

Deep Learning - Theory and Practice

IE 643
Lecture 1

August 14, 2020.

- 1 Credit Requirements
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- 6 Introduction
- 7 Perceptron

Credit Requirements

- **Course Project: 40%**

- ▶ Topics will be floated soon - selection to be done **only** from the list of topics floated.
- ▶ Team size: Limited to maximum of 3 members. (strict limit)
- ▶ 30% for mid-term evaluation, 70% for final evaluation.
- ▶ **Typical activities in project:** reading research papers, implementing algorithms, trying some improvements with ideas designed by the teams (or suggested by Instructor).
- ▶ More details will be provided soon.

Credit Requirements

- **Mid-Term Exam:** 20% (tentative)
- **Quiz:** 10%
 - ▶ Quizzes would be held during the live interaction time slots.
- **Assignments (Theoretical, Programming):** 10%
- **Scribing, class participation, other activities:** 10%
- **Homework problems, practice questions will be provided regularly.** (Will not be graded!)

Credit Requirements

- **Challenge Programming contests: 10%**

- ▶ Problem description and solution requirements along with training and validation data sets will be posted.
- ▶ Students can form teams of maximum size 3.
- ▶ Teams can propose solutions based on the problem description and solution requirements.
- ▶ Submissions will be ranked based on their performance on private test data sets.
- ▶ Marks will be provided as percentiles.
- ▶ Students who provide top 3 best performing solutions for each programming contest would be given extra marks, and their ideas will deserve special mention during the course.

Audit Requirements

- **Course Project** must be executed to completion.
- **Assignments** must be solved and submitted.
- Pass marks in **Mid-term exam** ($\geq \frac{40}{100}$) (**Tentative**)
- Quizzes are optional and will not be considered for evaluation.
 - ▶ However auditing students are strongly encouraged to participate in quizzes.
- Auditing students are encouraged to participate in programming contests, but this is optional.
- Auditing students will **not** be given scribing activity.

Essential Programming Skills

- Knowledge of Python programming language is essential
- No special training for Python programming language will be provided
- You must learn Python on your own. **Start now !**
- However some practice codes will be given for those who wish to refresh their Python.

Request to participants

- If you are completely new to Python
- If you are a sophomore B.Tech (or) B.S. student
- If you have already credited a different Deep Learning course in IITB

Please de-register !!!

Materials for self-study and Reference Texts

Materials for self-study

Lecture slides, scribes and related research papers will be posted in Moodle.

Ref. Book-1

Deep Learning. *Ian Goodfellow, Yoshua Bengio and Aaron Courville*. An MIT Press book. <https://www.deeplearningbook.org/>

Ref. Book-2

Deep Learning with Python. *François Chollet*. Manning Publications. <https://www.manning.com/books/deep-learning-with-python/>

Reference Texts

Ref. Book-3

Linear Algebra and Learning from Data. *Gilbert Strang*.
Wellesley-Cambridge Press.
<http://math.mit.edu/~gs/learningfromdata/>

Web Resources

- <https://towardsdatascience.com/>
- <https://medium.com/>
- Code repository: <https://github.com>

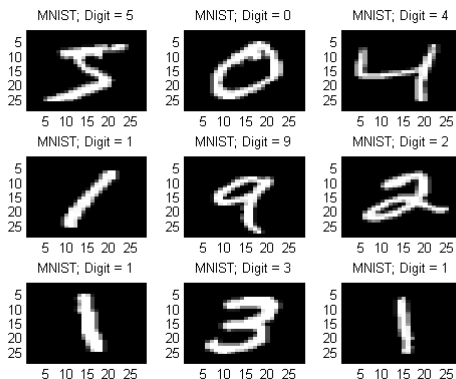
Teaching Assistants for the course

- Kunal Apurva (kunalapurva@iitb.ac.in)
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- Akash Saha (akashsaha@iitb.ac.in)

