



# **SNS COLLEGE OF TECHNOLOGY**



*(An Autonomous Institution)*

Approved by AICTE, New Delhi, Affiliated to Anna University,  
Chennai

Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &  
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)  
COIMBATORE-641 035, TAMIL NADU

## **DEPARTMENT OF COMPUTER APPLICATIONS**

**19CAE716 – DATA SCIENCE**

**UNIT – IV: DEEP LEARNING**

**TOPIC: INTRODUCTION**

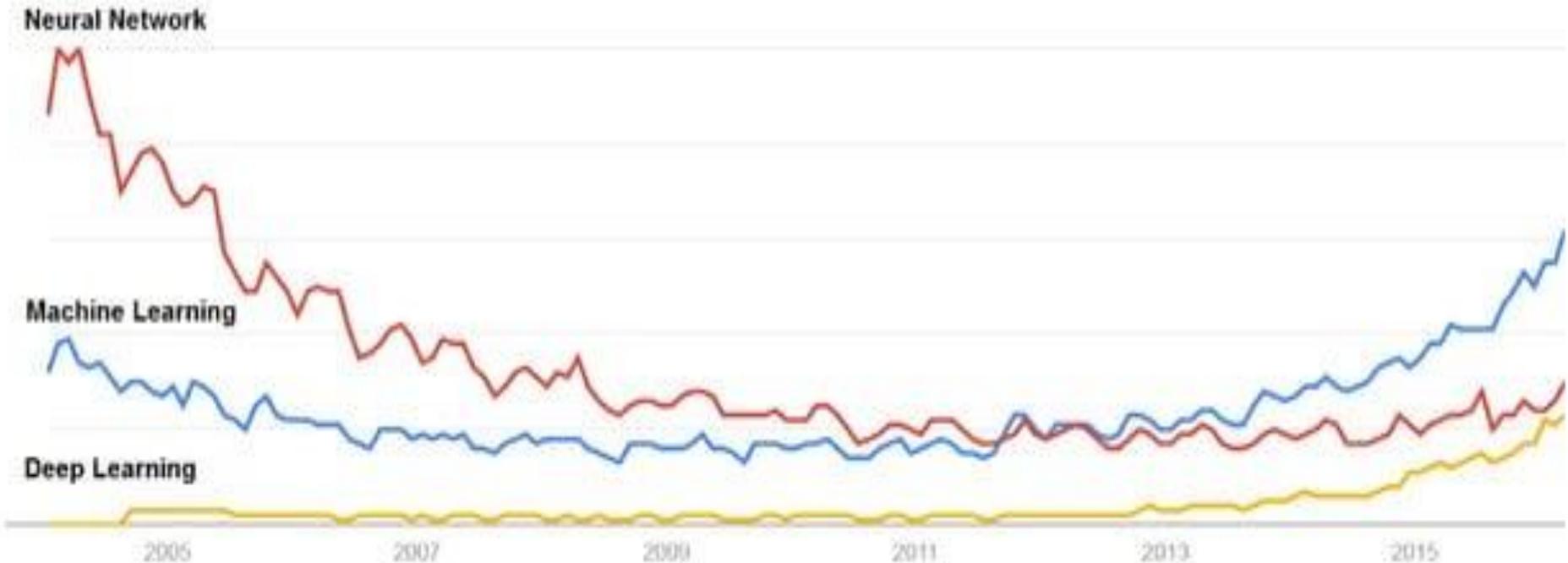


# Google NGRAM





# Google Trends





# Google Queries





# What is Artificial Intelligence?

- **Artificial Narrow Intelligence (ANI):** Machine intelligence that equals or exceeds human intelligence or efficiency at a specific task.
- **Artificial General Intelligence (AGI):** A machine with the ability to apply intelligence to any problem, rather than just one specific problem (human-level intelligence).
- **Artificial Super Intelligence (ASI):** An intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills



# Machine Learning

- **Machine Learning** is a type of Artificial Intelligence that provides computers with the ability to learn



# What is Deep Learning?

- **Part of the machine learning** field of learning representations of data.
- **hierarchy of multiple layers** that mimic the neural networks of our brain
- **If you provide the system tons of information**, it begins to understand it and respond in useful ways.



# Why we needs Deep Learning?

- SuperIntelligent Devices
- Best Solution for
  - image recognition
  - speech recognition
  - natural language processing
  - Big Data



# A brief History



1958 Perceptron

1974 Backpropagation



Convolution Neural Networks for Handwritten Recognition

1998



Google Brain Project on 16k Cores

2012

awkward silence (AI Winter)

