Convolutional Neural Networks (CNN)   +4

Is there a difference between neural networks and convolutional neural networks?

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## 10 Answers

[avatar] **Anirudh Sharma**, Fascinated with Deep Learning   👤⁺
Answered Jul 12, 2018

Neural Networks is a **generic term in Deep Learning** that works on the basis of the structure and functions of a human brain. Like the human brain has interconnected neurons that constantly transmit signals, a neural network also has interconnected artificial neurons that transmit data among each other and are called as nodes.

A typical neural network consist of 3 layers - input layer, hidden layers and output layer. This is how it looks:

Input Layer   Hidden Layers   Output Layer
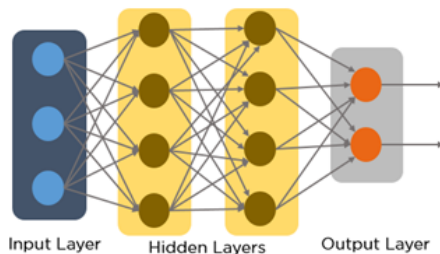
Input layer accepts inputs in different forms. Hidden layers transform the inputs and do several calculations and feature extractions. The output layer produces the desired output. Each node in the network consists of certain random weights and each layers has a bias attached to it that influence the output of every node. Certain activation functions are applied to each layer to decide which nodes to fire.

A CNN accepts arrays of pixel values as input to the network. The hidden layer consists of several different layers which carry out feature extraction. There is a fully connected layer that recognizes the objects in the image.

Convolution operation forms the core of every convolution neural network. There are 4 layers in a CNN. These are **Convolution layer, ReLU layer, Pooling layer and Fully Connected Layer**.

The **Convolution layer** uses a filter matrix over the array of image pixels and performs convolution operation to obtain a **convolved feature map**. Below is an example which represents the convolution operation over the input array.

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1	1	1	0	0
0	1	1	1	0
0	0	1	1	1
0	0	1	1	0
0	1	1	0	0

1	0	1
0	1	0
1	0	1

We shall slide this filter matrix over the input image and compute the convolution operation.

Image pixels

1	1	1	0	0
0	1	$1_{\times 1}$	$1_{\times 0}$	$0_{\times 1}$
0	0	$1_{\times 0}$	$1_{\times 1}$	$1_{\times 0}$
0	0	$1_{\times 1}$	$1_{\times 0}$	$0_{\times 1}$
0	1	1	0	0

The result is a matrix called the the Convolved feature map.

Convolved Feature

4	3	4
2	4	3

Convolved Feature

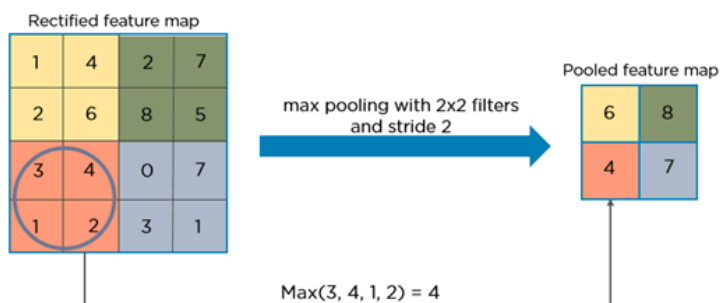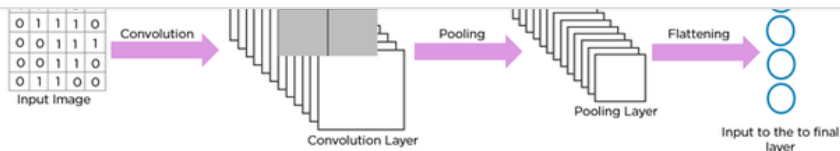| 4	3	4
2	4	3
2	3	4

The next layer is the **ReLU layer** which introduces **non-linearity to the network**. It sets all negative pixels to zero and performs element wise operation. The original image is scanned in multiple Convolution and ReLU layers for locating hidden features and patterns in the image. The output is a **Rectified Feature Map**.

