Building and Training a Deep Learning Network

Deep Learning — Unit 3

Dr. Jon Krohn
jon@untapt.com

Slides available at jonkrohn.com/talks

July 28th, 2018

Outline

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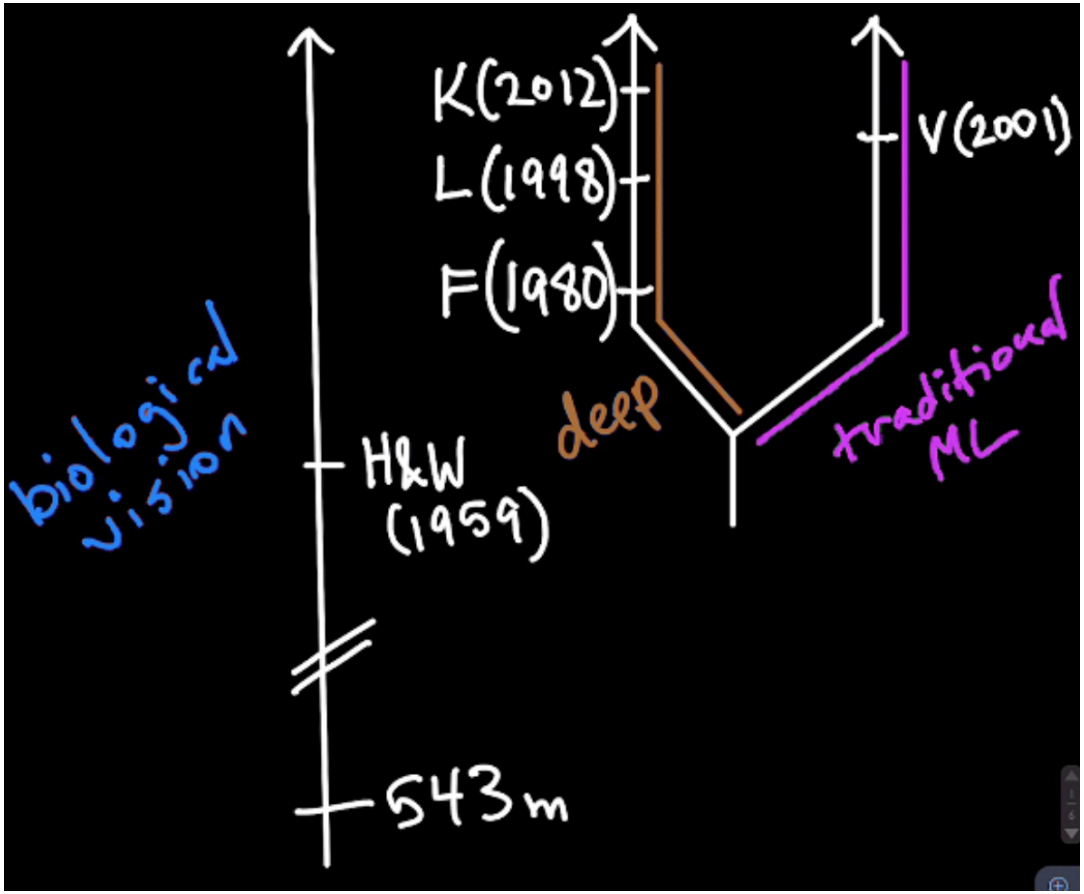
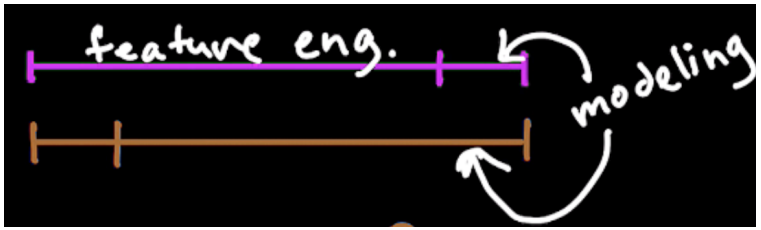
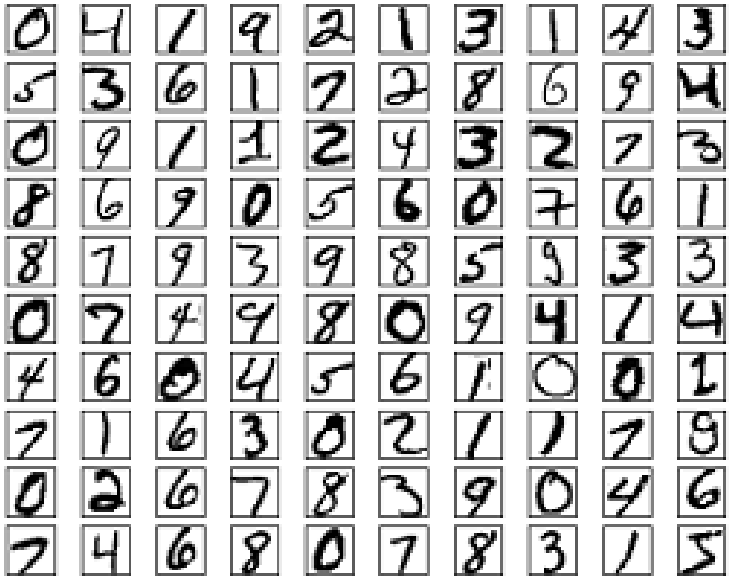