Deep Learning - Motivating Applications

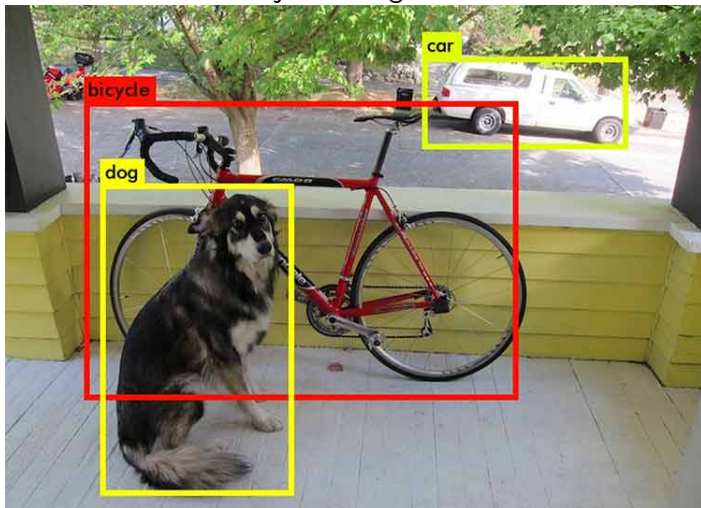
Deep Learning Applications

Handwritten Character Recognition



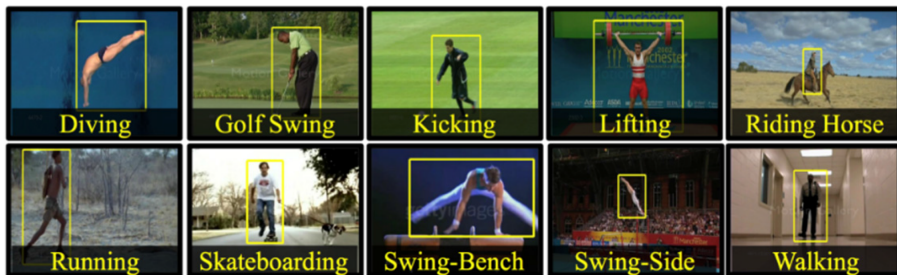
Deep Learning Applications

Object Recognition



Deep Learning Applications

Action Recognition



Deep Learning Applications

Machine Translation

English ▼



Thai ▼

I am a student.

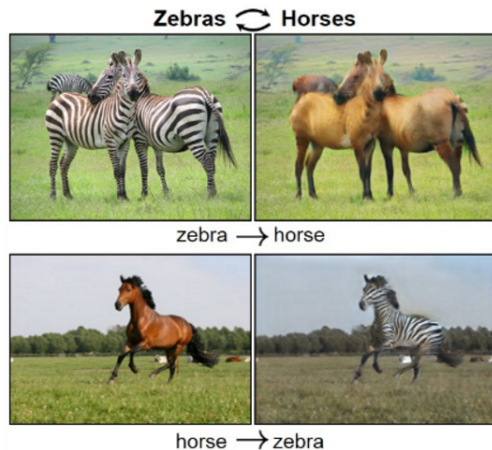


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Chān pĕn nakreīyn.

Deep Learning Applications

Image Generation



Deep Learning Applications

Real time object Recognition

[Click for video](#)

Deep Learning Applications

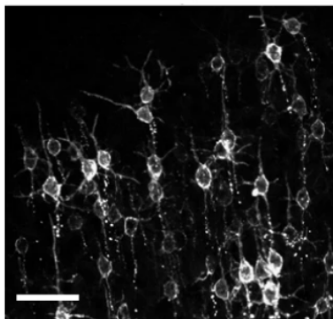
Real time notes to music

[Click for video](#)

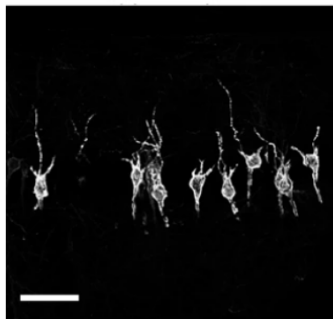
Perceptron

Biological Motivation

Cortex layer



Hippocampus



Population imaging of neural activity in awake behaving mice. K. D. Piatkevich et al. Nature, 574, pp. 413-117, 2019.

Perceptron

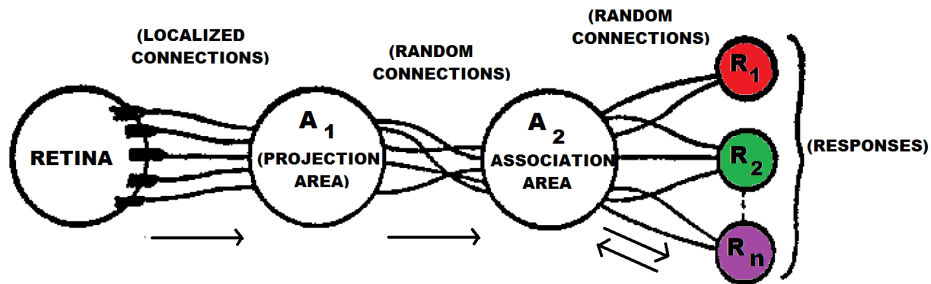
Psychological Review
Vol. 65, No. 6, 1958

