



**CORNELL
TECH**

Deep Learning Clinic (DLC)

Lecture 1 - Introduction

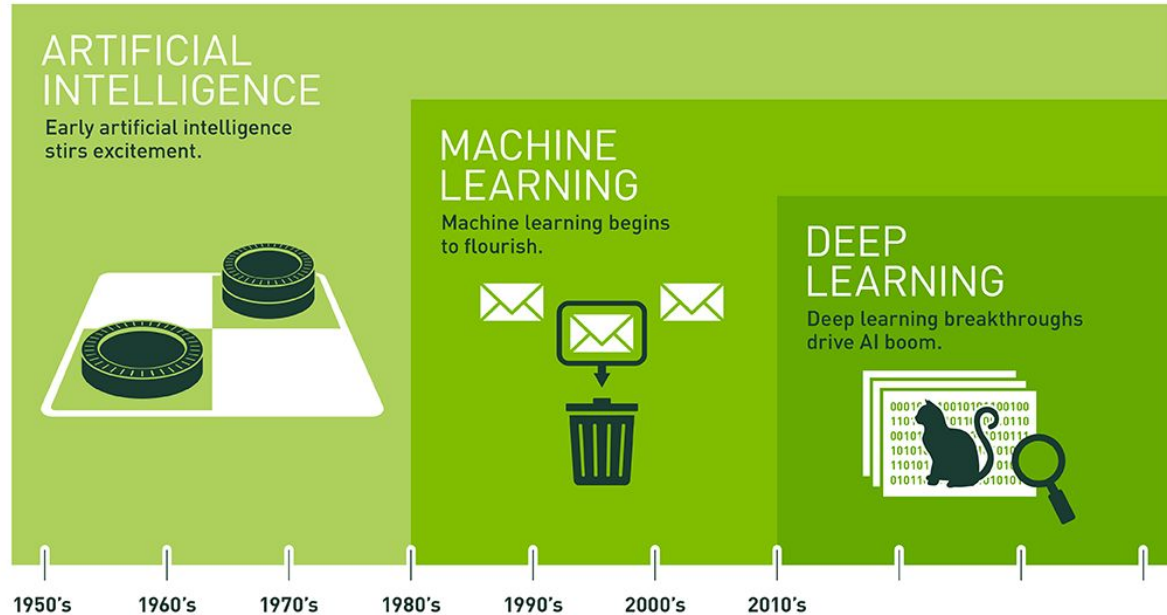
Jin Sun

9/28/2018

Welcome

- **Overview of the class**
 - Background
 - Logistics
- Lectures preview
- Lab preview
- FAQ
- A simple interactive machine learning example

Overview of DLC - Background



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Overview of DLC - Background



Overview of DLC - Background



Overview of DLC - Background

What DL is good for

Problems with massive data

Classification problems

Regression problems

Correlation relationship

What DL is not good at

Limited amount data

Partial labels

Structure output

Long term relationship

Causal relationship

Overview of DLC

deep learning tutorial



Deep Learning Tutorial
PDF

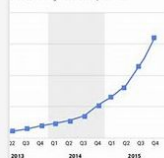
Open Source
Deep Learning Tutorial

Deep Learning
Examples

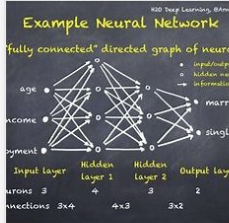
Deep Learning
Explained

of Deep Learning at Google

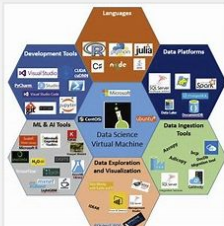
series containing model description files



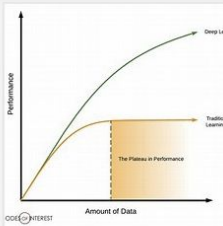
Deep Learning
Google



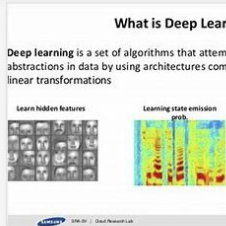
Deep Learning
Example



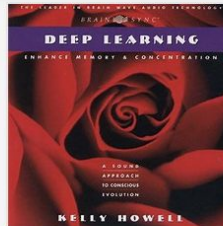
Deep Learning
Tools



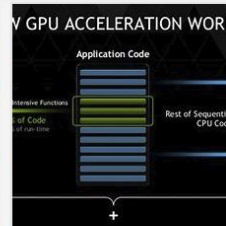
Deep Learning
Plateau



Deep Learning
Algorithms



Deep Learning
Kelly Howell



Deep Learning
GPU



Deep
Processing a

Deep Learning To The Rescue

- Deep Learning is implemented through Neural Networks.
- Motivation behind Neural Networks is the biological Neuron.



deeplearning.stanford.edu

Unsupervised
Feature Learning
and Deep Learning
Tutorial

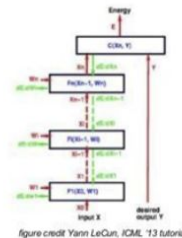
Deep learning Tutorial
with Caffe

Haosdent Huang 08/27/2015

Why Deep Learning?

Compositional Models
Learned End-to-End

Back-propagation jointly learns
all of the model parameters to
optimize the output for the task.



