

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

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- 1 Introduction
 - Machine learning
 - Tensorflow and OpenCv

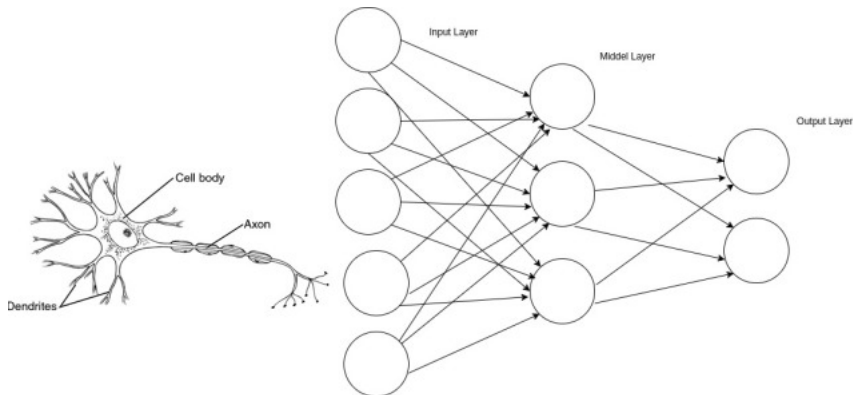
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What does machine learning means?

► 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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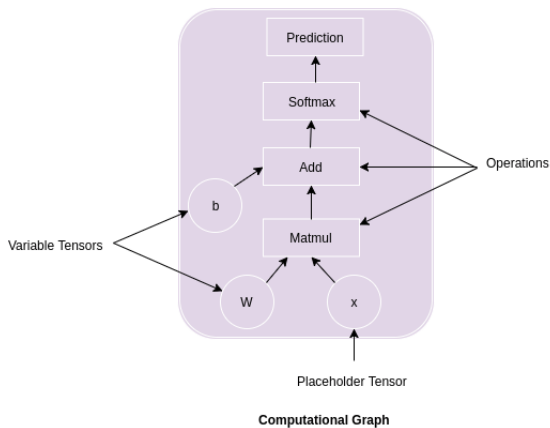
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Tensorflow and OpenCv

► 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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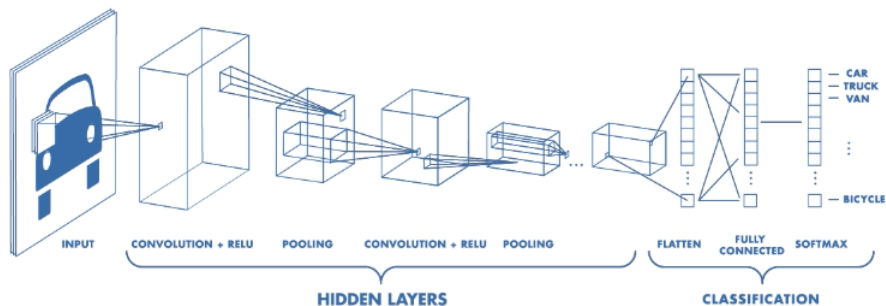
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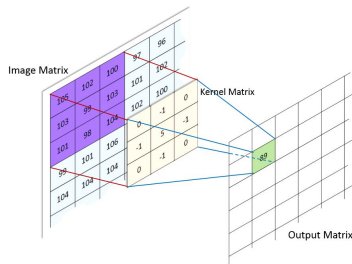
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Convolutional Neural Network



Convolutional layers

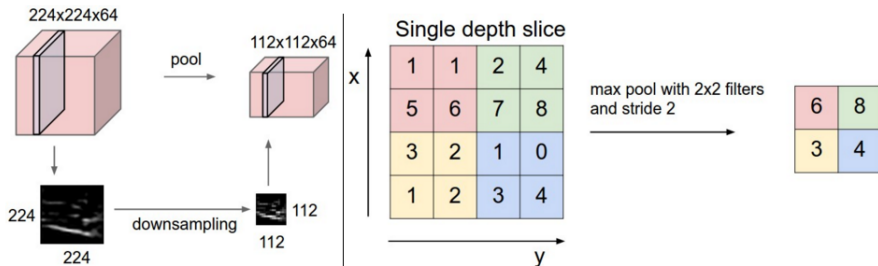
► Convolutional matrix (Kernel)



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

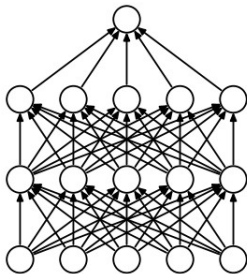
Pooling layers

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

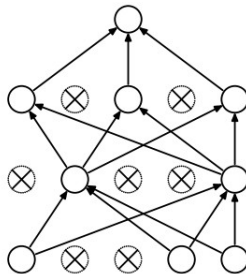


Fully connected layers and dropout

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



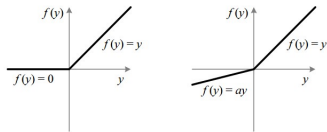
(a) Standard Neural Net



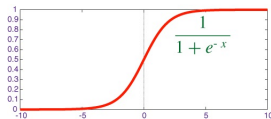
(b) After applying dropout.

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
- ▶ How the script works?
 - It use some OpenCv functions to get hundreds of photos in less than 30 seconds
 - 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:
 - it's a large visual database designed for use in visual object recognition software research
 - ImageNet contains over 20 thousand categories; a typical category, such as "balloon" or "strawberry", contains several hundred images.
 - all the images are labelled and this is fundamental for machine learning works on it
- ▶ ImageNet Large Scale Visual Recognition Challenge (ILSVRC):
 - is a competition where research teams evaluate their algorithms on the given data set(ImageNet)
 - they compete to achieve higher accuracy on several visual recognition tasks

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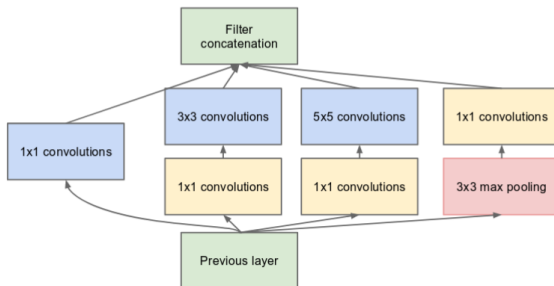
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Inception network

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



- ▶ 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) ([Link to issue](#))

Useful links

- ▶ Project repository: [Link to repo](#)
- ▶ Tensorflow: [Link to Tensorflow page](#)
- ▶ OpenCv: [Link to OpenCv project](#)