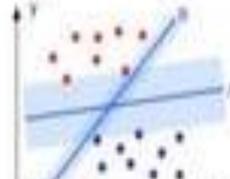
1969

Perceptron criticized



1995

SVM reigns



2006

Restricted Boltzmann Machine



2012

AlexNet wins ImageNet

IMAGENET



# Superstar Researchers

**Geoffrey Hinton:** University of Toronto & Google



**Yann LeCun:** New York University & Facebook



**Andrew Ng:** Stanford & Baidu



**Yoshua Bengio:** University of Montreal





# Superstar Companies

Google

facebook

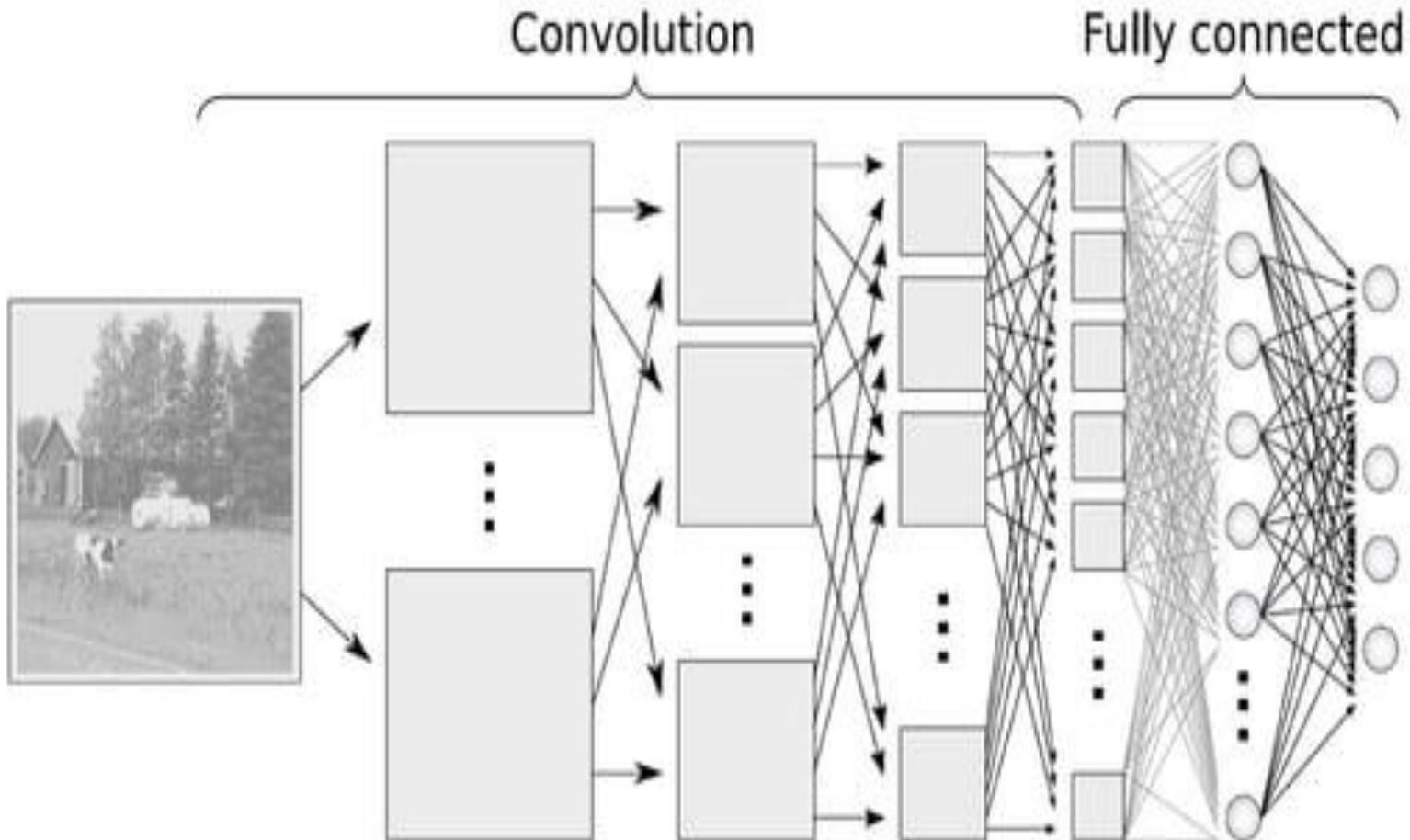
 Microsoft



NVIDIA



# Deep Learning





# Deep Learning Requirements

- Large data set with good quality
- Measurable and describable goals
- Enough computing power
- Neural Network (Brain of Human)



