Deep Learning - Theory and Practice

[11-1-2019]

Sriram Ganapathy

web - http://leap.ee.iisc.ac.in/sriram/teaching/DL19/

Teaching Assistants - Purvi Agrawal and Shreyas R.

email - deeplearning.cce2019@gmail.com
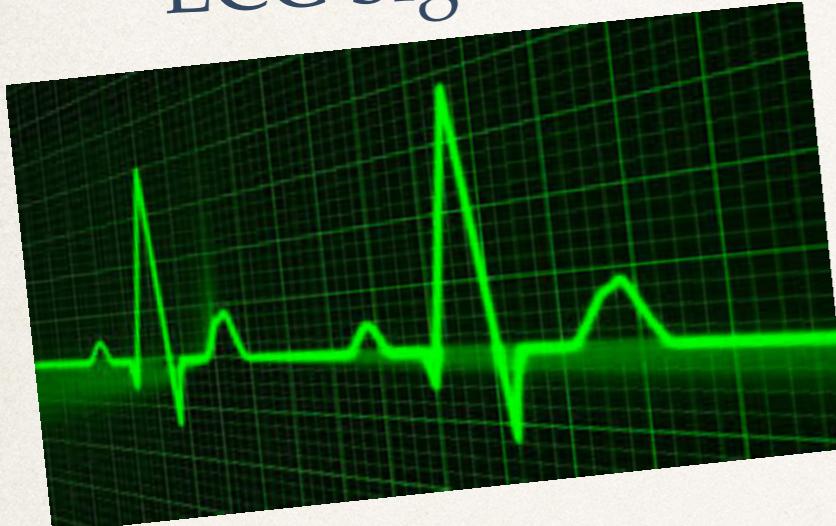
sriramg@iisc.ac.in
*C 334, Electrical Engineering, IISc*
+91 80 2293 2433

What are signals
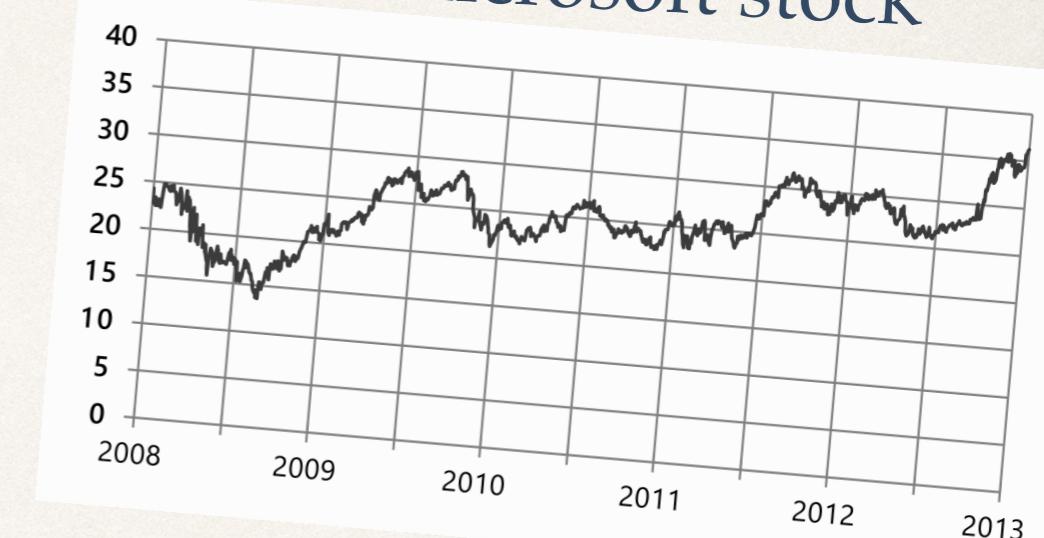
✤ Roland Priemer (1991). Introductory Signal Processing

