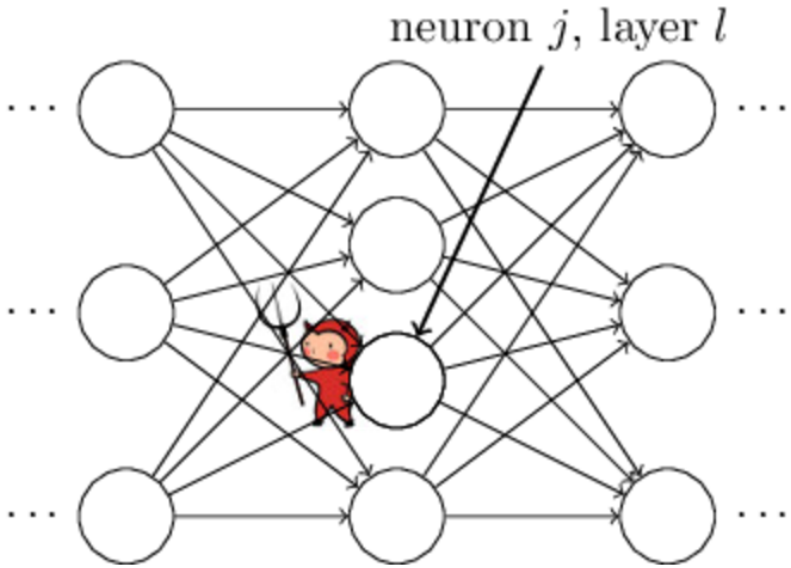
Essential Theory I

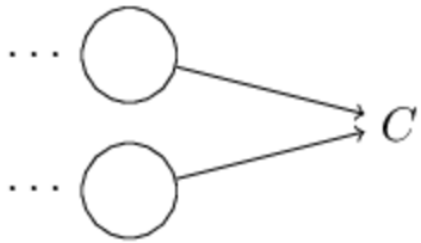
Neural Units



Essential Theory II

Cost Functions, Gradient Descent, and Backpropagation





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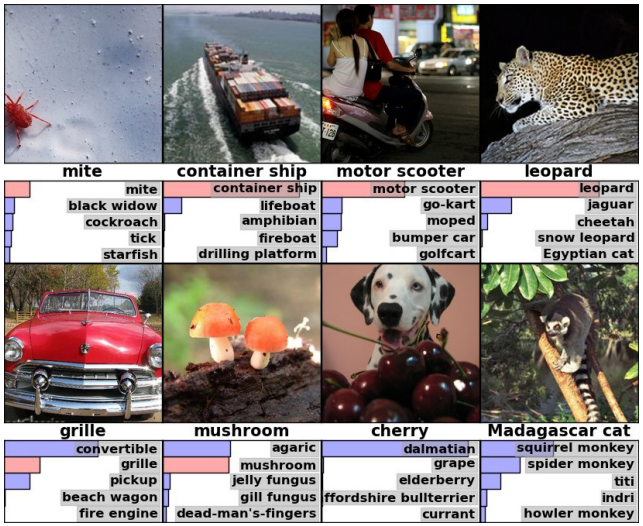
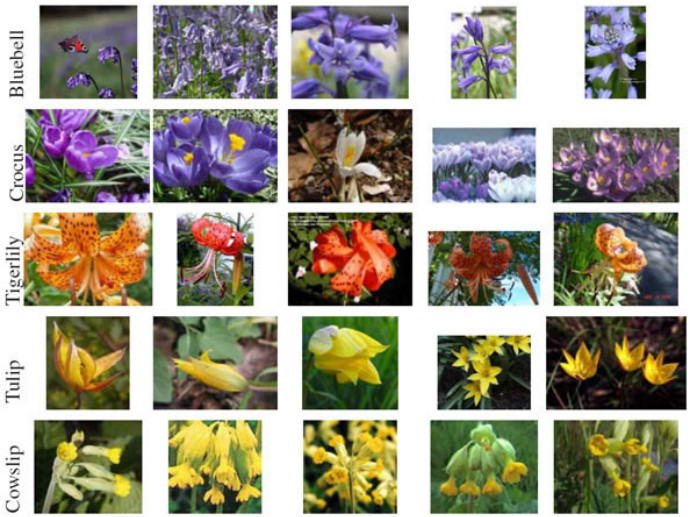
An Intermediate Neural Network