THE PERCEPTRON: A PROBABILISTIC MODEL FOR INFORMATION STORAGE AND ORGANIZATION IN THE BRAIN

F. ROSENBLATT

Cornell Aeronautical Laboratory

Perceptron

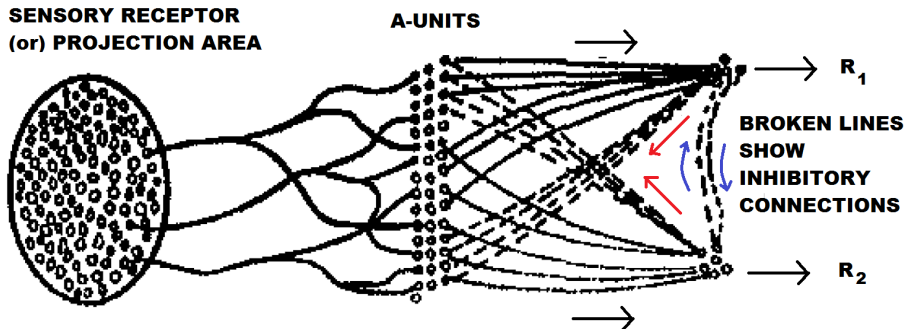


Perceptron

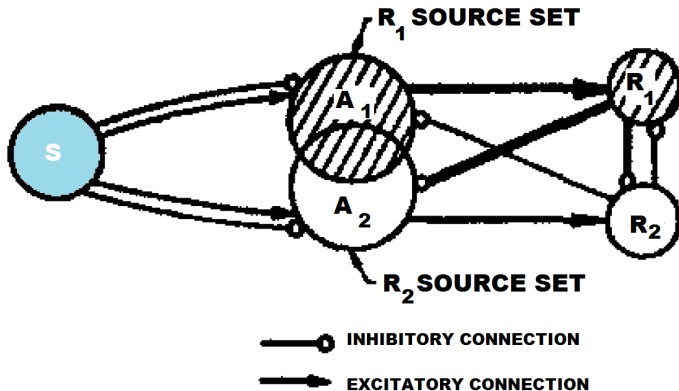
Key Assumptions

- Stimuli which are **similar** will tend to form pathways to some sets of response cells.
- Stimuli which are **dissimilar** will tend to form pathways to different sets of response cells.
- Application of positive or negative reinforcements may facilitate or hinder the formation of connections.
- **Similarity** of stimuli is a dynamically evolving attribute.

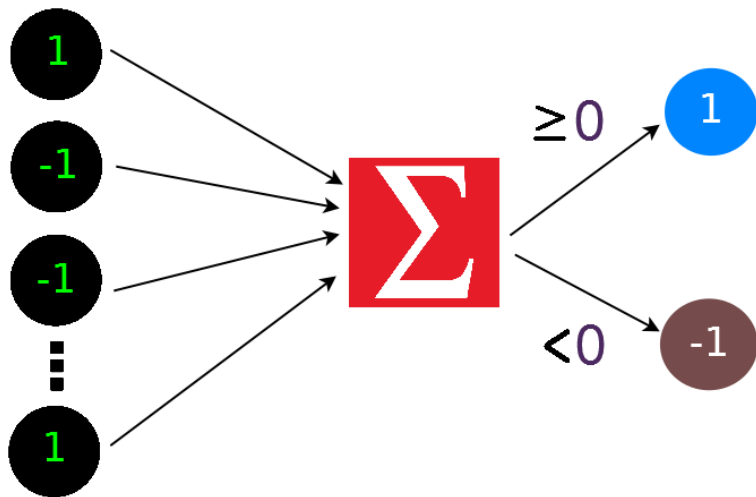
Perceptron



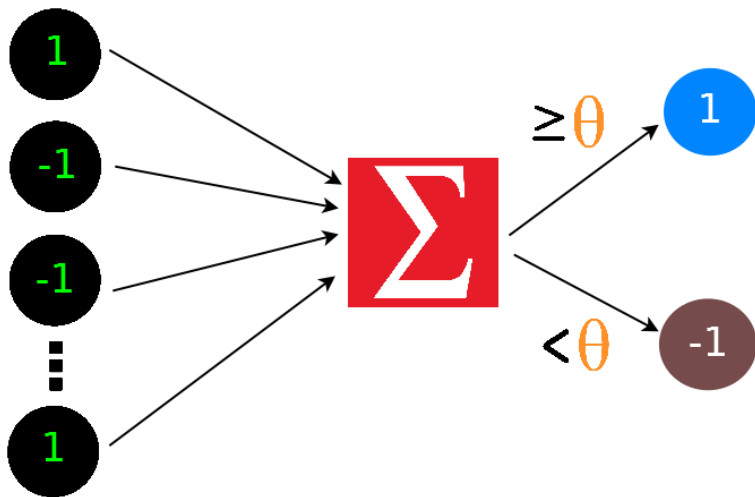
Perceptron



Perceptron



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