Anything that conveys information about attributes or behavior of underlying phenomenon
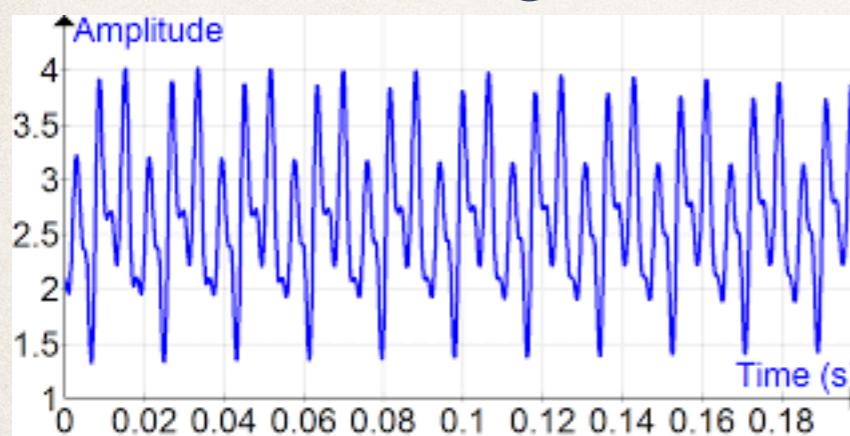
ECG Signal

Microsoft stock

Music Signal

Wikimedia

What are signals

✤ Roland Priemer (1991). Introductory Signal Processing
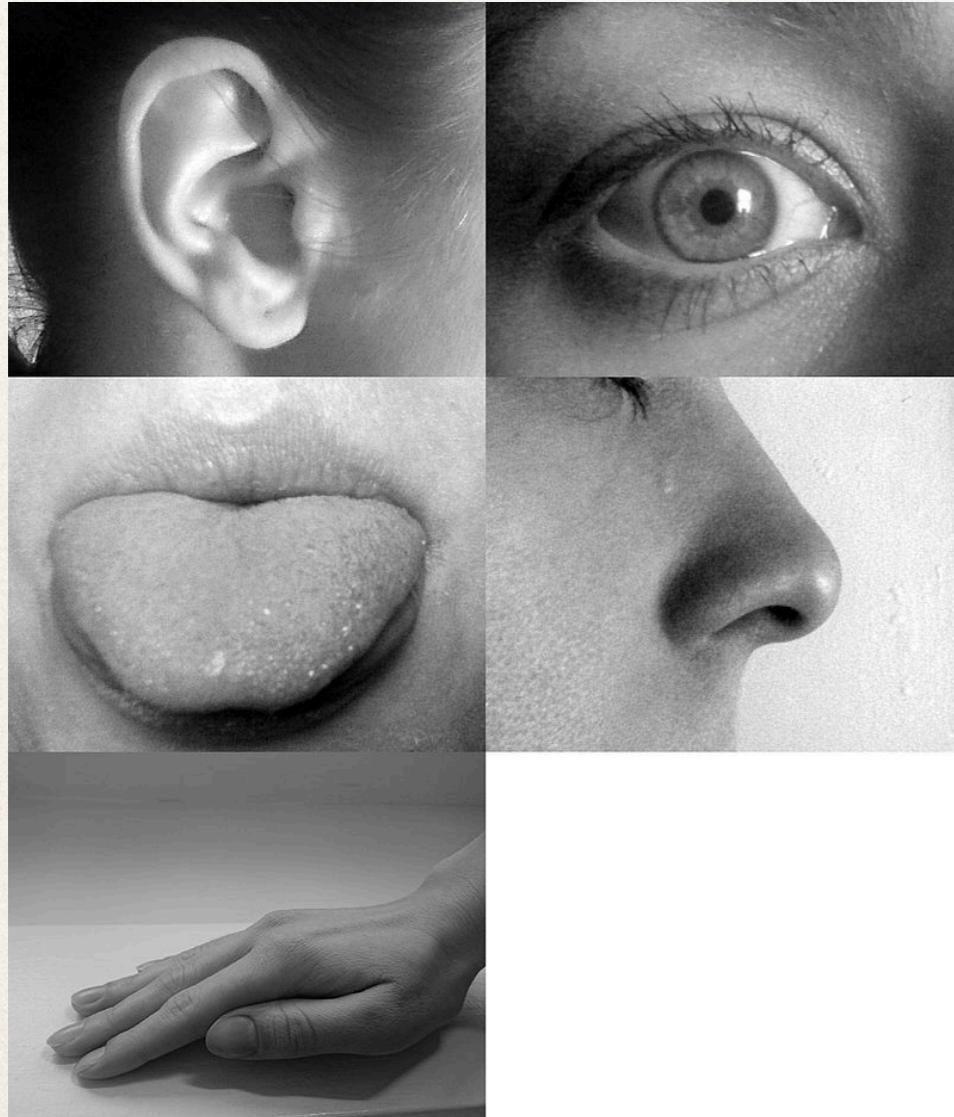
Anything that conveys information about attributes or behavior of underlying phenomenon

