

# Multiple face recognition in images

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Presentation on Convolutional Neural Networks, 2018

# Outline

- 1 Introduction
  - Machine learning
  - Tensorflow and OpenCv
- 2 Image classification
  - Convolutional Neural Network
  - Dataset

- ImageNet
  - Inception V3 by Google
  - Tensorflow and retraining
- 3 Summary
    - Conclusion
    - Future implementation
    - Best bugs

# Outline

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## Introduction

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- Tensorflow and OpenCv

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## Image classification

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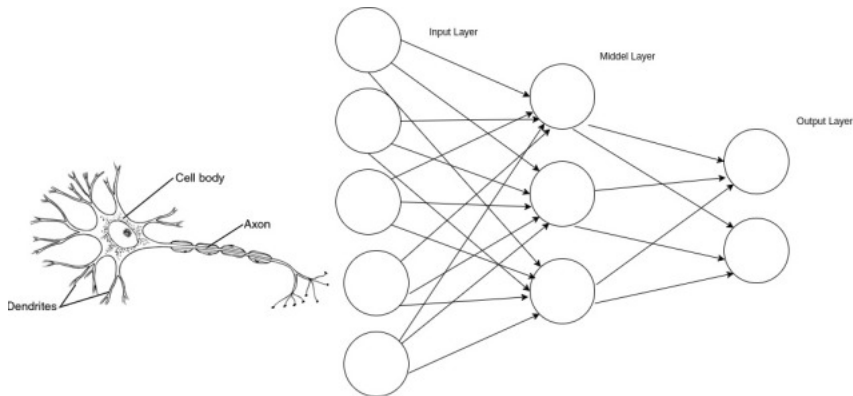
3

## Summary

- Conclusion
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# What does machine learning means?

► Is this a neural network or a graph?



# What does machine learning means?

- ▶ The concept of `training`
  - Minimize the loss
  - Loss functions
  - Weights update
- ▶ The importance of a large and well organized dataset
  - Common problems
  - Cognitive bias

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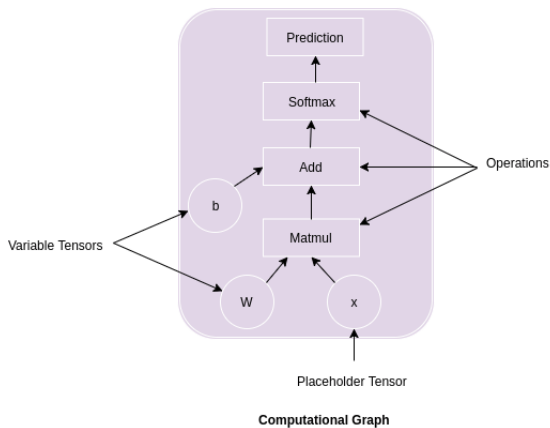
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# Tensorflow and OpenCv

## ► Tensorflow and computational graph concept



# Tensorflow and OpenCv

- ▶ Low level and high level API
  - Tensorflow functions
  - Keras and tflearn
- ▶ OpenCv "magic" detection algorithm
  - HaarCascadeClassifier
  - Dlib library for facial features detection



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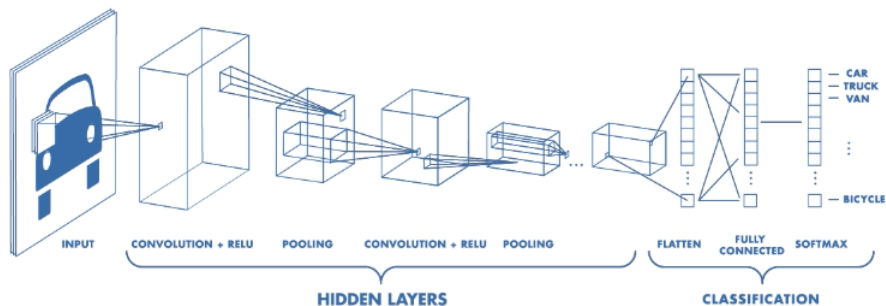
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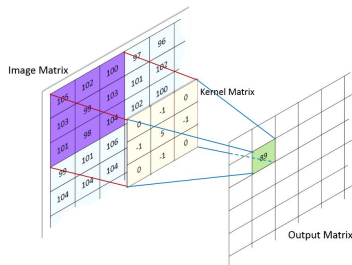
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# Convolutional Neural Network