[intermediate notebook]

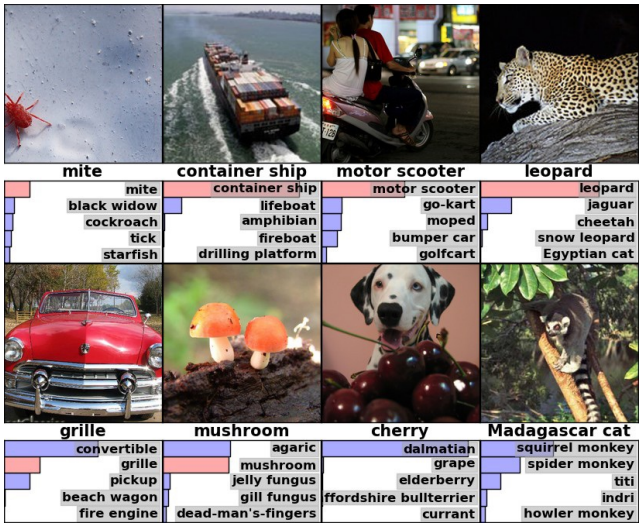
Data Sets for Deep Learning

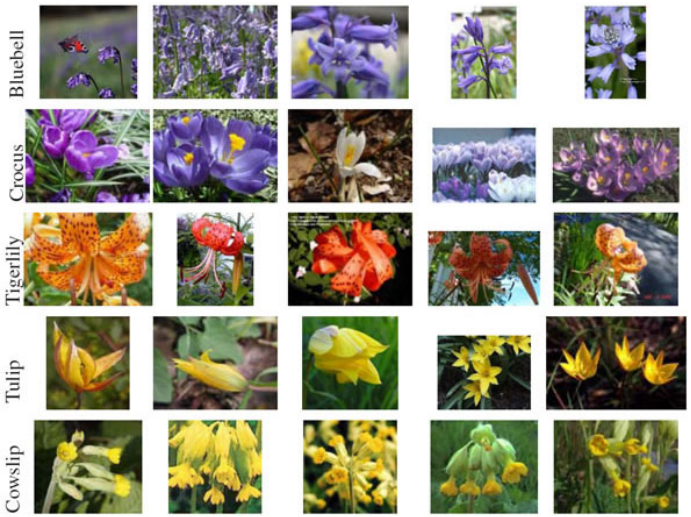




Dataset	Classes	Train Samples
AG's News	4	120,000
Sogou News	5	450,000
DBPedia	14	560,000
Yelp Review Polarity	2	560,000
Yelp Review Full	5	650,000
Yahoo! Answers	10	1,400,000
Amazon Review Full	5	3,000,000
Amazon Review Polarity	2	3,600,000

Data Sets for Deep Learning





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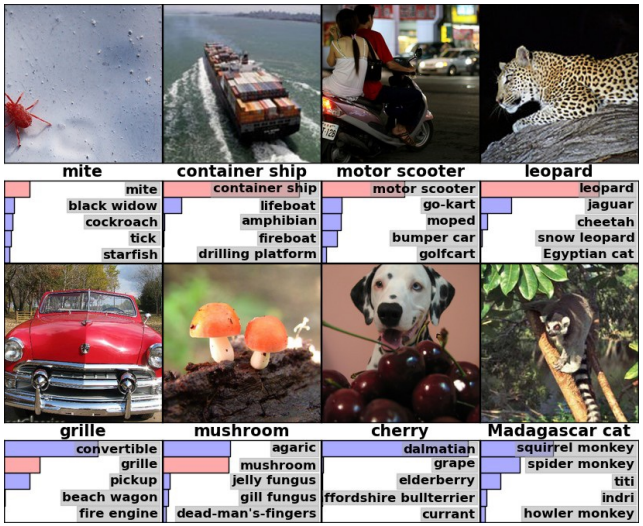

