

Neural Networks

A high level introduction course

Hello!



My name is Cristina Sahoo.

I will be your instructor during this short course about Neural Networks.

Background:

- 10+ years experience in Technology
- 2+ years experience in Data Science
- 4+ years experience teaching and training
- Fun fact about me: I'm from Romania

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Objectives:

1. Define Neural Networks (Nets)
2. List the components of a Neural Network
3. Describe how Neural Networks work
4. List 3 types of Neural Networks
5. Identify 3 problems solved by Neural Networks

Note: Due to the high level and introductory nature of this course, we will not go into all the details, and focus on reviewing important concepts to gain a high level understanding of Neural Networks. This presentation will be made available to all students at the end of the class, and you can find a long list of resources which provide an opportunity to each of you to gain a deeper understanding of Neural Nets.

1. What are Neural Networks [Nets]?

History:

- started in 1943 by Warren McCulloch and Walter Pitts
- created a computational model for neural networks
- research split into two approaches: biological processes and application to AI

Machine learning:

- computer program can learn and adapt to new data without human intervention

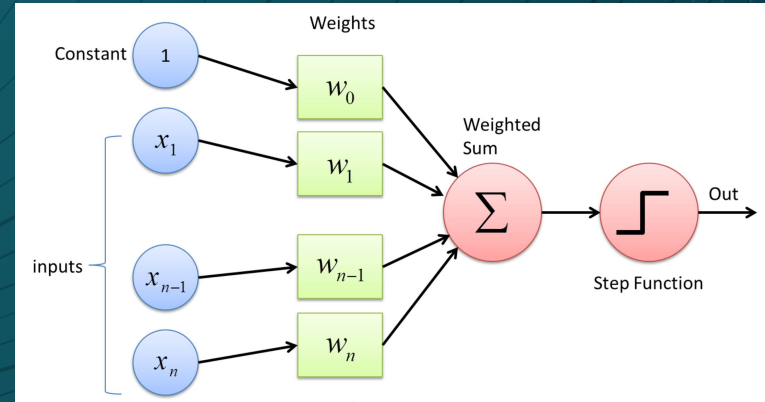
Neural Networks:

- neural nets are a means of doing machine learning, in which a computer learns to perform some task by analyzing training examples

2. What are the Components of a NN?

Components of a Neural Networks (single layer):

- Input values
- Weights
- Transfer function (i.e. weighted sum)
- Activation function (i.e. step function)

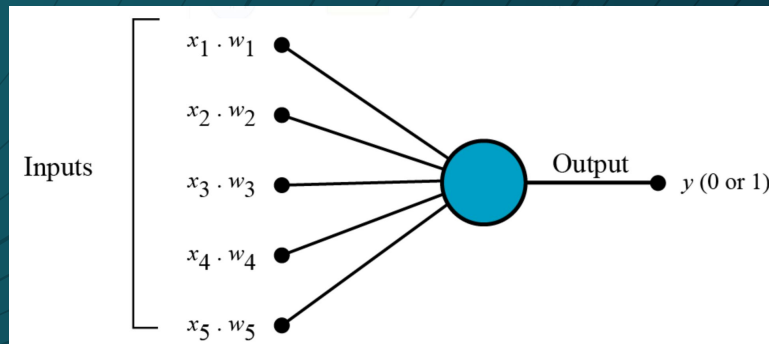


Note: a Neural Network with a single layer is called a Perceptron.

3. How do Neural Networks work?

The Math:

- Multiply all input values by their respective weights
- Add all the multiplied values and call it weighted sum
- Apply the weighted sum to the correct activation function



In Practice:

- a computer learns to perform some task by analyzing training examples
- the examples have been hand-labeled in advance
- example: feed thousands of labeled images of cars, houses, coffee cups, and so on into a NN, and it would find visual patterns in the images that consistently correlate with particular labels