DL/ML Basic Concepts

Real World Application

Hands On

Step-by-step

Deep Learning Clinic

Practical Guidance

One-on-one

Get Started

Technical Background

What tools to use

For You

How to use existing tools

Eager to solve complex real world problems

How to train a DL model

Overview of DLC - Logistics

Lecture Session

Fri 8:30-10am, Bloomberg 081

- Introduction to:
 - Techniques
 - Tools
 - Tricks
 - How to solve a real-world problem
- Concise

Lab Session

Wed 8:30-9:30am, Bloomberg 061

- One-on-one advice
- Problem solving:
 - Feasibility evaluation
 - Modeling and task formulation
 - Network design
 - Practical guidance on training

Zero-credit, no assignments or evaluations.

Overview of DLC - Reference

Online Courses

MIT 6.S191: Introduction to Deep Learning [link](#)

Stanford CS231n: Convolutional Neural Networks
for Visual Recognition [link](#)

Free Textbooks

A Course in Machine Learning by Hal Daume III
[link](#)

Deep Learning by Ian Goodfellow and Yoshua
Bengio and Aaron Courville [link](#)

Overview of DLC - Logistics

Jin Sun

jinsun@cornell.edu - *Please include the tag 'DLC' in the subject

<http://www.cs.cornell.edu/~jinsun/>

Slack channel: <https://dlc18.slack.com/>, open to cornell.edu address

Survey: <https://www.surveymonkey.com/r/NVV8V59>

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- **Lectures preview**
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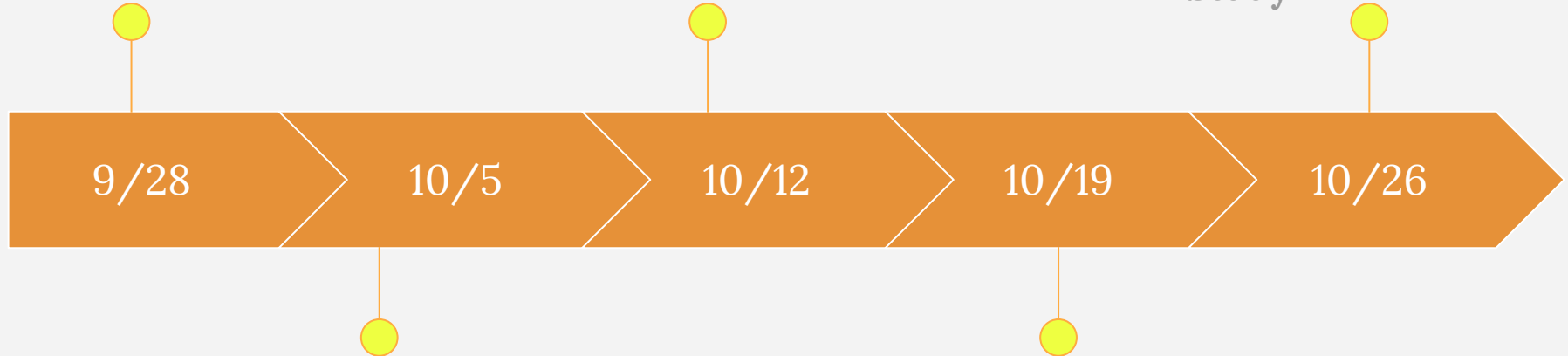
Intro to Machine Learning

Introduction

Overview, learning problem example

Review ML concepts: supervised learning, classification, regression, etc

DL in the Real-world: A Case Study



Deep Learning Frameworks

Setup DL env, Pytorch, TensorFlow

Intro to Deep Learning

Optimization, network structures

10/5 Deep Learning Frameworks

How to set up a basic deep learning development environment

Python virtualenv, Jupyter Notebook



By the end of this lecture, you should have a working DL environment to play with!

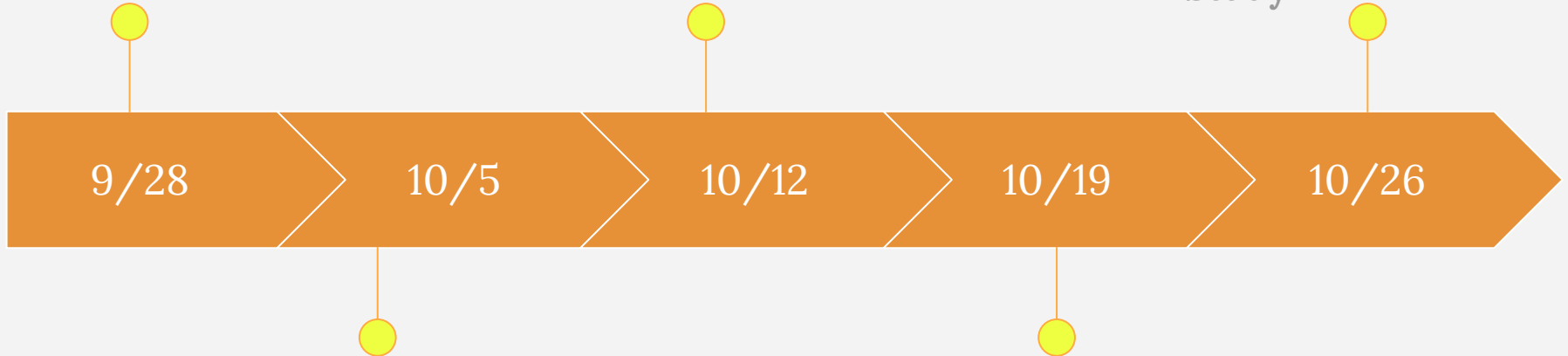
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10/12 Brief Introduction to Machine Learning