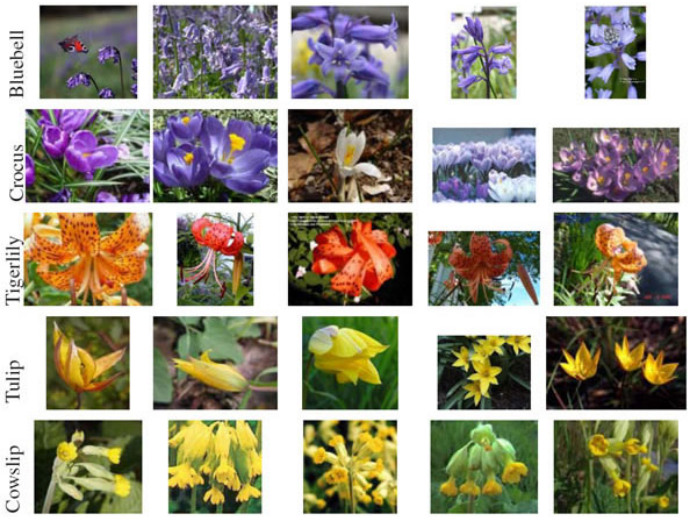

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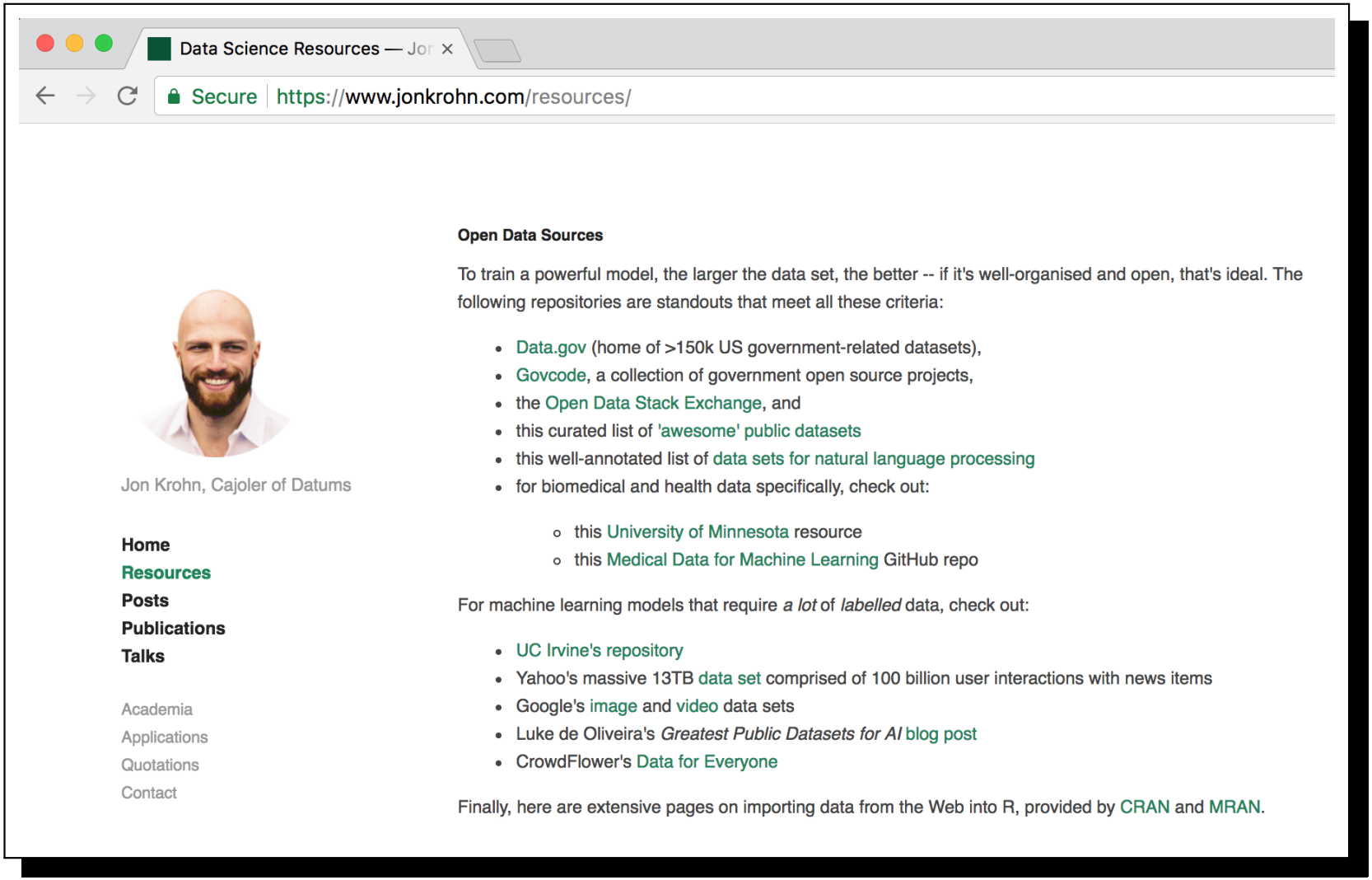
Data Science Resources — Jon
Secure https://www.jonkrohn.com/resources/
Jon Krohn, Cajoler of Datums
Home
Resources
Posts
Publications
Talks
Academia
Applications
Quotations
Contact
Open Data Sources
To train a powerful model, the larger the data set, the better -- if it's well-organised and open, that's ideal. The following repositories are standouts that meet all these criteria:
Data.gov (home of >150k US government-related datasets),
Govcode, a collection of government open source projects,
the Open Data Stack Exchange, and
this curated list of 'awesome' public datasets
this well-annotated list of data sets for natural language processing
for biomedical and health data specifically, check out:
this University of Minnesota resource
this Medical Data for Machine Learning GitHub repo
For machine learning models that require a lot of labelled data, check out:
UC Irvine's repository
Yahoo's massive 13TB data set comprised of 100 billion user interactions with news items
Google's image and video data sets
Luke de Oliveira's Greatest Public Datasets for AI blog post
CrowdFlower's Data for Everyone
Finally, here are extensive pages on importing data from the Web into R, provided by CRAN and MRAN.

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Your Deep Learning Project I

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Your Deep Learning Project I

Ideating

Perspectives to approach ideating from:

- Identify a data set $\Rightarrow$ use it to solve a problem
- Identify a problem that you'd like to solve $\Rightarrow$ find an appropriate data set

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Review
Unit 1
Exercise 1
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Theory III
Theory IV
A Deep Net
TensorBoard

Outline

Weight Initialization

- uniform
- normal
- Xavier Glorot

[Jupyter demo]

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Stochastic Gradient Descent

- learning rate
- batch size
- second-order gradient learning
  - momentum
  - Adam

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Unstable Gradients

- vanishing
- exploding

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NYC DATA SCIENCE ACADEMY

Avoiding Overfitting

(Or, Model Generalization)

- L1/L2 regularization
- dropout
- artificial data set expansion

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Last, But Not Least

- more layers
  - max-pooling
  - flatten
- *batch normalization* avoids *covariate shift*; advantages:
  1. initialization parameters
  2. avoid neuron saturation
  3. regularizing effect

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Let's make [intermediate net] *deep*!

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1. add callback as in [AlexNet Jupyter notebook]
2. use Terminal to navigate to your `logs` directory
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