✤ Common signals - (mapping from one domain to another)

  ✤ function of time (e.g. speech, music, ECG, financial data etc)

  ✤ function of space (e.g. images)

  ✤ joint function of time and space (eg. video signals)

✤ Sensory signals

A sense is a physiological capacity of organisms that provides data for perception.
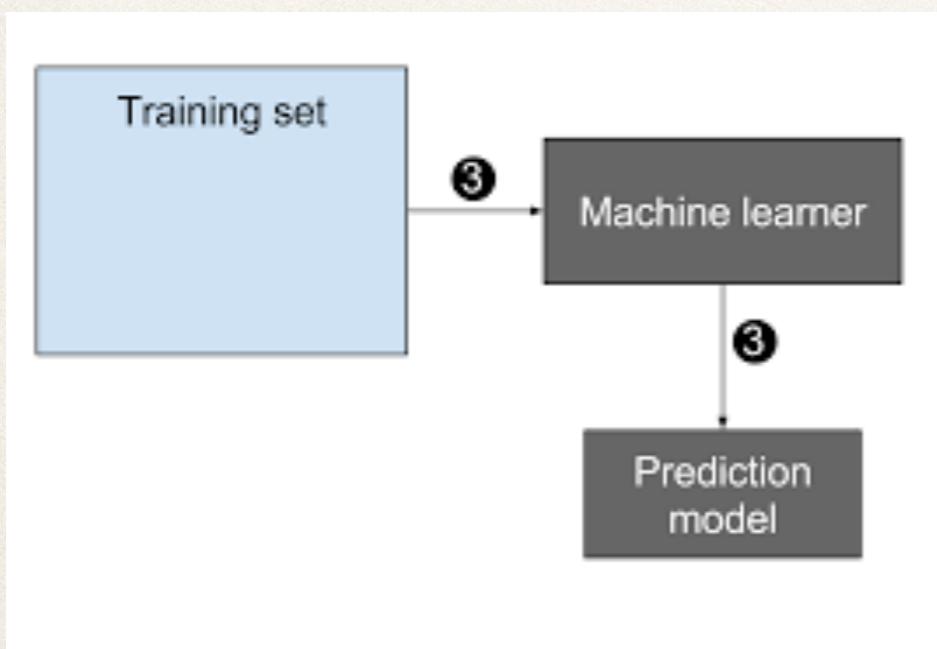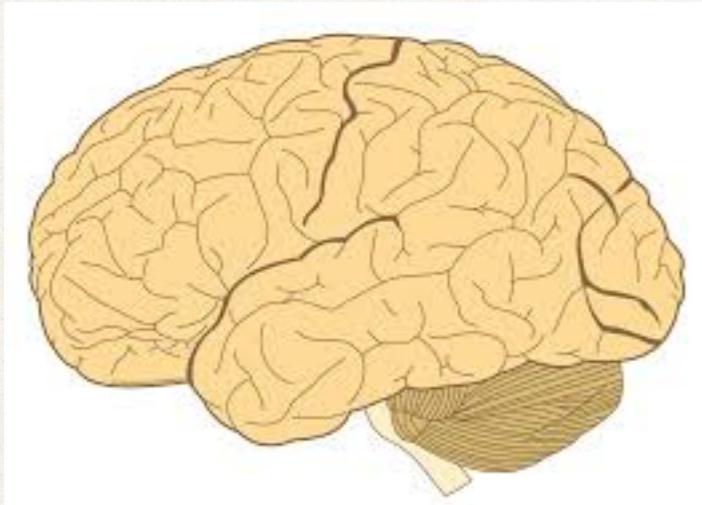
✤ Living organisms have multitude of sensations.