# Deep Learning Architectures

**Deep neural networks**

**Deep belief networks**

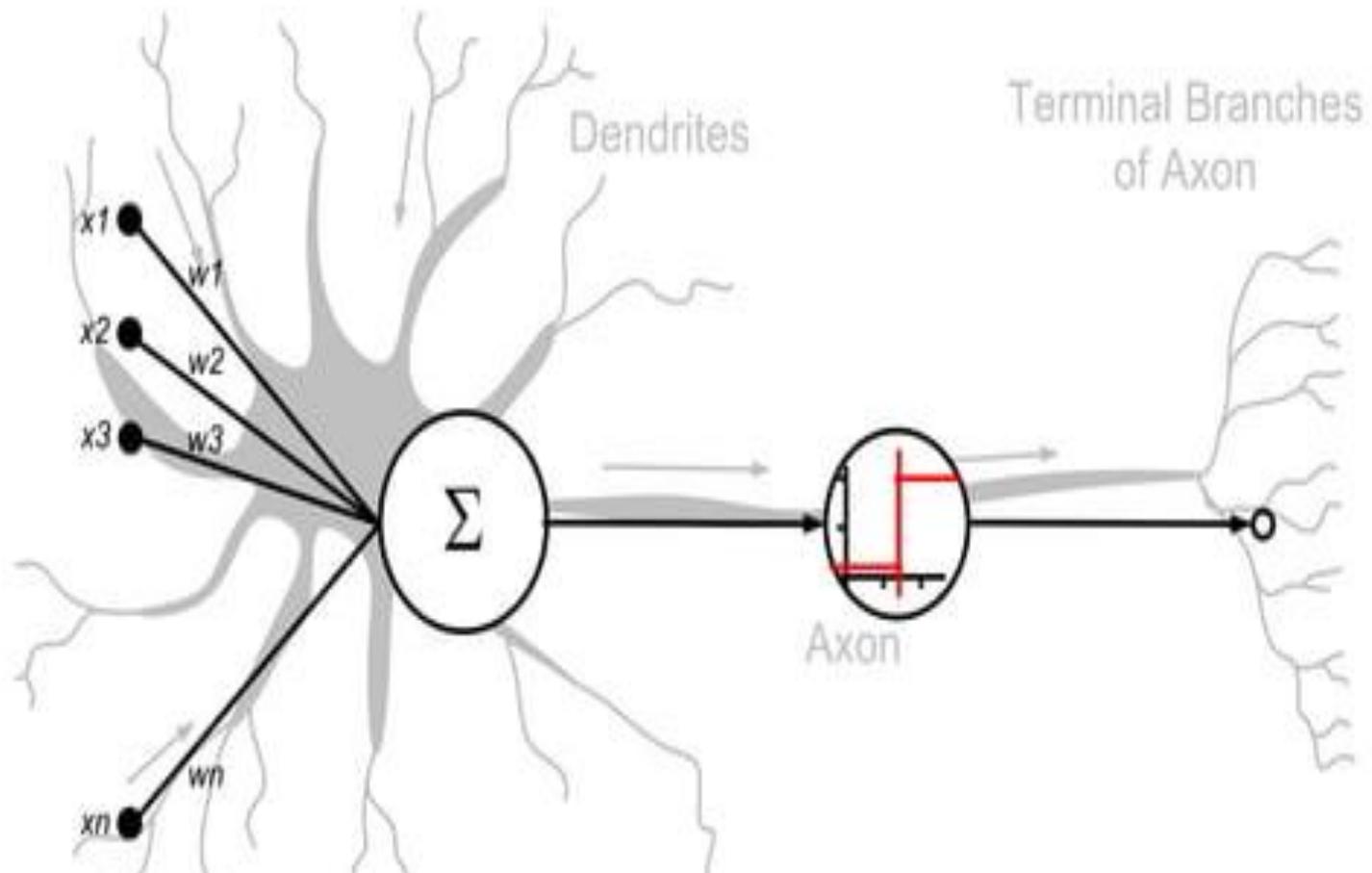
**Convolutional neural networks**

**Deep Boltzmann machines**

**Deep generative models**

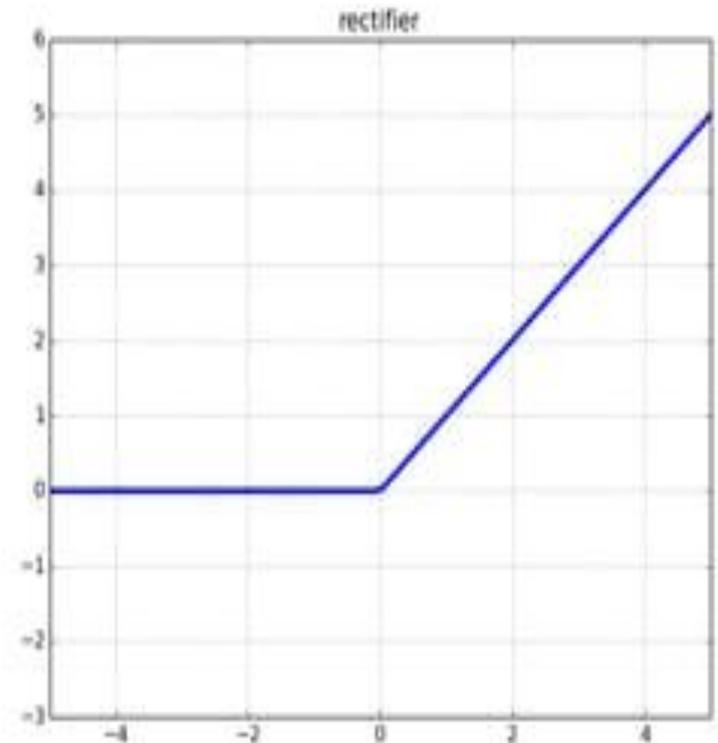
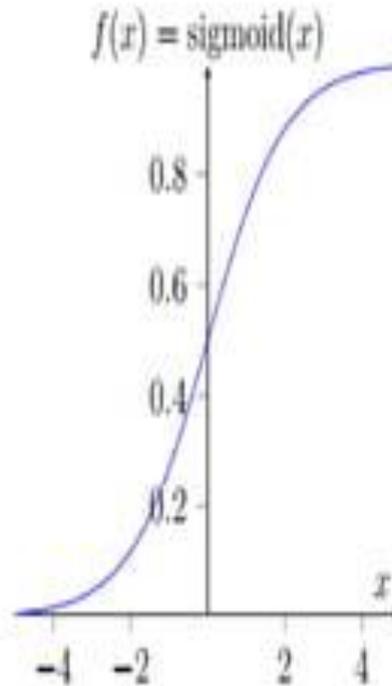
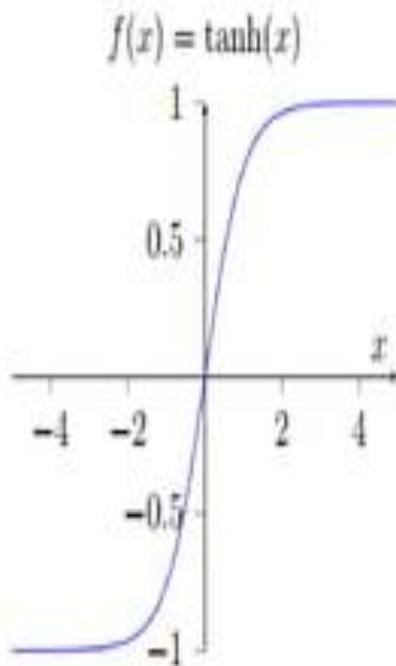