# Convolutional layers

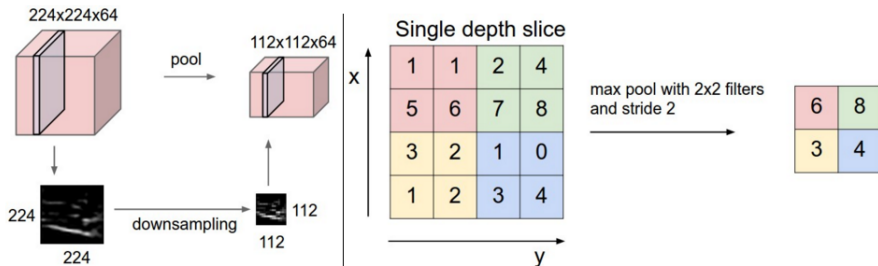
## ► Convolutional matrix (Kernel)



- 3x3, 5x5, or 7x7, why only odd numbers?
- Edge detection
  - Similarity with human vision
  - From simple to complex forms

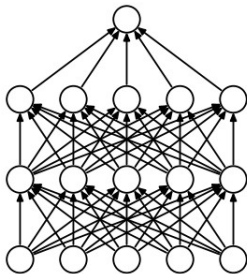
# Pooling layers

- ▶ Reducing number of information: best way to avoiding overfitting and decreasing computation complexity

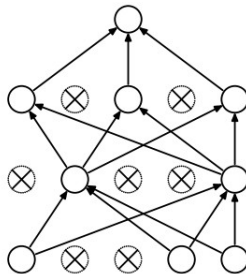


# Fully connected layers and dropout

- ▶ Fully connected layers are the last layer of the CNN
- ▶ Once the high-level features are recognized, they deal with classifications



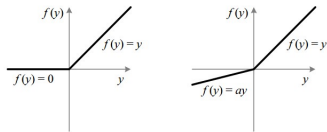
(a) Standard Neural Net



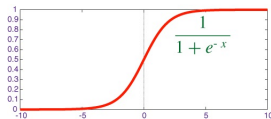
(b) After applying dropout.

# Activation functions

## ► ReLU



## ► Softmax



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# Dataset

- ▶ The perfect dataset should be:
  - made with hundreds of images
  - different images with different colors to help the network classify them better
  
- ▶ The script use some OpenCv functions to get hundreds of photos in less than 30 seconds and, after that, crop them and saves them. This is made to avoid the recognition of unwanted features as background color without the need of hundreds of images taken in different places



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# ImageNet Challenge

- ▶ The ImageNet project is a large visual database designed for use in visual object recognition software research. Over 14 million URLs of images have been hand-annotated by ImageNet to indicate what objects are pictured; in at least one million of the images, bounding boxes are also provided. ImageNet contains over 20 thousand categories; a typical category, such as "balloon" or "strawberry", contains several hundred images.
- ▶ Since 2010, the annual ImageNet Large Scale Visual Recognition Challenge (ILSVRC) is a competition where research teams evaluate their algorithms on the given data set(ImageNet), and compete to achieve higher accuracy on several visual recognition tasks

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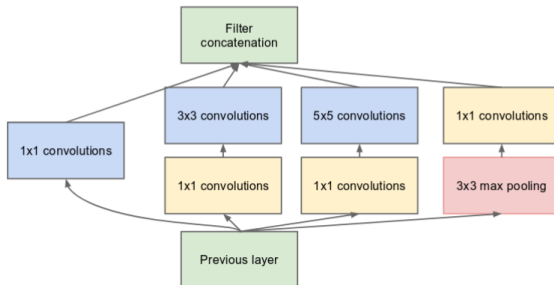
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# Inception network

- Inception networks analyze images with different kernel size (in the same conv layer)



(b) Inception module with dimension reductions

- Here an example: GoogleNet

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# Tensorflow and retraining

- ▶ Concept of retraining
- ▶ Tensorflow-hub: the key to create your own classifier with good result and without a tesla k80
- ▶ Everything you need to know about retrain: tensorflow retraining

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# Conclusion

- ▶ Create your own machine learning program using another pre-trained model can help you to build something useful without the need of a workstation or cloud computing
- ▶ This project is only a small example of the potentiality of Tensorflow and the machine learning approach



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# Future implementation

- ▶ Let the users to choose beetwen more pre-trained models
- ▶ Find the best way to recognize an unknown person (someone who does not have photos yet)

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# Best bugs

- ▶ OpenCv imshow freezing bug on unix like system
- ▶ Tensorflow-hub requires a tensorflow version that could not work with lots of processors(precompiled with AVX activation)

# Useful links

- ▶ Project repository: Link to repo
- ▶ Tensorflow: Link to Tensorflow page
- ▶ OpenCv: Link to OpenCv project