K(2012)
L(1998)
F(1980)
V(2001)
biological vision
H&W (1959)
deep
traditional ML
543m


feature eng.
modeling

MNIST Digits & LeNet-5

LeCun, Boutou, Bengio & Haffner (1998)



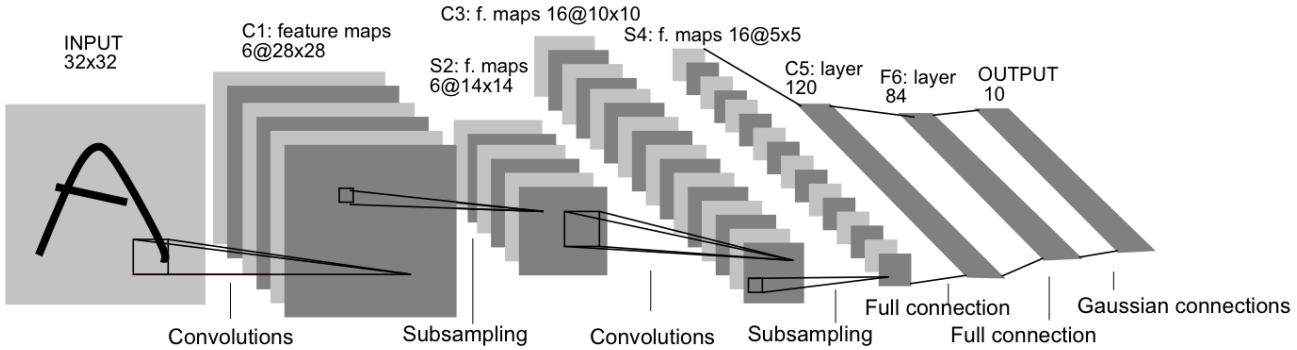
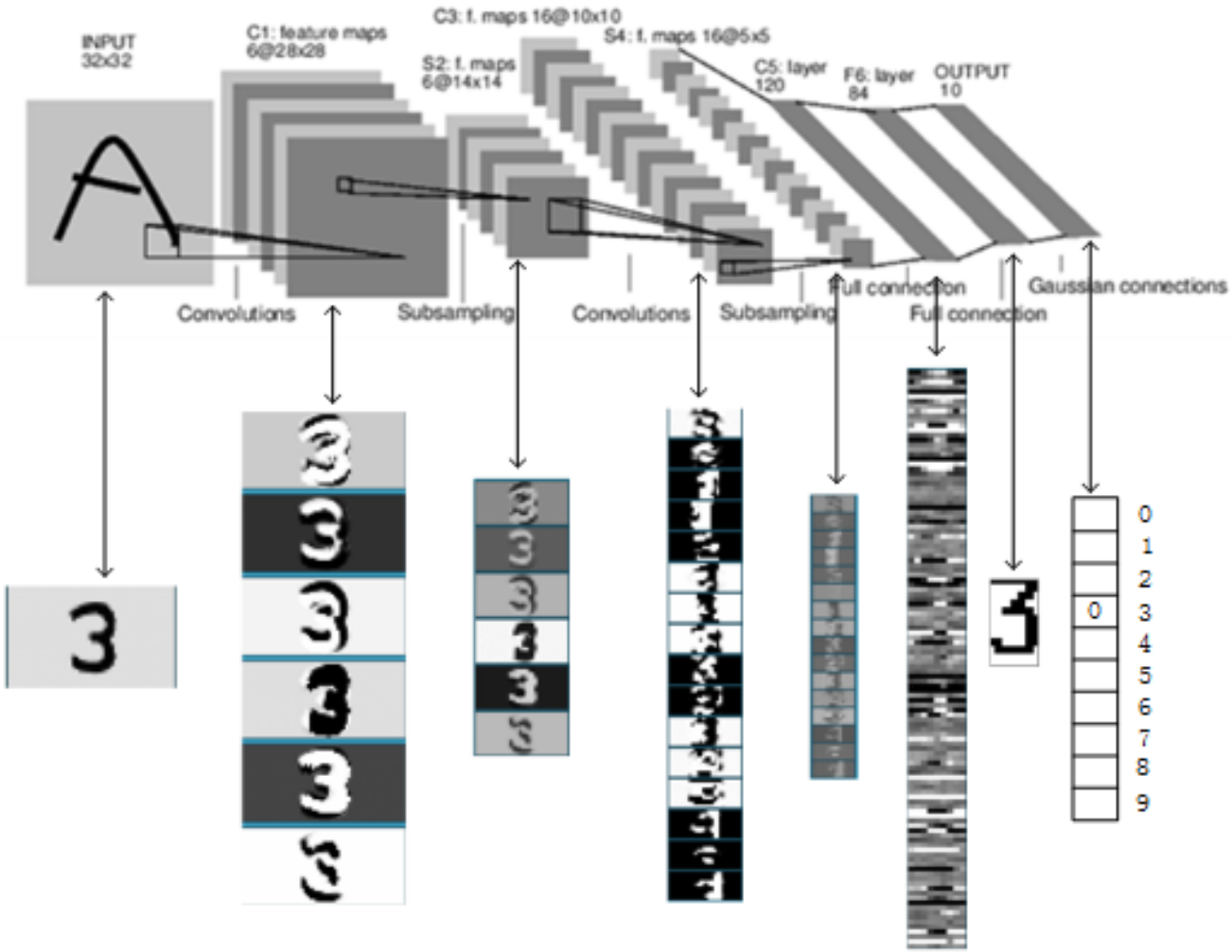