The third layer is known as **Pooling layer**. It reduces the dimensionality of the feature map. The output is a **Pooled feature map**.

Rectified feature map

1	4	2	7
2	6	8	5
3	4	0	7
1	2	3	1

max pooling with 2x2 filters and stride 2

Pooled feature map

6	8
4	7

Max(3, 4, 1, 2) = 4

Pooling layers uses different filters to identify different parts of the image like edges, corners, body, etc.

The pooled feature map is then converted into a **long continuous linear vector**. This process is called **Flattening**. This flattened matrix goes through a Fully Connected Layer to classify the images.

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To understand how CNN works, refer to the below video:

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Ismail Elezi, Computer Science student
Answered Dec 10, 2016 · Upvoted by Nikhil Badugu, M.S Computer Science & Machine Learning, Northeastern University

Neural networks is a generic name for a large class of machine learning algorithms, including but not limited to: perceptrons, Hopfield networks, Boltzmann machines, fully connected neural networks, convolutional neural networks, recurrent neural networks, long short term memory neural networks, autoencoders, deep belief networks, generative adversarial networks and many more. Most of them are trained with an algorithm called backpropagation.

In the late eighties, early to mid nineties, the dominating algorithm in neural

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parameters, and so do not scale well. Here comes convolutional neural networks which could be considered essentially a not fully connected neural nets (each neuron is connected to only a few neurons in the previous layer) and neurons share weights. These type of networks have been proven successfully especially in the fields of computer vision and natural language processing, where they broke every record. The success of convolutional neural networks was the main reason why neural nets (now called deep learning) has become such a hot topic in the last 5 years.

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Tomasz Dryjanski
It's a bit imprecise to tell that convolutional neural networks broke every record in t…

1 more comment from Kalin Dumitrescu

Joseph Lee, Worked with Andrew Ng in Stanford Machine Learning Group 🖈
Answered Feb 2

The nature of images is such that:

1. There are a lot of 'input features', each corresponding to the R, G and B value of each pixel, which thus requires a lot of parameters.

2. A cat in the top left or a cat in the bottom right of the image should give similar outputs.

Our normal neural network doesn't address these concerns.

If you want an intuitive understanding of neural networks, consider this post I've written:

[Intuitive Deep Learning Part 1a: Introduction to Neural Networks](#)

Anyway, instead of using our traditional neural networks, perhaps we can consider this following method. Suppose we have an … (more)

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Rory Sharp 🖈
Updated May 16

Normal neural networks consist of dense layers where all the input data is sent to each neuron on the first layer, each neuron then performs a dot product of the input data and the neuron's weights to produce a single number as output. The outputs of these neurons are then concatenated (joined together) and sent to all

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Avishake Dutta, works at Students
Answered May 17

Neural Networks *are basically a default name given to a huge class of ML algorithms rather called a framework where the input data is sent to each neuron of the first layer, each neuron then does a dot product of the input data with the weight of the neuron and consequently the results are then feed forwarded to the neurons of the next layer and the process goes on until an output if generated.*

But in case of *convolution neural network (CNN)* *small matrices are assigned for the weight which is then convolved with each of the pixels to produce a new pixel. This new image produced is then feed ...* (more)

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Tapa Ghosh, Founder and CEO at Vathys
Answered Dec 10, 2016

Yes. Convolutional neural networks slide a kernel across dimensions and can have an input of any size, this kernel's weights/parameters are shared in every slide for that layer. By contrast, neural networks tend to have far more parameters/weights because they have associated weights *for every single input*, in addition, they require a fixed input size.

The "normal" neural network is the "fully-connected layer" and the convolutional layer is well, the convolutional neural network.

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

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Ayesha Malik
So which one is better for face recognition?

Quinn Ora, Cloud Architect
Answered May 15

Originally Answered: What is the difference between a Convolutional Neural Network and a regular Neural Network?

In simple terms, a CNN has at least on convolution layer, whereas a neural net doesn't necessarily have that layer.

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