Introduction/Review of core ML concepts:

Supervised learning

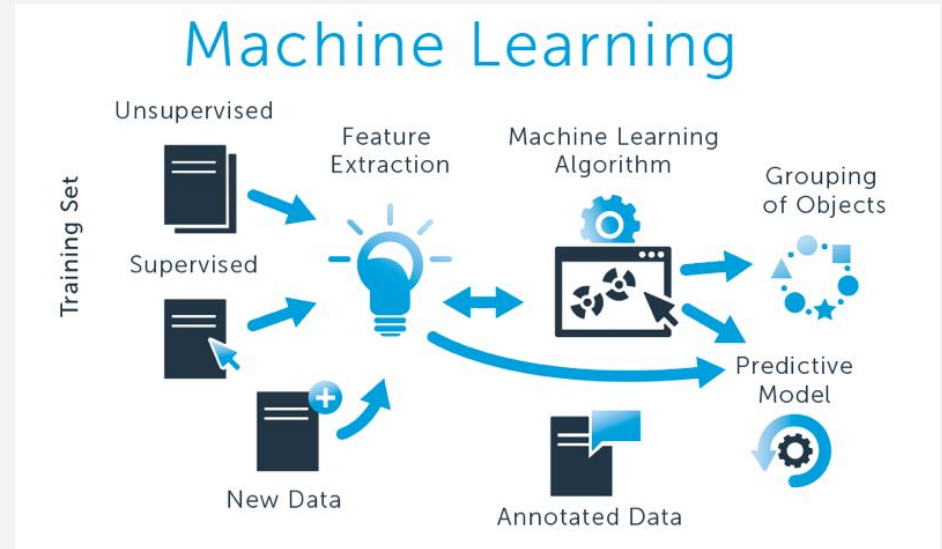
Unsupervised learning

Classification

Regression

Training

Evaluation, Cross-validation, and etc



Reference

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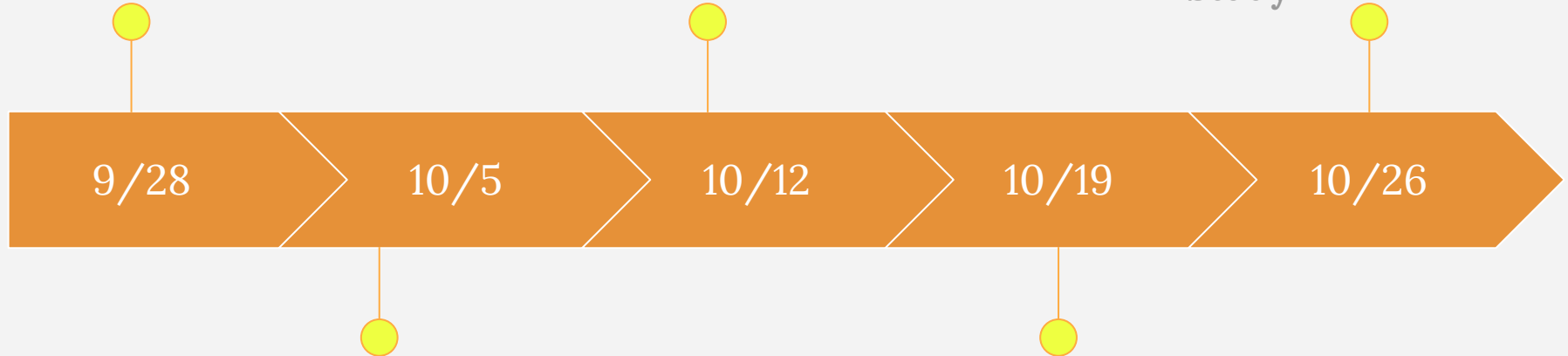
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10/19 Brief Introduction to Deep Learning

Introduction/Review of DL topics:

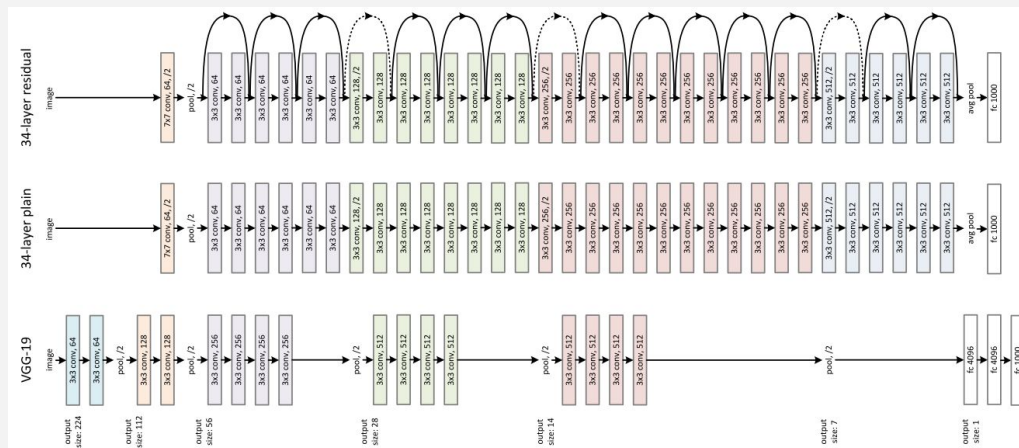
Optimization techniques

Network structures (e.g., Fully Connected Nets, Convolutional Nets, Recurrent Nets)

Generative Adversarial Nets

Reinforcement Learning

...