4. What are 3 Types of NN?

Feed Forward (FN) Neural Network

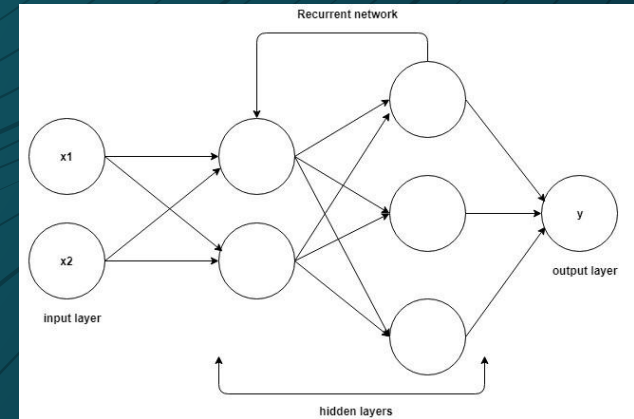
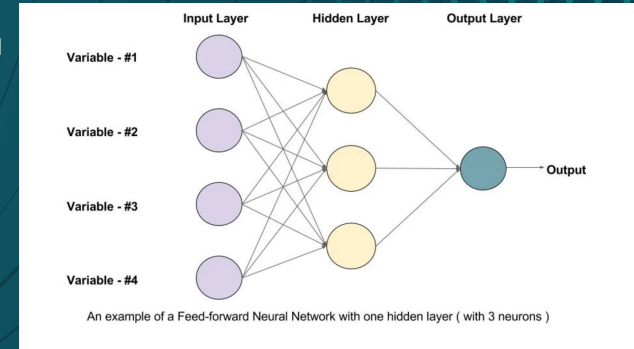
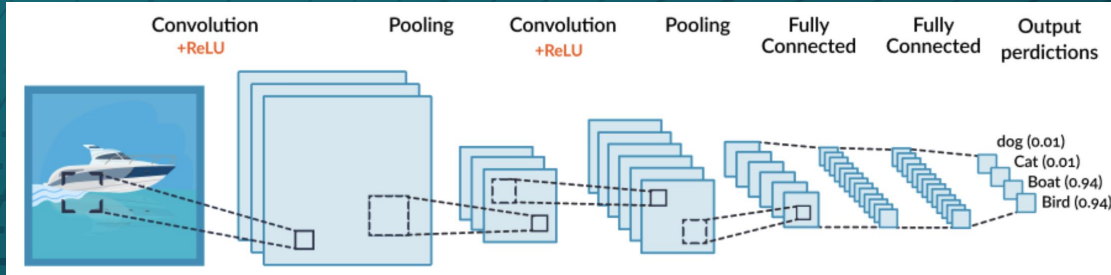
- connections between the nodes **do not** form a cycle

Recurrent Neural Network (RNN)

- the **output from previous step** are fed as input to the current step

Convolutional Neural Network (CNN)

- designed for **working with two-dimensional image data**



5. What are 3 Problems solved by NN?

Arithmetic:

- bit shifting, addition of N p -bit numbers, and multiplication of two n -bit numbers, **FNN**

Language:

- Language translation, speech recognition, predictive text, using **RNN**
- Google Translation

Computer Vision:

- classification (i.e. cat vs dog), object localization and detection (where it is and what is it), segmentation (identify object boundaries), using **CNN**
- ResNet (Microsoft)
- MobileNet (Google)

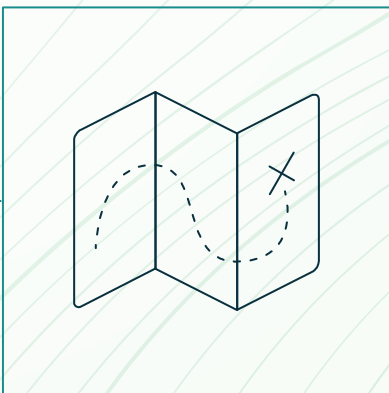
Summary:

- Neural Networks are a means of doing machine learning, i.e. teaching a computer.
- Their components are inputs, weights, transfer function, and activation function.
- With NN, a computer learns to perform a task by analyzing pre-labeled training examples.
- 3 types of Neural Networks are: Feed Forward, Recurrent, and Convolutional.
- NN can solve arithmetic, language, and computer vision problems.

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Resources:

1. [The mostly complete chart of Neural Networks, explained](#)
2. [6 Types of Artificial Neural Networks currently used in Machine Learning](#)
3. [Convolutional Neural Networks: How to build one in Keras and PyTorch](#)
4. [6 Computer Vision Problems solved by Machine Learning](#)
5. [History of Artificial Neural Networks](#)
6. [Explained: Neural Networks](#)
7. [Artificial Neural Networks for total beginners](#)
8. [Neural Networks: Architecture, Components, and Top Algorithms](#)
9. [The Fundamentals of Neural Networks](#)
10. [Perceptrons and Multi-layer Perceptrons](#)



Thank you!

Any questions?

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