Fig. 2. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

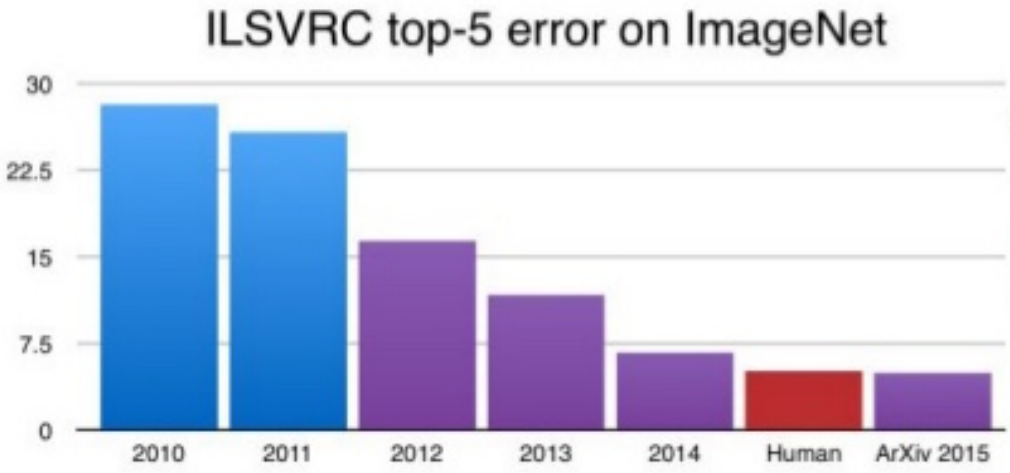
LeNet-5

LeCun, Boutou, Bengio & Haffner (1998)