Reference

Online Courses

Stanford CS231n: Convolutional Neural Networks
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Free Textbooks

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Bengio and Aaron Courville [link](#)

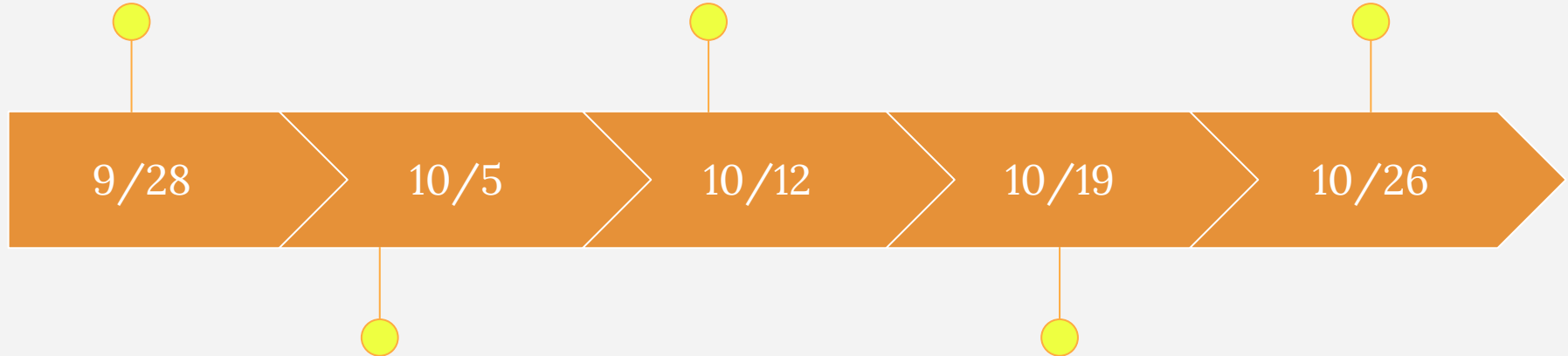
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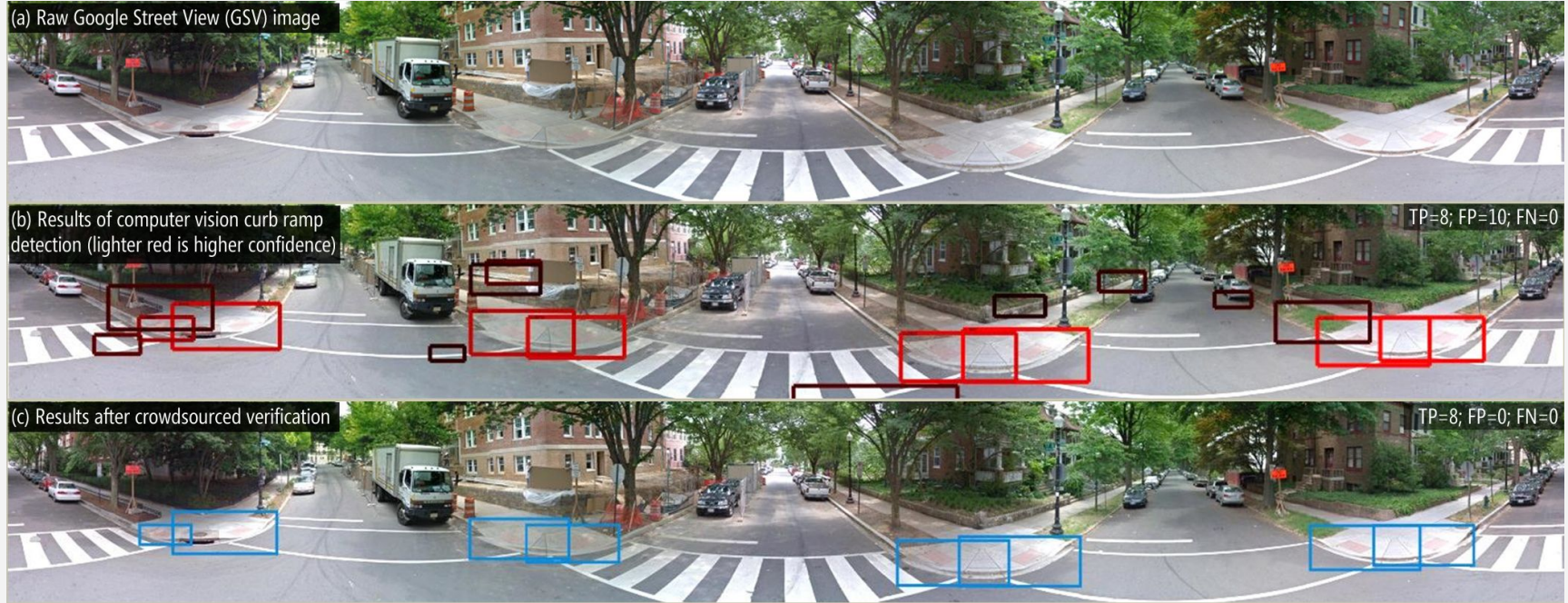
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10/26 DL in the Real-World: A Case Study