# Artificial Neural Networks





# Activation Functions



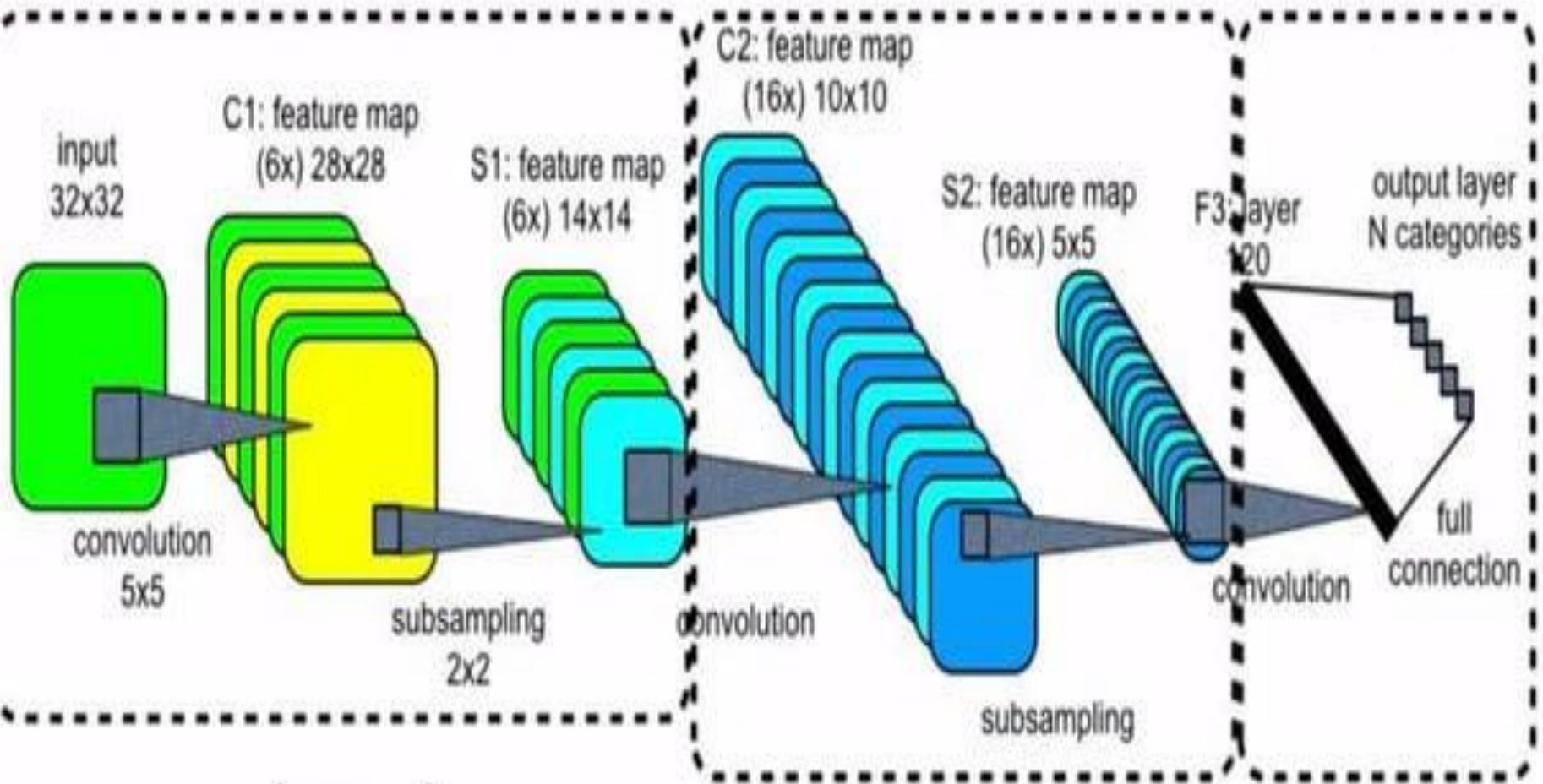


# ReLU

- The advantages of using Rectified Linear Units in neural networks are
  - ReLU doesn't face gradient vanishing problem as with sigmoid and tanh function.
  - It has been shown that deep networks can be trained efficiently using ReLU even without pre-training.