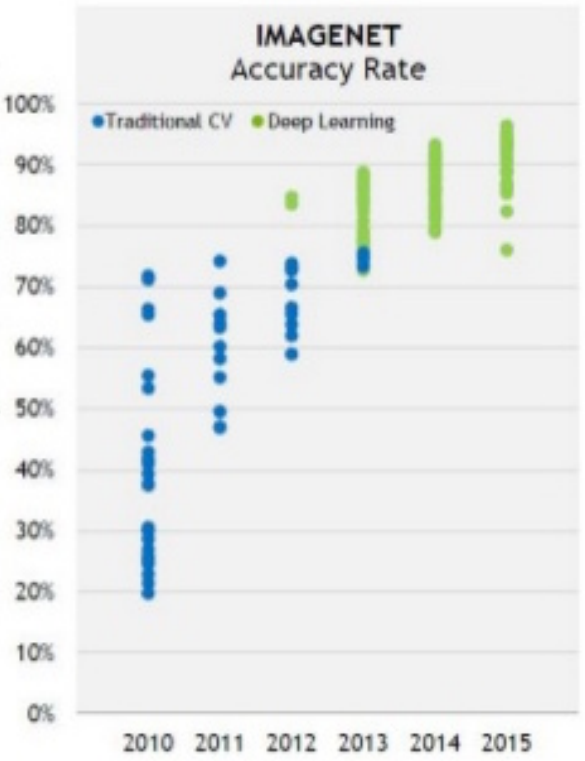


ImageNet Classification Error

ILSVRC: 1.4m, 1k object classes

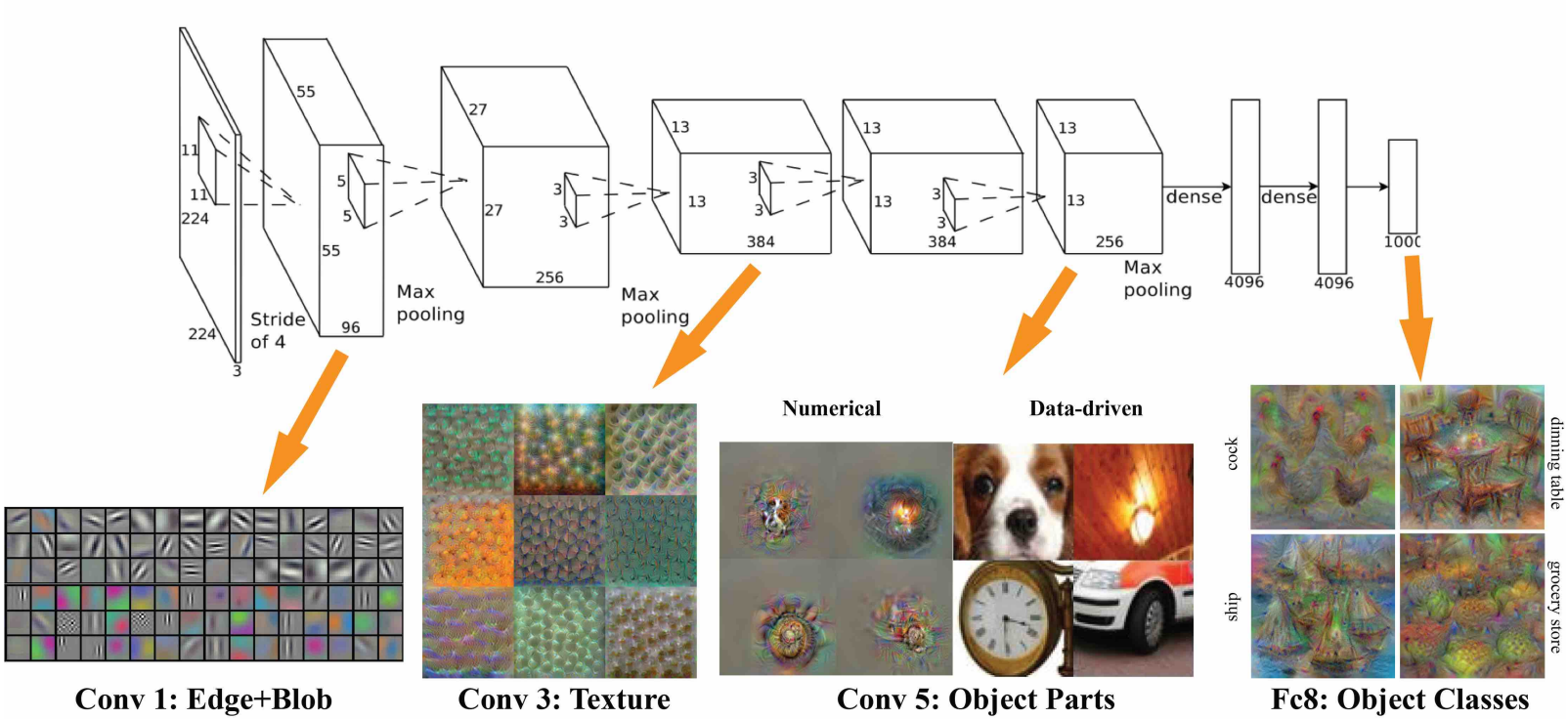


- Blue: Traditional CV
- Purple: Deep Learning
- Red: Human

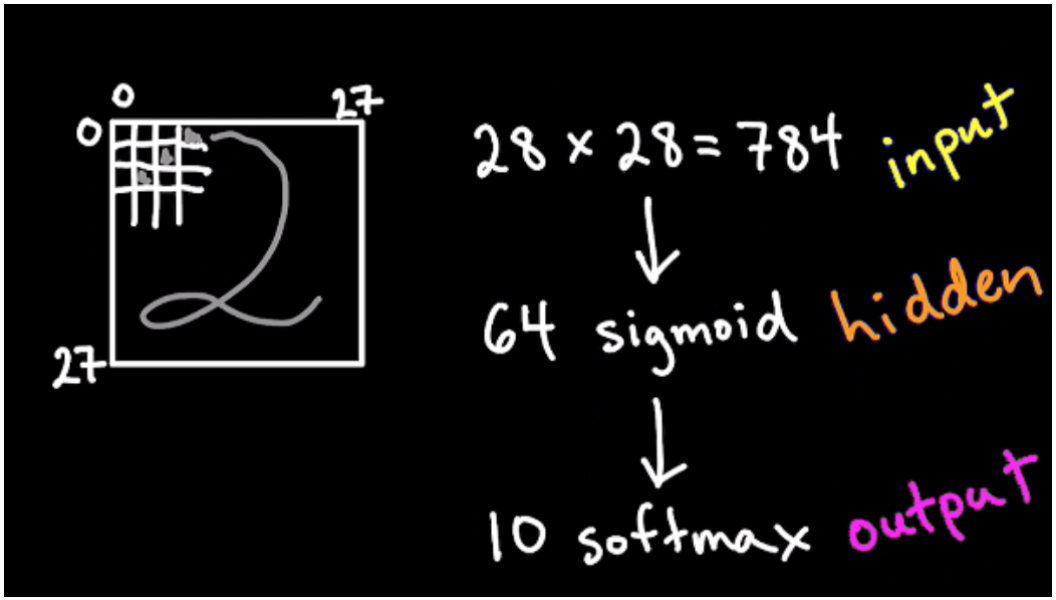


AlexNet

Krizhevsky, Sutskever & Hinton (2012)



A Shallow Neural Network



[shallow notebook]

Outline

TensorFlow Playground

Interactive ANN Visualization

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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
- softmax layer
- output layer