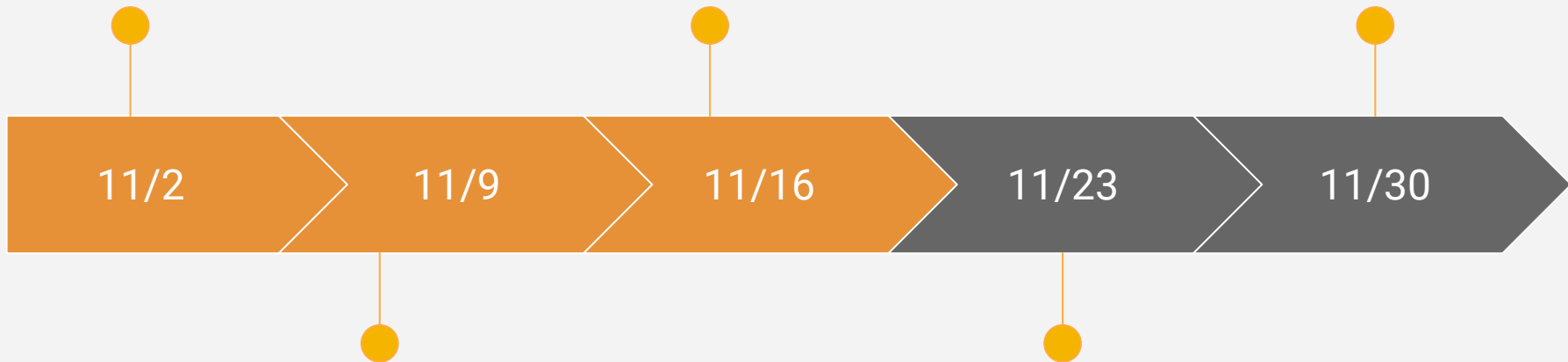
Data

Data collection, labeling,
verification, MTurk

Real-World Ready Tools

Google Cloud Vision, AutoML,
Face++, Detectron, NLTK, etc

Office Hours



Tricks on Training NN

Practical tips: pre-processing,
learning rate, batch size, etc

Thanksgiving

Data


Data Collection

Data Annotation

Verification

How to use

Amazon Mechanical Turks



[Your Account](#)[HITS](#)[Qualifications](#)

[Introduction](#) | [Dashboard](#) | [Status](#) | [Account Settings](#)

Amazon Mechanical Turk
Artificial Intelligence

Mechanical Turk is a marketplace for work.
We give businesses and developers access to an on-demand, scalable workforce.
Workers select from thousands of tasks and work whenever it's convenient.

405,999 HITS available. [View them now.](#)


Make Money by working on HITS

HITS - *Human Intelligence Tasks* - are individual tasks that you work on. [Find HITS now.](#)


As a Mechanical Turk Worker you:

- Can work from home
- Choose your own work hours
- Get paid for doing good work


Find an interesting task



Work



Earn money



[Find HITS Now](#)

or [learn more about being a Worker](#)


Get Results from Mechanical Turk Workers

Ask workers to complete HITS - *Human Intelligence Tasks* - and get results using Mechanical Turk. [Get Started.](#)


As a Mechanical Turk Requester you:

- Have access to a global, on-demand, 24 x 7 workforce
- Get thousands of HITS completed in minutes
- Pay only when you're satisfied with the results


Fund your account



Load your tasks



Get results



[Get Started](#)

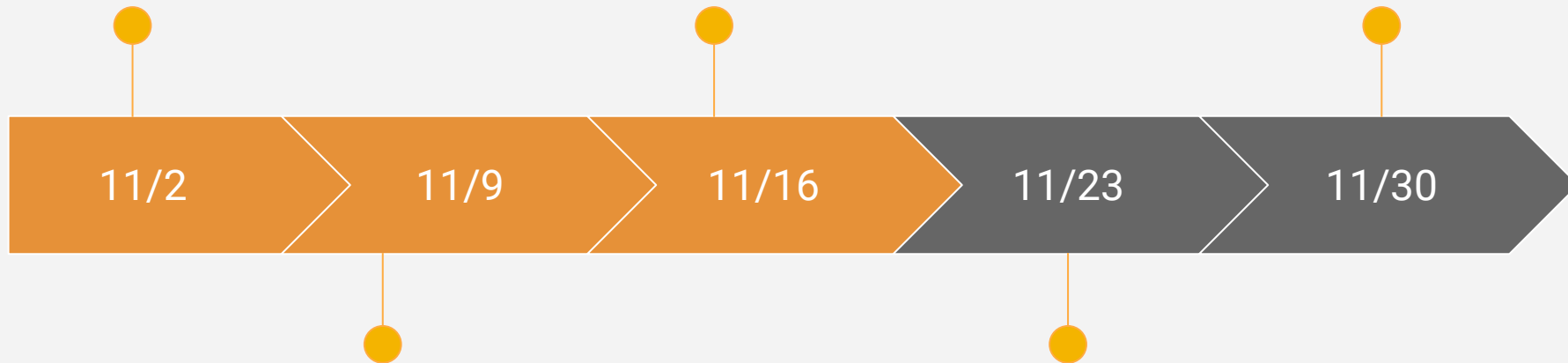
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Tricks on Training NN