✤ Humans have the most complex perception system for these sensory signals.

What is learning

✤ Learning

Act of acquiring new/reinforcing existing knowledge, behavior, skills

✤ Human learning starts even before birth.
  ✤ Fundamental to the existence and evolution.

✤ Machine learning
  ✤ Branch of artificial intelligence
  ✤ Attempts to use data to learn models that can predict/ classify.

Wikimedia

- ❖ Objectives

  - ❖ Automatic discovery of patterns.

  - ❖ Motivated by human capabilities to process real world signals.

  - ❖ Mimicking/Extending/Replacing human functions.

  - ❖ Branch of artificial intelligence.

  - ❖ Classification and Regression.

❖ Domain Identification - Blog v/s Chat ?

"I tried these Butterscotch Muffins today
and they turned out so good. I had half
the pack of butterscotch chips that I
bought long back so wanted to use it up."

"Hey, it's Geoff from yesterday. How's it going?
Hi there. Don't wanna bother you long, but
you saw this video?"
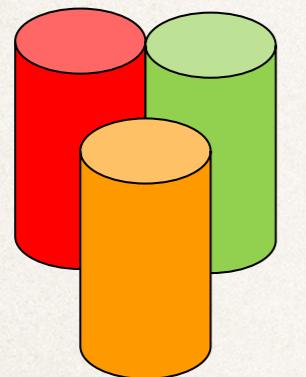
Examples

❖ Did a Human or Machine write this ?

"A shallow magnitude 4.7 earthquake was reported Monday morning five miles from Westwood, California, according to the U.S. Geological Survey. The temblor occurred at 6:25 AM, Pacific time at a depth of 5.0 miles."

"Kitty couldn't fall asleep for a long time. Her nerves were strained as two tight strings, and even a glass of hot wine, that Vronsky made her drink, did not help her. Lying in bed she kept going over and over that monstrous scene at the meadow."

Established
1911

Focus of the Course

Data Set → Features → Models for Pattern Recognition

- ❖ Modeling the separation of data

  - ❖ Deep Neural Networks.