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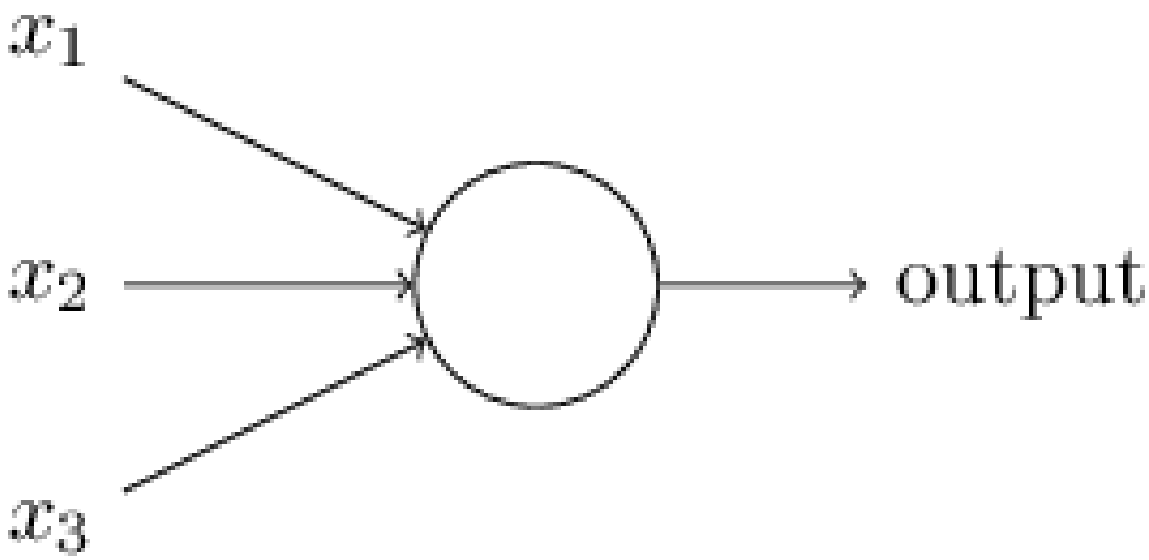
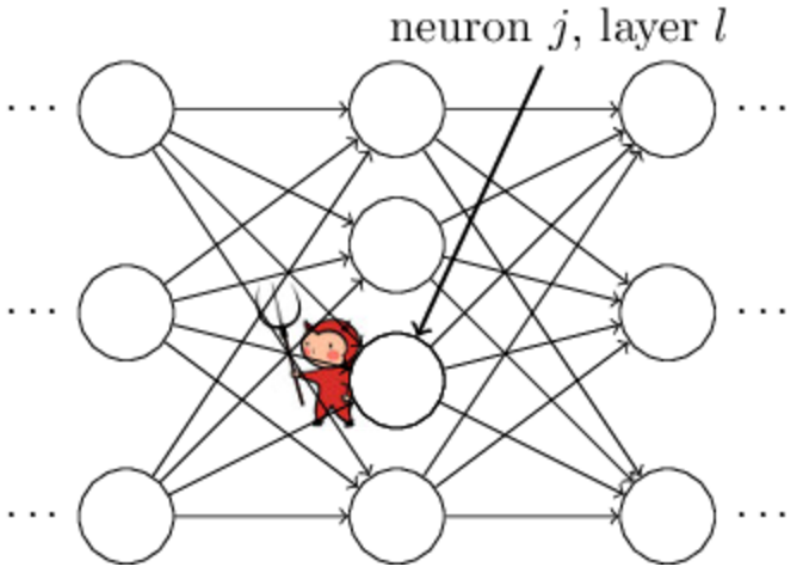
Essential Theory I

