

# DEEP LEARNING

A Modern Approach to  
Artificial Intelligence

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# 100 INTRODUCTION



## Perceptron

Rosenblatt  
1958

## Perceptrons

Minsky & Seymour  
1958

## Boltzmann Machine

Hinton  
1985

## CNN

LeCun  
1989

## Contrastive Divergence

Hinton  
2002

## GAN

Goodfellow  
2014

1959

Hubel & Wiesel

## Cat Visual Cortex

1979

Fukushima

## NeoCognitron

1986

Smolenski

## Harmonium

Hinton

## RBM

Rumelhart, Hinton &  
Williams

## MLP

Jordan

## RNN

1997

Hochreiter & Schmidhuber

## LSTM

Schuster & Paliwal

## BRNN

2012

Hinton

## Dropout

2017

Sabour, Frosst &  
Hinton

## Capsule Network

# |00 INTRODUCTION



## AlexNet

Krizhevsky, Sutskever & Hinton  
2012

## ResNet

He, Zhang, Ren & Sun  
2015

## ResNetXt

Xie, Girshick et al.  
2019

2014

Simonyan & Zisserman

## VGG

Google

## Inception Network

2016

Huang et al.

## DenseNet

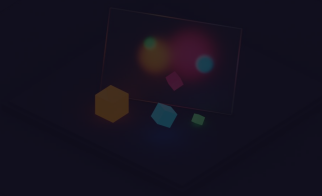


# 01|

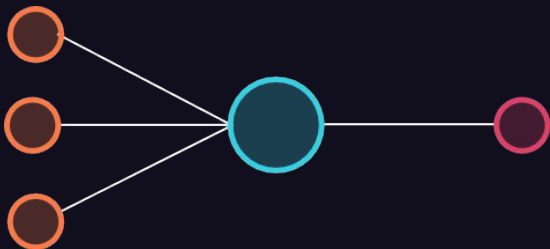
## PERCEPTRON

The Beginning and the End

# |01 PERCEPTRON

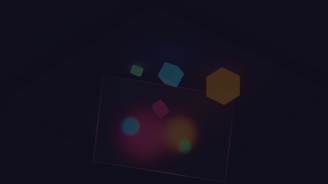


## PERCEPTRON

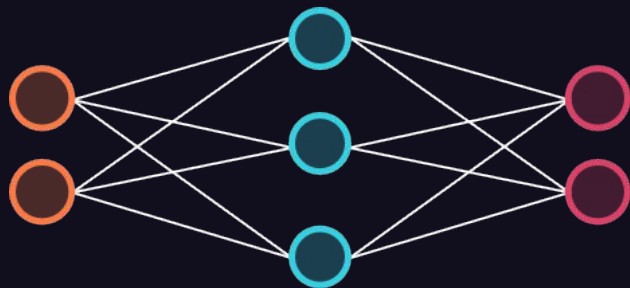
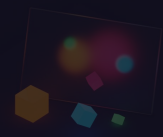


$$\hat{y} = f(wx + b)$$

$$f(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{else} \end{cases}$$



# |01 PERCEPTRON

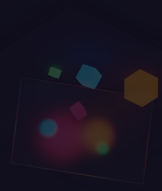


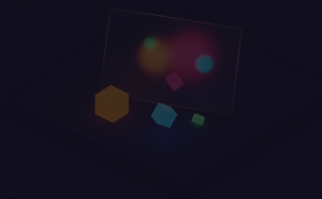
## MULTILAYER PERCEPTRON

$$\hat{y} = f(w_2 h + b_2)$$

$$h = f(w_1 x + b_1)$$

$$f(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{else} \end{cases}$$





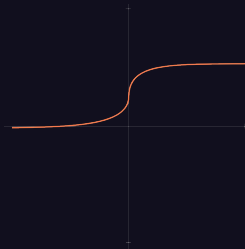
## ACTIVATION FUNCTIONS

**Step**



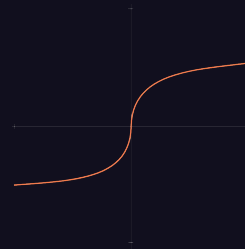
$$f(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{else} \end{cases}$$

**Sigmoid**

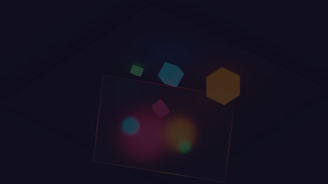


$$\sigma(x) = \frac{1}{1+e^{-x}}$$

**Tanh**



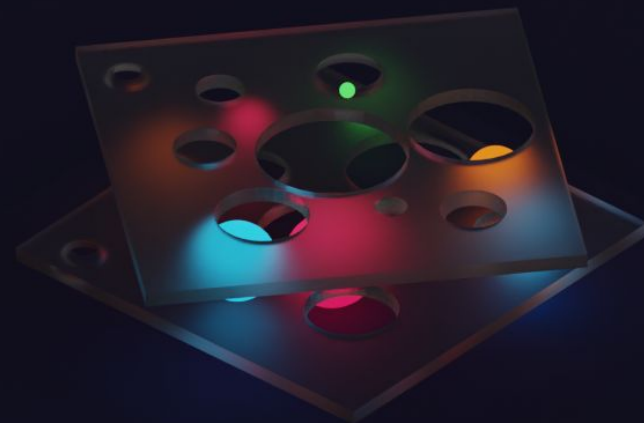
$$\tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$



# 102

## CONVOLUTION

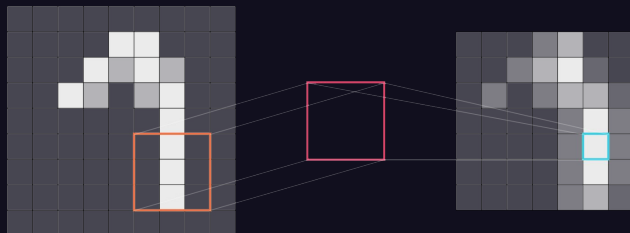
Signal Processing 101







## CONVOLUTION CROSS CORRELATION



$$(f * g)(x) = \int_{-\infty}^{+\infty} f(x)g(x - t)dt$$

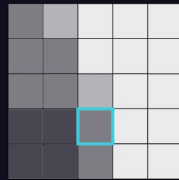
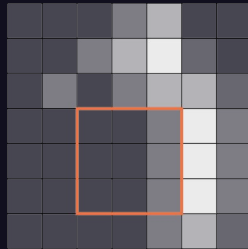
**Weight Sharing**



# |02 CONVOLUTION



## POOLING



**Dimensionality Reduction**



## CONVOLUTIONAL NEURAL NETWORK