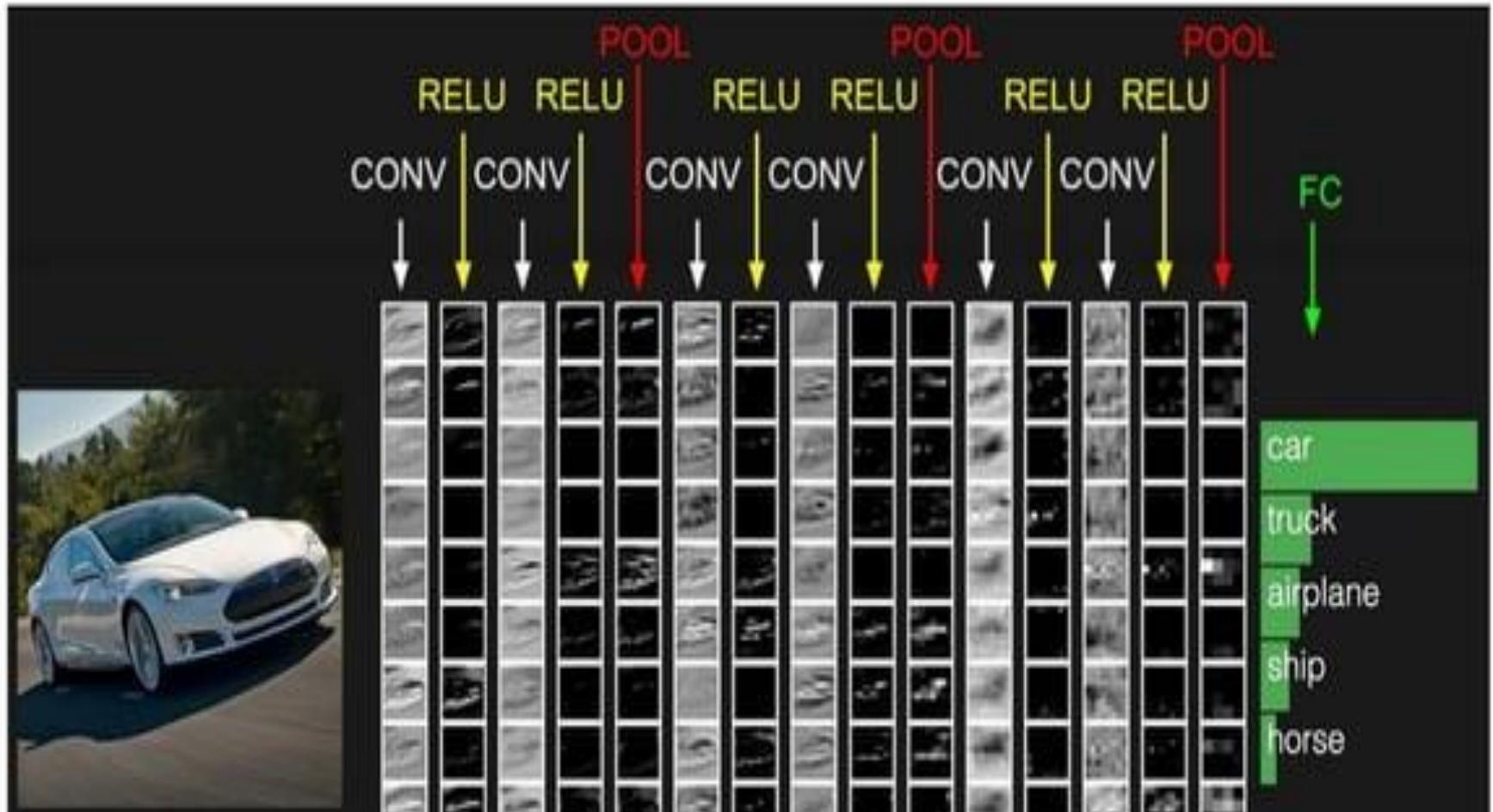
# Convolution Neural Network



layer 1



# Convolution Neural Network



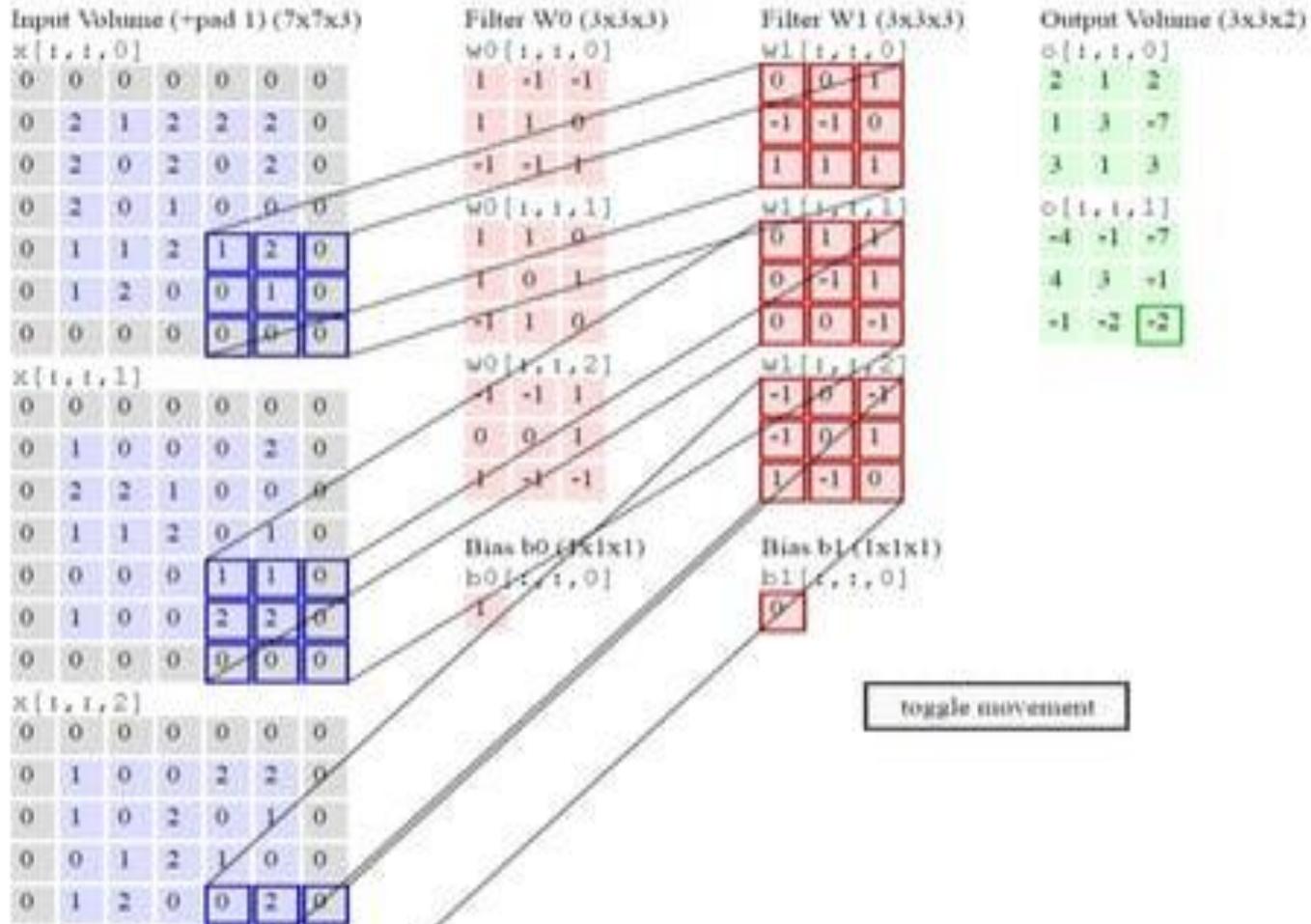


# CNN Layers

- Convolution Layer
- Pooling Layer
- Fully-connected layer

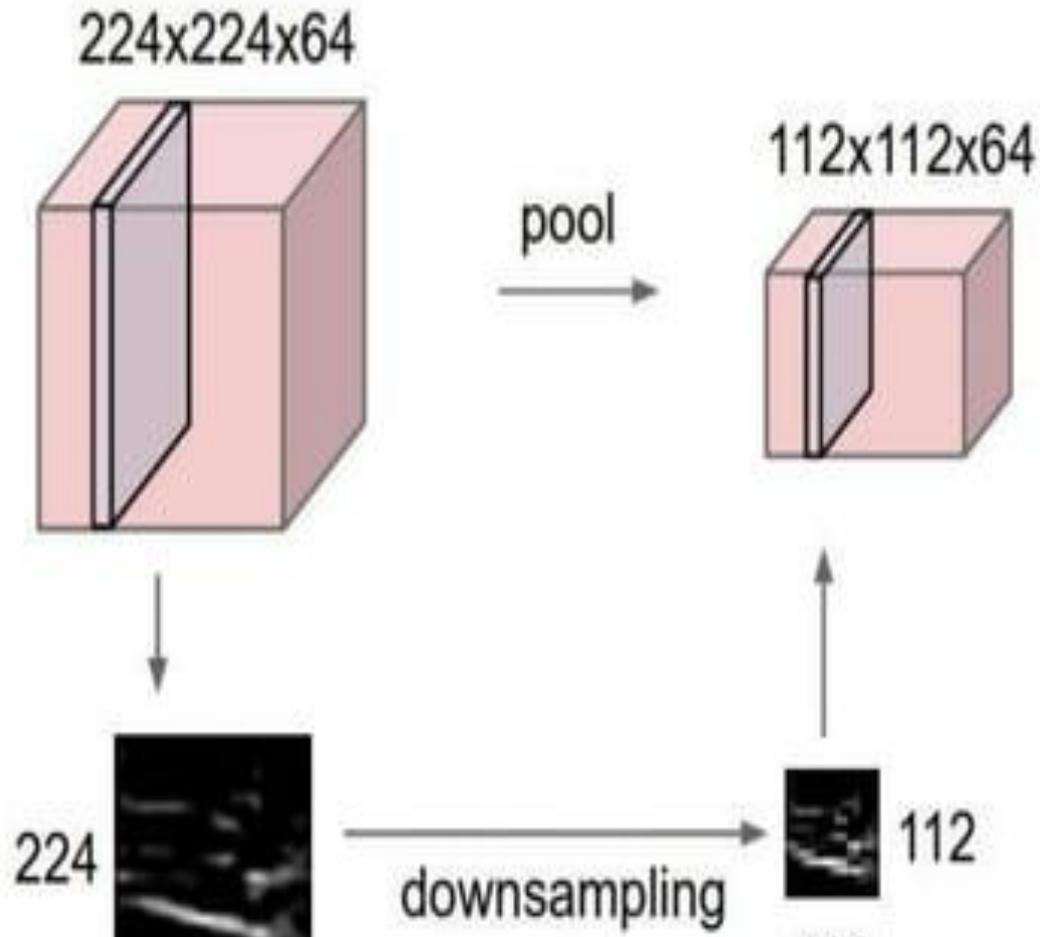


# Convolution Layer



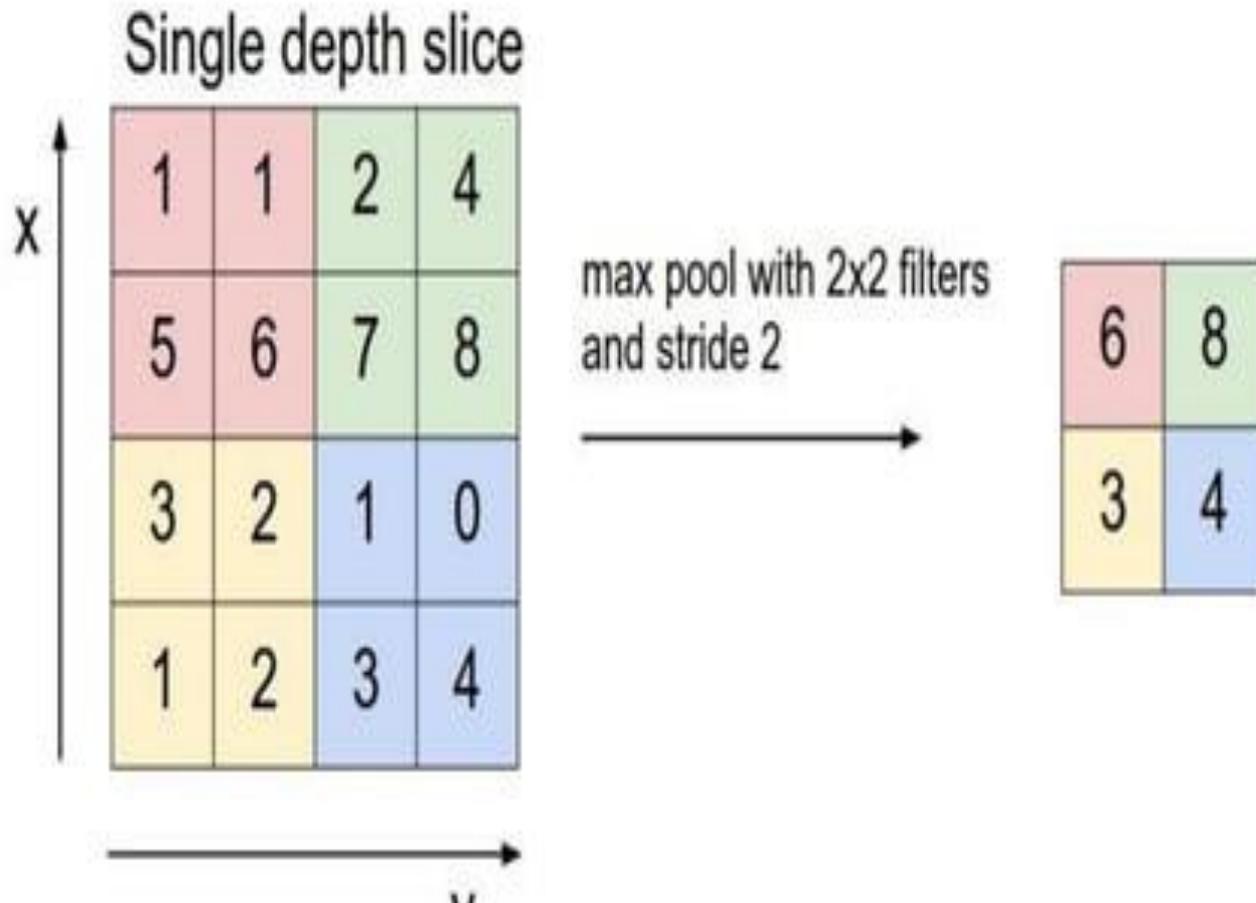