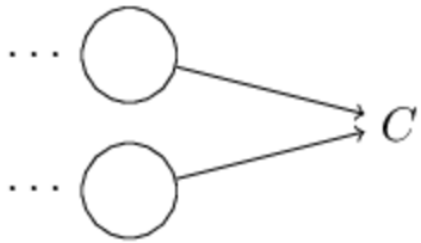
Neural Units



Essential Theory II

Cost Functions, Gradient Descent, and Backpropagation

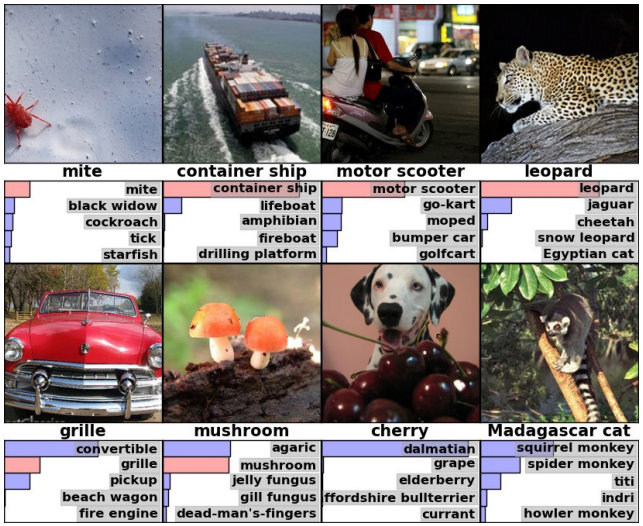


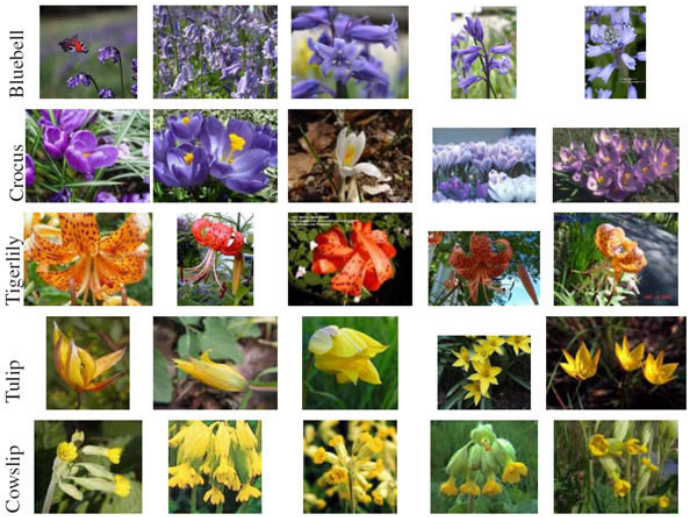


An Intermediate Neural Network

[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

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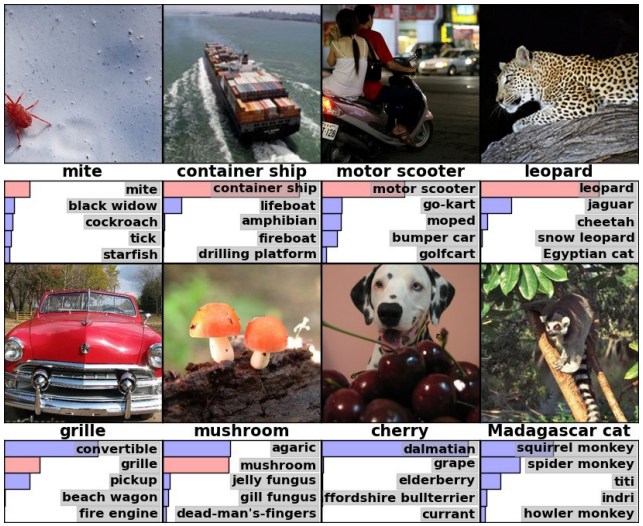

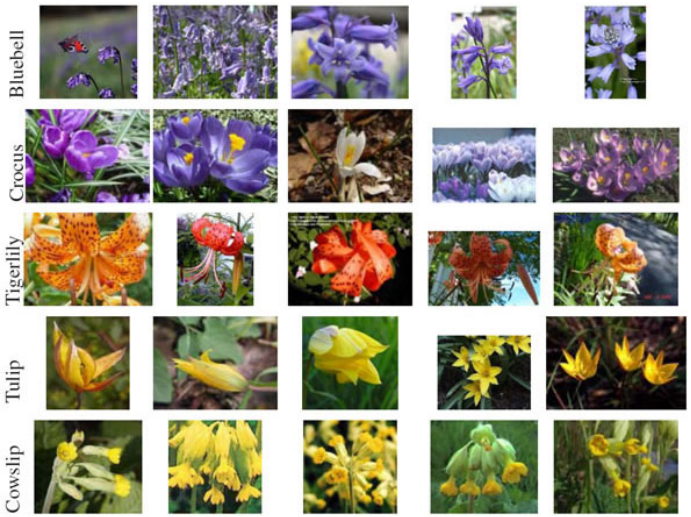

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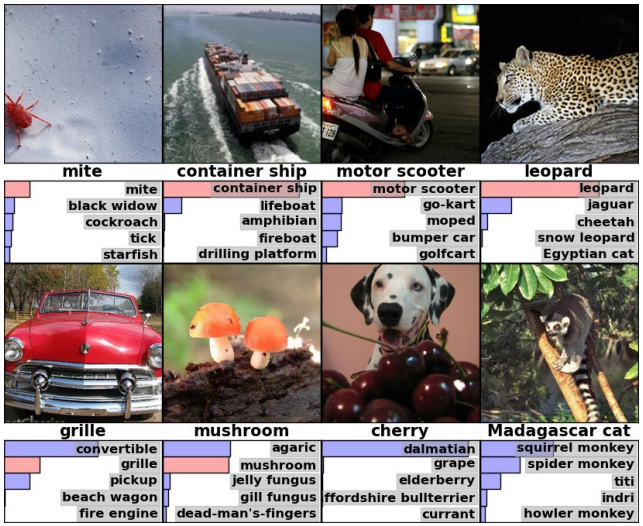