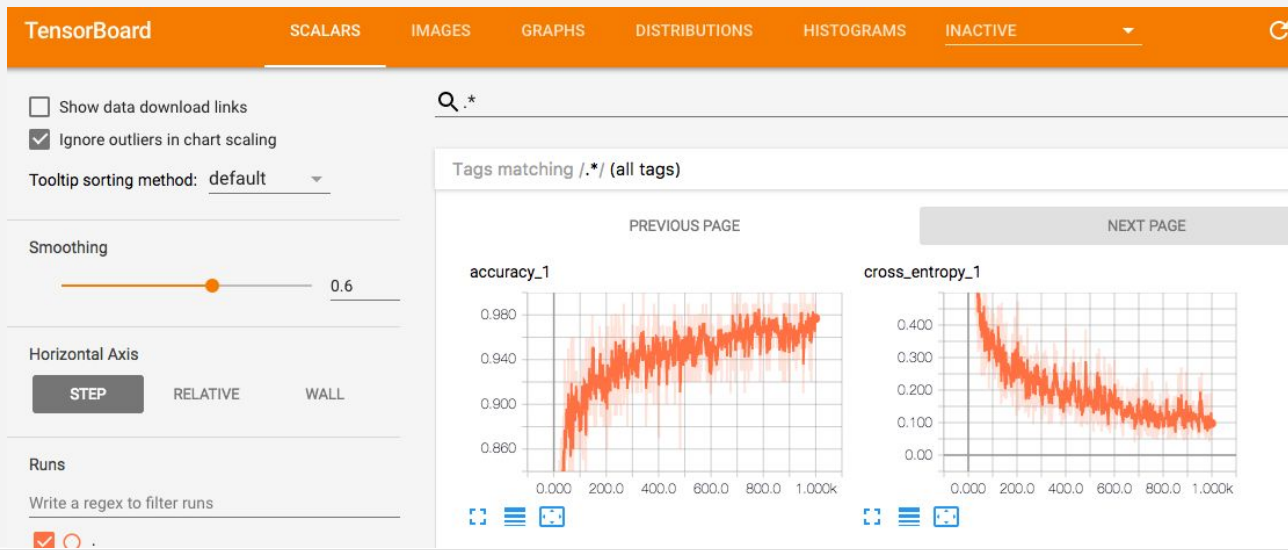
Practical tips: pre-processing, learning rate, batch size, etc

Thanksgiving

11/9 Tricks on Training Neural Networks

Practical tips and tricks

Pre-processing, post-processing, learning rate, batch size, normalization, network depth, architecture search, fine-tuning, and etc



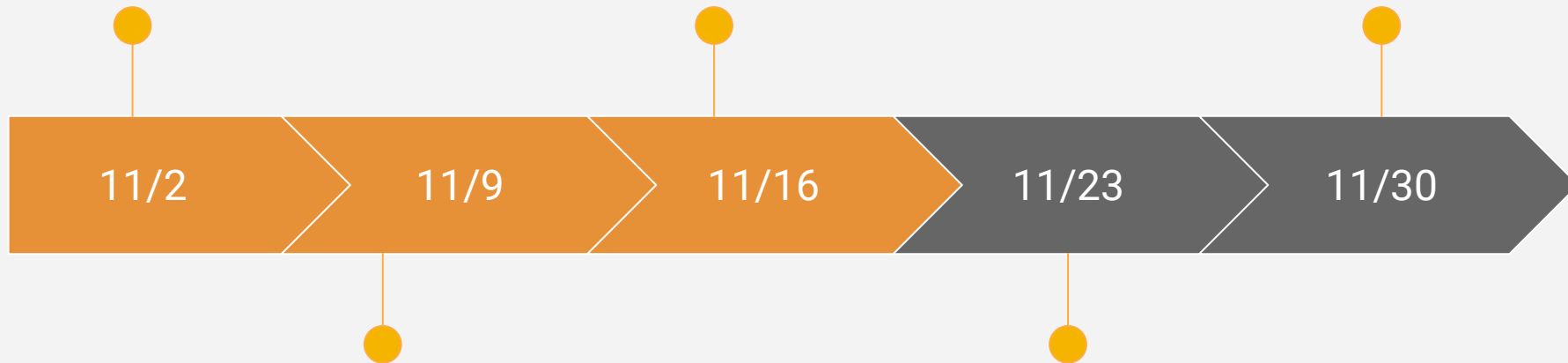
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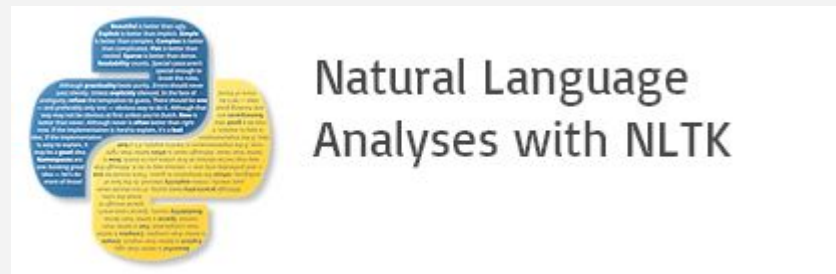
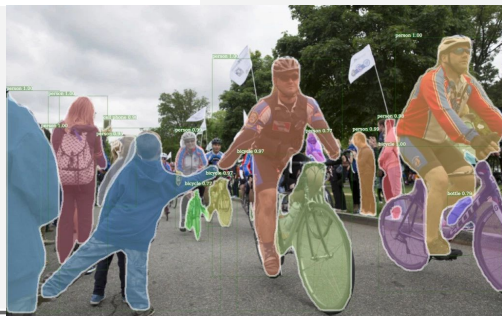
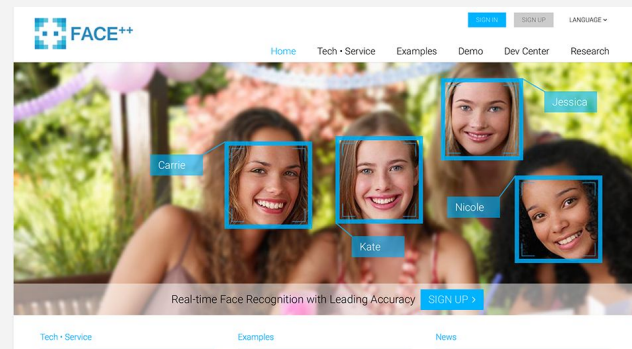
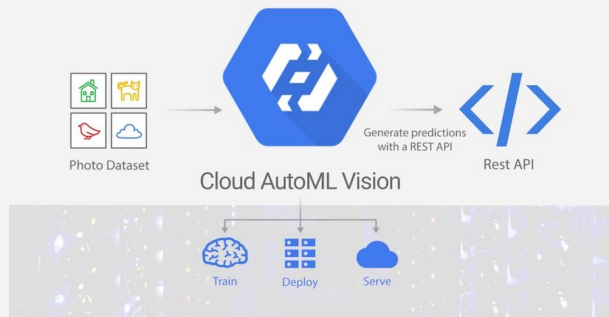
Tricks on Training NN