# Pooling Layer



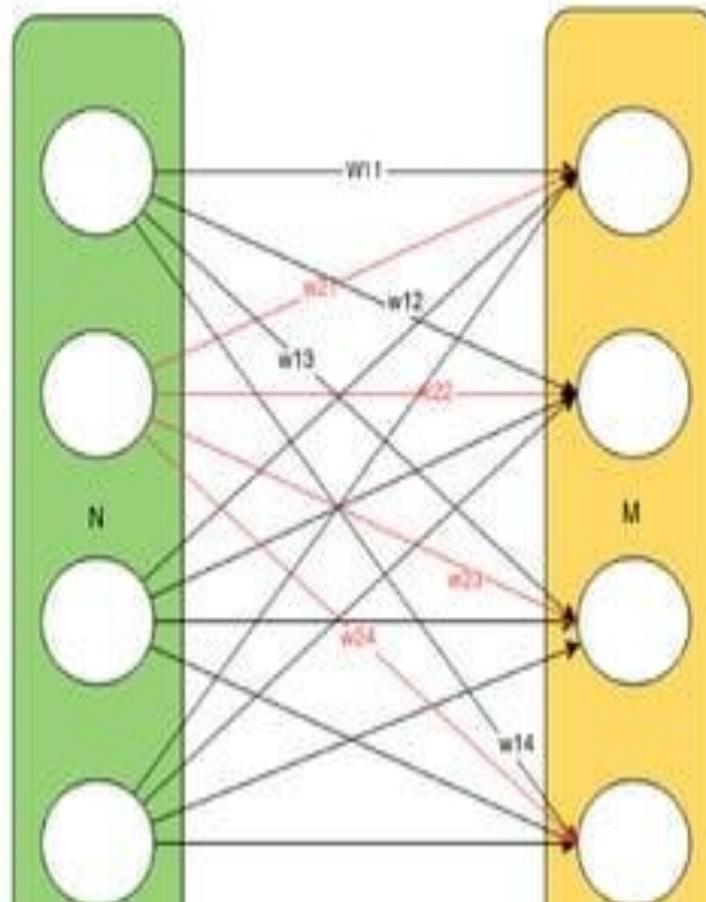


# Max Pooling





# Fully-connected layer





# Case studies

**LeNet** :The first successful applications of CNN

**AlexNet**: The first work that popularized CNN in Computer Vision

**ZF Net**: The ILSVRC 2013 winner

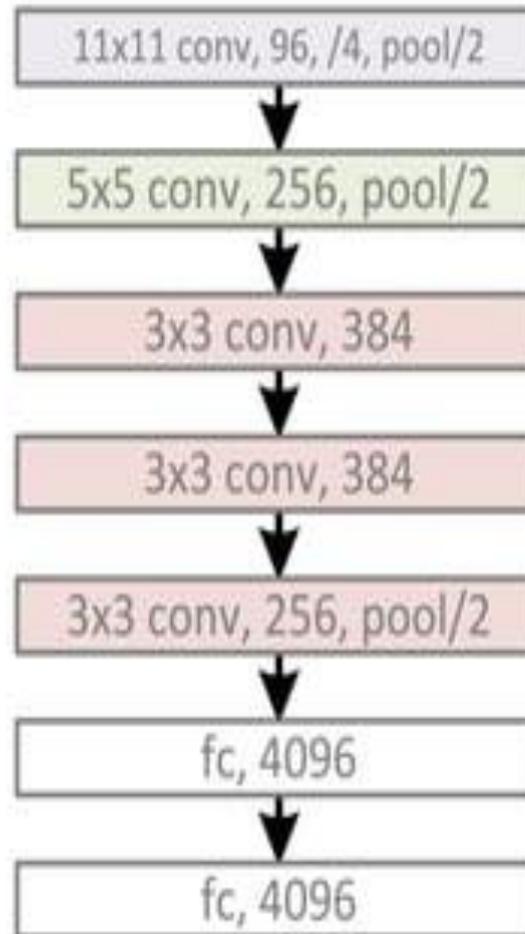
**GoogLeNet**: The ILSVRC 2014 winner

**VGGNet**: The runner-up in ILSVRC 2014



# AlexNet

AlexNet, 8 layers  
(ILSVRC 2012)







# Revolution of Depth

AlexNet, 8 layers  
(ILSVRC 2012)



VGG, 19 layers  
(ILSVRC 2014)



ResNet, 152 layers  
(ILSVRC 2015)





# ILSVRC

- **The ImageNet Large Scale Visual Recognition Challenge (ILSVRC)** evaluates algorithms for object detection and image classification at large scale.



# Summary

- **Deep learning** is a class of machine learning algorithms.
- Harder problems such as video understanding , natural language processing and Big data will be successfully tackled by **deep learning algorithms.**