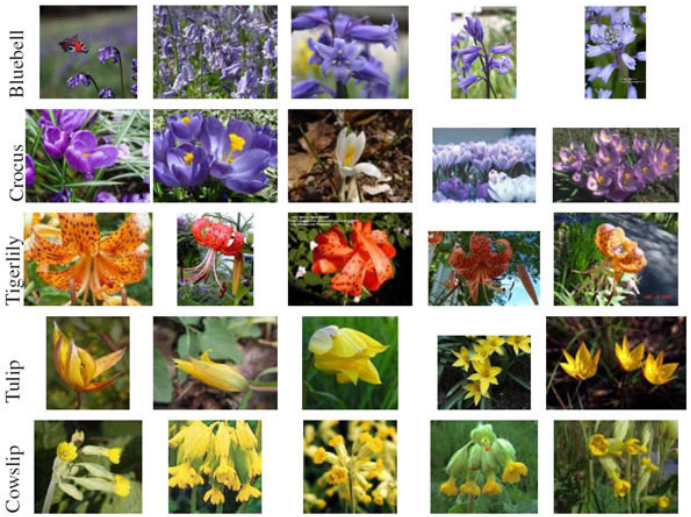

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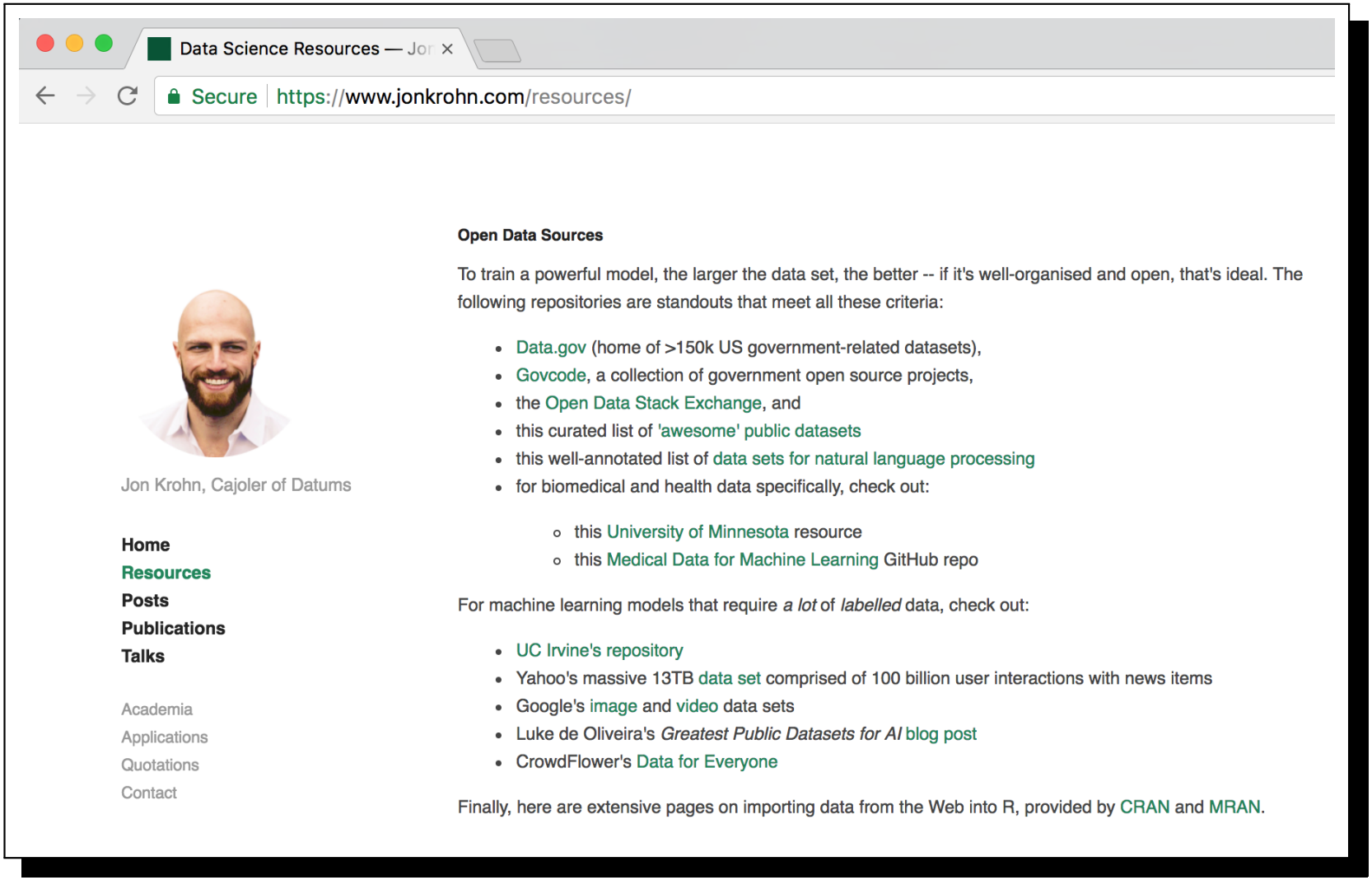
Data Science Resources — Jon
Secure https://www.jonkrohn.com/resources/
Jon Krohn, Cajoler of Datums
Home
Resources
Posts
Publications
Talks
Academia
Applications
Quotations
Contact
Open Data Sources
To train a powerful model, the larger the data set, the better -- if it's well-organised and open, that's 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.

Outline

Your Deep Learning Project I

Ideating

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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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- Xavier Glorot

[Jupyter demo]