Practical tips: pre-processing,
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Thanksgiving

Real-World Ready Machine Learning Tools

Tools that are widely used and proven to be effective in real-world problems



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Lab Preview



The background image shows a hand holding a stethoscope against a blue background. Overlaid on this are several hexagonal icons with medical symbols: a heart, a cross, a person, a clipboard, a flame, a first aid kit, a pill, and a molecular structure. The word 'MEDICAL' is repeated in several hexagons. Text overlays are present: 'Me' in a dark box on the left, and a large central box containing the title and a list of topics.

Me

Your Deep Learning Concerns:

- Feasibility Evaluation
- Modeling and Task Formulation
- Network Search and Design
- Training Guidance

Welcome

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FAQ

Can I attend only selected sessions?

Sure! But I recommend to you to attend the first few introduction lectures to grasp some basic understanding about DL/ML.

I don't have a strong technical background, can I still attend?

Of course! Come for the lectures that provide high level idea and how to use existing tools for quick prototyping. (9/28, 10/5, 10/26, 11/2, 11/16)

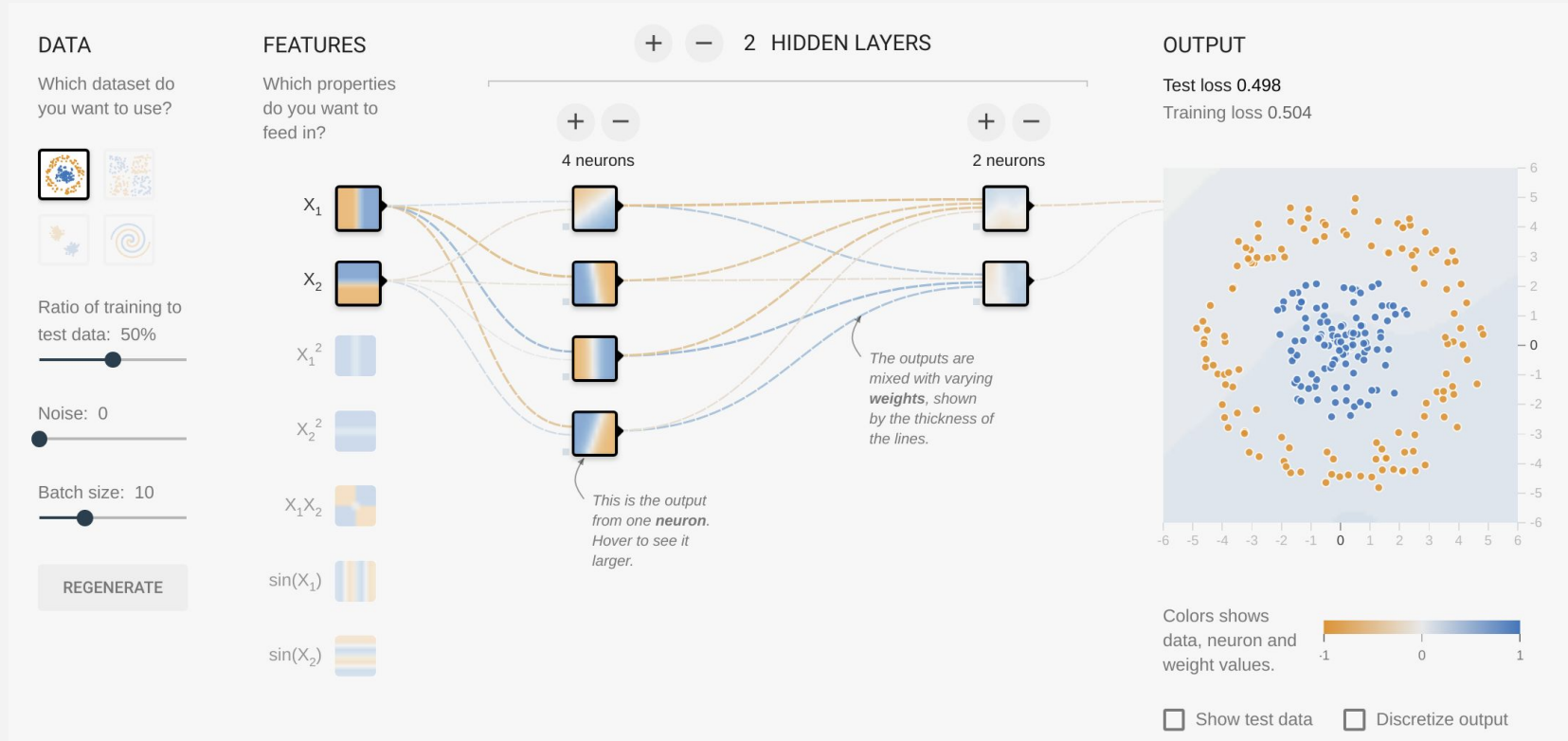
Do I have to come for every lab session?