What we will do in DL course

- ❖ Basics of Machine Learning

- ❖ Neural networks

- ❖ Deep learning methodologies and Architectures

- ❖ Implementing Deep models

Housekeeping

Requisite

❖ What will help in Background learning

  ❖ Intro to probability

  ❖ Intro to linear algebra

❖ Coding

  ❖ Coding in Python

  ❖ We will use Keras and Torch for DL coding.
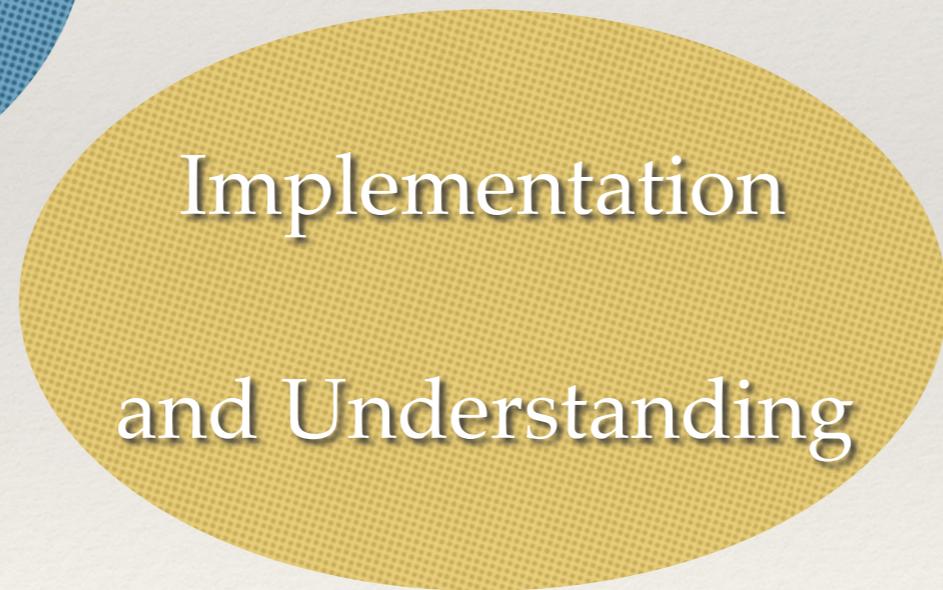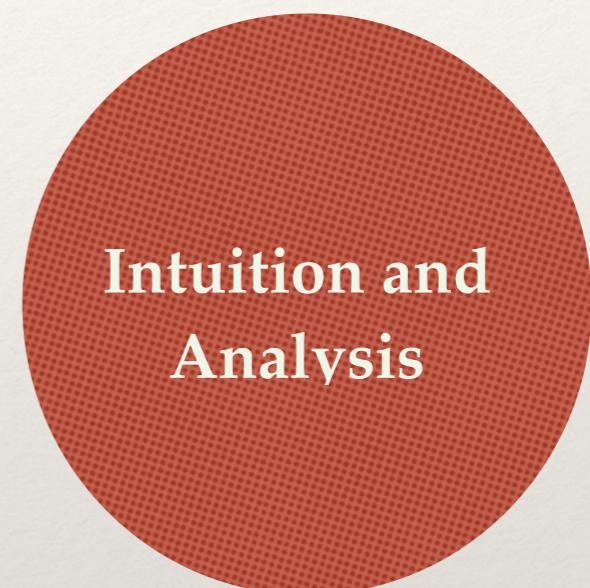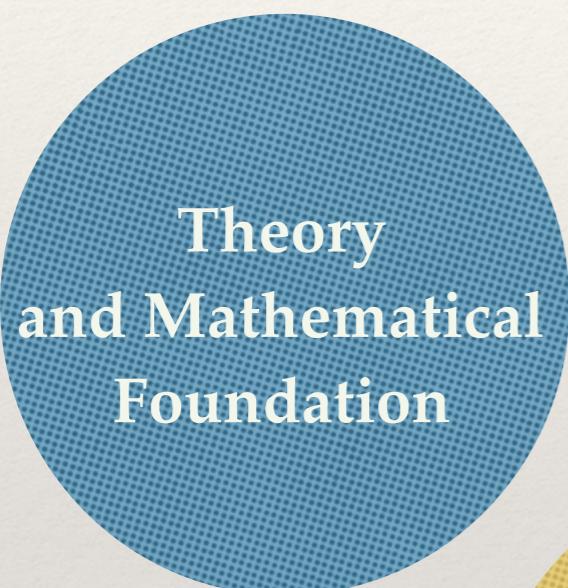
Grading

❖ Assignments - Theory + Implementation (50%)

❖ Mid-term (20%)

❖ Finals (30 %)

Content Delivery

Theory
and Mathematical
Foundation

Intuition and
Analysis

Implementation

and Understanding

Rough Schedule

- 2 weeks - Basics of Machine Learning and Pattern Recognition. Matrix Algebra and Calculus

- 2 weeks - Logistic Regression - architecture, loss, learning using gradient descent.

- 2 weeks - Perceptron and Multi-layer perceptron, back propagation.

- 1 week - MidTerm Exam

- 2 weeks - Convolutional and recurrent neural networks.

- 2 weeks - Deep representation learning and deep unsupervised modeling.

- 1 week - Final Exam.

- 5 Assignments spread over 3 months (roughly one assignment every two weeks).