



ROBOTICS CLUB

SCIENCE AND TECHNOLOGY
COUNCIL
IIT KANPUR



Winter Workshop

Machine Learning in Robotics

Courtesy: Professor Vipul Arora (EE698V Instructor)
ColdFusion (Youtube Channel)



How did it all begin?



It all began with an image classification problem!

https://www.youtube.com/watch?v=IBe2o-cZncU



Revision: Convolution of Images



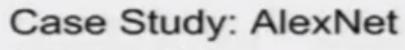
Neural Networks



For learning any ML algorithm, you need to-Appreciate the Algorithm Understand the underlying Mathematics Implement the Algorithm







[Krizhevsky et al. 2012]

Architecture:

MAX POOL1

NORM1 CONV2

MAX POOL2

CONV3

CONV4

CONV5 Max POOL3

FC6

FC7

FC8



34% → 75% Shifting to **Neural Networks** 75% → 97% Optimization of the CNN



Completely Automated Public Turing test to tell Computers and Humans Apart



What language do you think in?



In Programming, if you can think in C, you can code in any language.

(That's precisely why we are taught C in ESC101)





Tools we will be using:

Jupyter Notebooks (Python3) Google Colab Python Notebooks



Libraries - Benefiting from Other people's Social Work:

Numpy
Matplotlib
cv2
keras
pytorch
scikitlearn



Q. How can we create a 3x3 array of zeros in C?



Using numpy

```
In [12]: A = np.zeros((4,4))
    print(A)
```

```
[[0. 0. 0. 0.]
[0. 0. 0. 0.]
[0. 0. 0. 0.]
[0. 0. 0. 0.]]
```



Task: Create a 5x2 array of ones

Hint: Python is super-intuitive



You'll find a function for all tasks in Python!

But you need to learn "The Art of Googling!"



Principal Component Analysis in Python



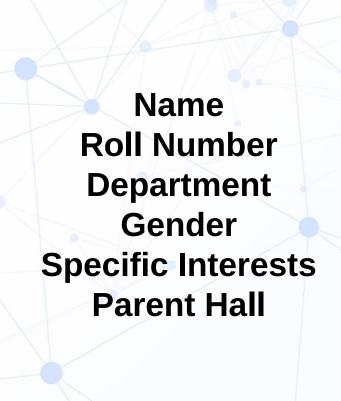
Principal Component Analysis

Principal component analysis (PCA) is a mathematical procedure that transforms a number of (possibly) correlated variables into a (smaller) number of uncorrelated variables called principal components. ... Principal components analysis is similar to another multivariate procedure called Factor Analysis.











This is a lot of data and there's redundancy.
I want to make my life easy!



What I want? 2 new sets of informationDim1 Dim2





Implementation in Jupyter Notebooks using numpy and matplotlib