Only come as you needed, or when there's a guided exercise (later this semester) that you are interested.

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A Simple Interactive Machine Learning Example



A Neural Network Playground [Link](#)

DATA

Which dataset do you want to use?



Ratio of training to test data: 50%



Noise: 0



Batch size: 10



REGENERATE

Data:

(x,y) 2D Points

Binary Label

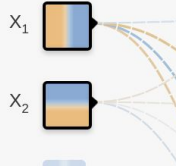
Train/Test Split

Noise Level

Batch Size

FEATURES

Which properties
do you want to
feed in?



$$X_1^2$$

$$X_2^2$$

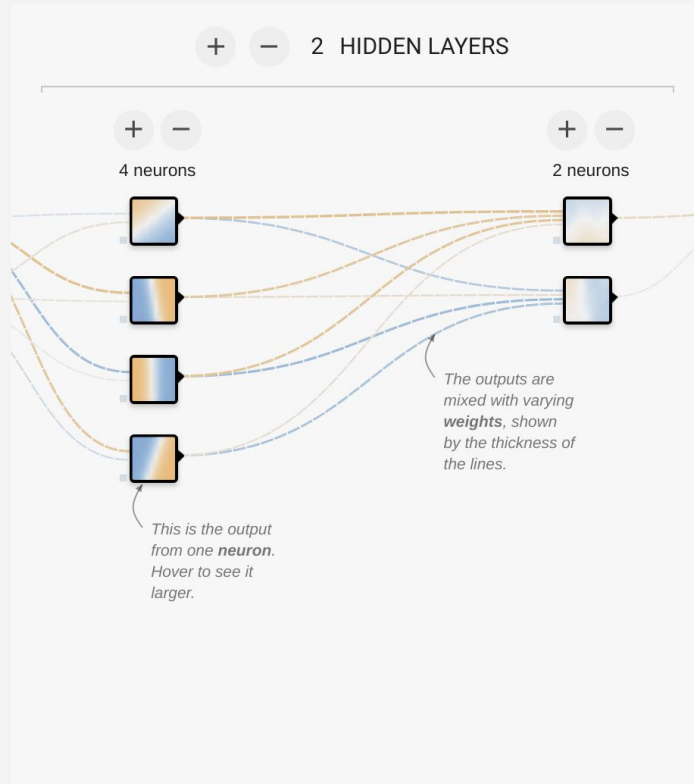
$$X_1 X_2$$

$$\sin(X_1)$$

$$\sin(X_2)$$

Feature Representation:

Learning problem becomes easier/harder with different feature representations, even with the same data!



A Learning Model:

Network Structure

Layers

Connectivity

No network works for all the problems!



Epoch
000,000

Learning rate

0.03



Activation

Tanh



Regularization

None



Regularization rate

0



Problem type

Classification



Training:

Train/Test Loss

Epochs

Optimization Algorithm

Evaluation:

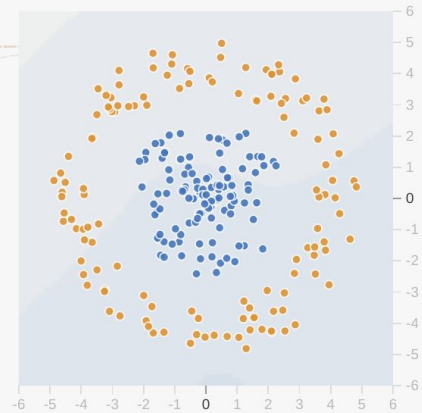
Metric (accuracy, distance, ...)

Cross-validation

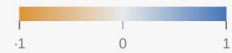
OUTPUT

Test loss 0.498

Training loss 0.504



Colors shows
data, neuron and
weight values.



☐ Show test data

☐ Discretize output

Next Friday: Deep Learning Frameworks

How to set up a basic deep learning development environment

Python virtualenv, Jupyter Notebook



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DLC Logistics

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<http://www.cs.cornell.edu/~jinsun/>

Slack channel: <https://dlc18.slack.com/>, open to cornell.edu address

Survey: <https://www.surveymonkey.com/r/NVV8V59>