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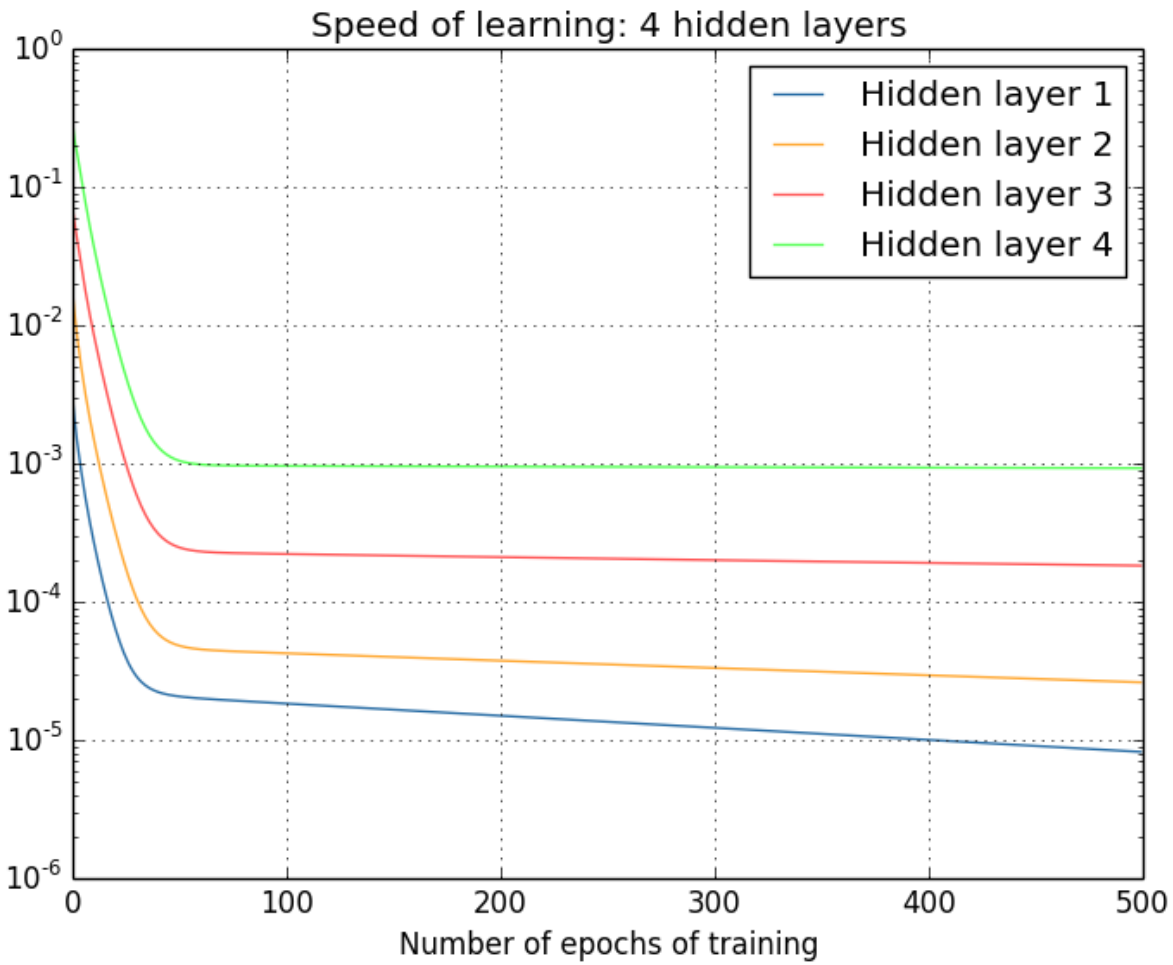

Unstable Gradients

- vanishing
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(Or, Model Generalization)

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- dropout
- artificial data set expansion

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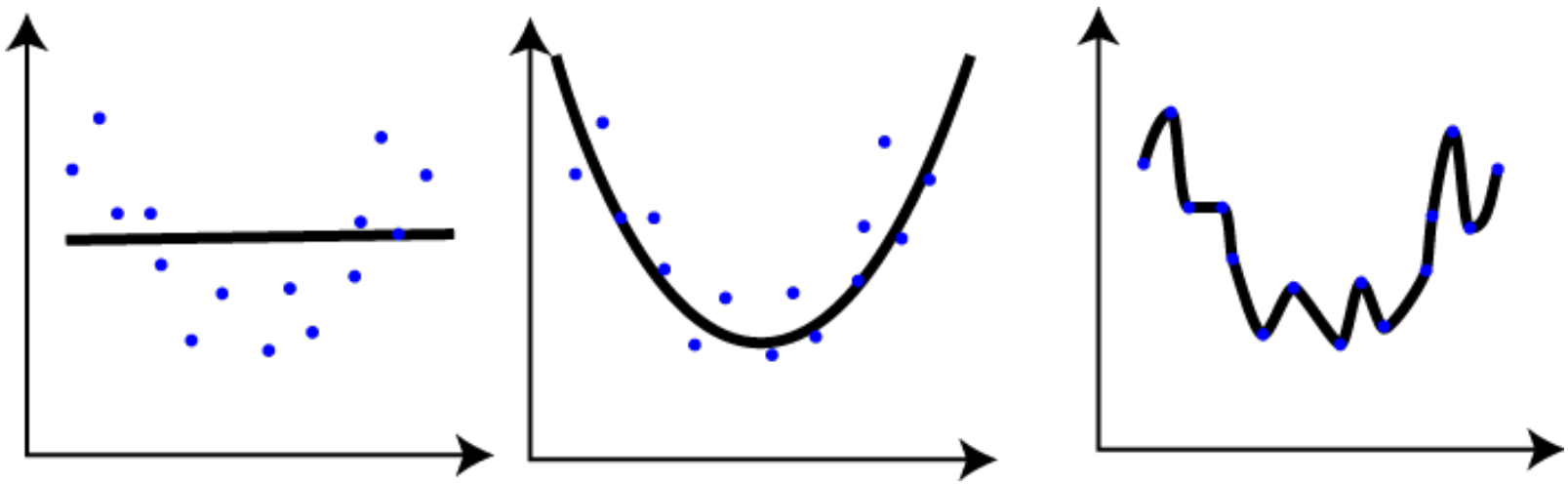

Last, But Not Least

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

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

Outline

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

Outline

TensorBoard

1. add callback as in [Deep Net in Keras Jupyter notebook]
2. use Terminal to navigate to your `logs` directory
3. run `tensorboard --logdir=. --port 6006`
4. navigate to `http://localhost:6006/` in a web browser

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TensorBoard

The Interpretation of Model Outputs