Introduction to Machine Learning

Anupam Guha

Modern History

- 1951 Ferranti Mark 1
- 1954 AI Boom
- 1956 Dartmouth Workshop
- ELIZA
- 1974 First AI Winter
- 1980 Expert Systems Boom
- 1987 Bust
- 1993 – 2011 Victory of the Neats
- Since 2011Deep Learning and Big Data

What is Machine Learning?

Algorithms that improve automatically through experience by using data

Data is unprocessed information

Information is data after processing

Training Data

Testing Data

Validation Data

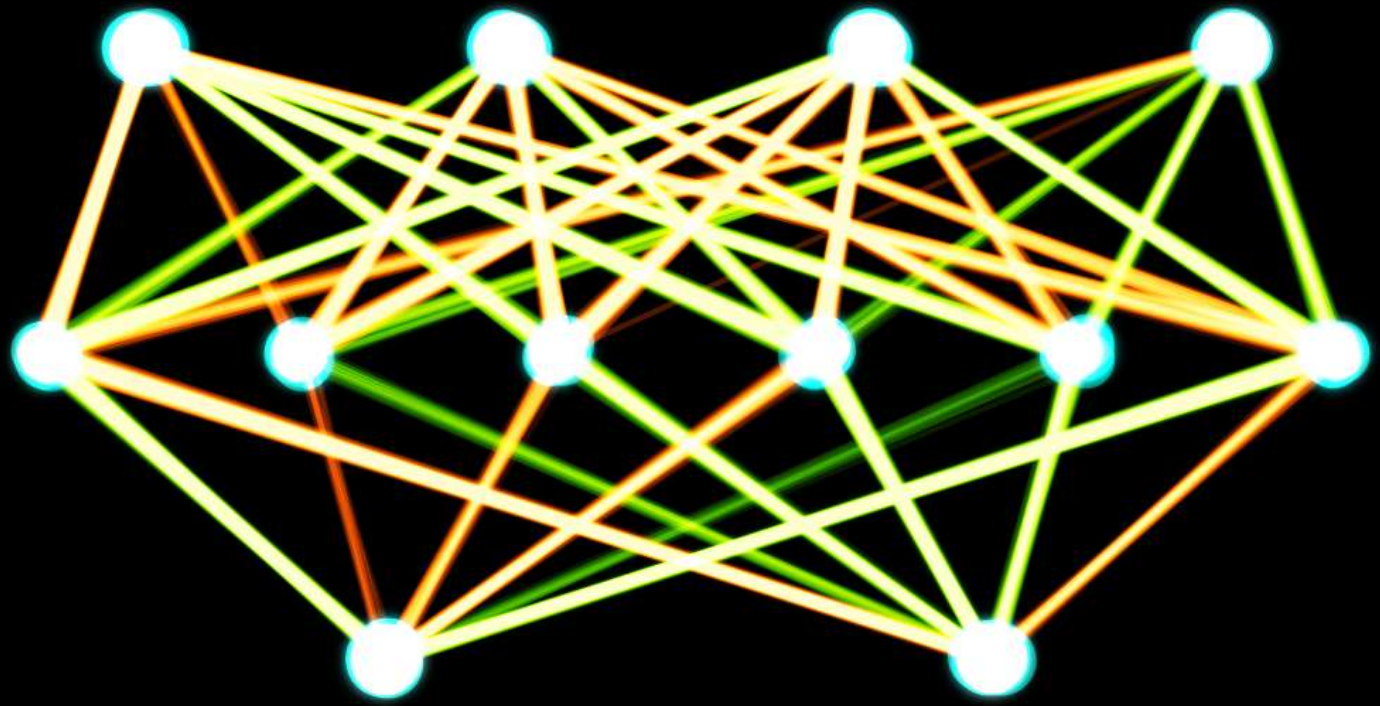
Features

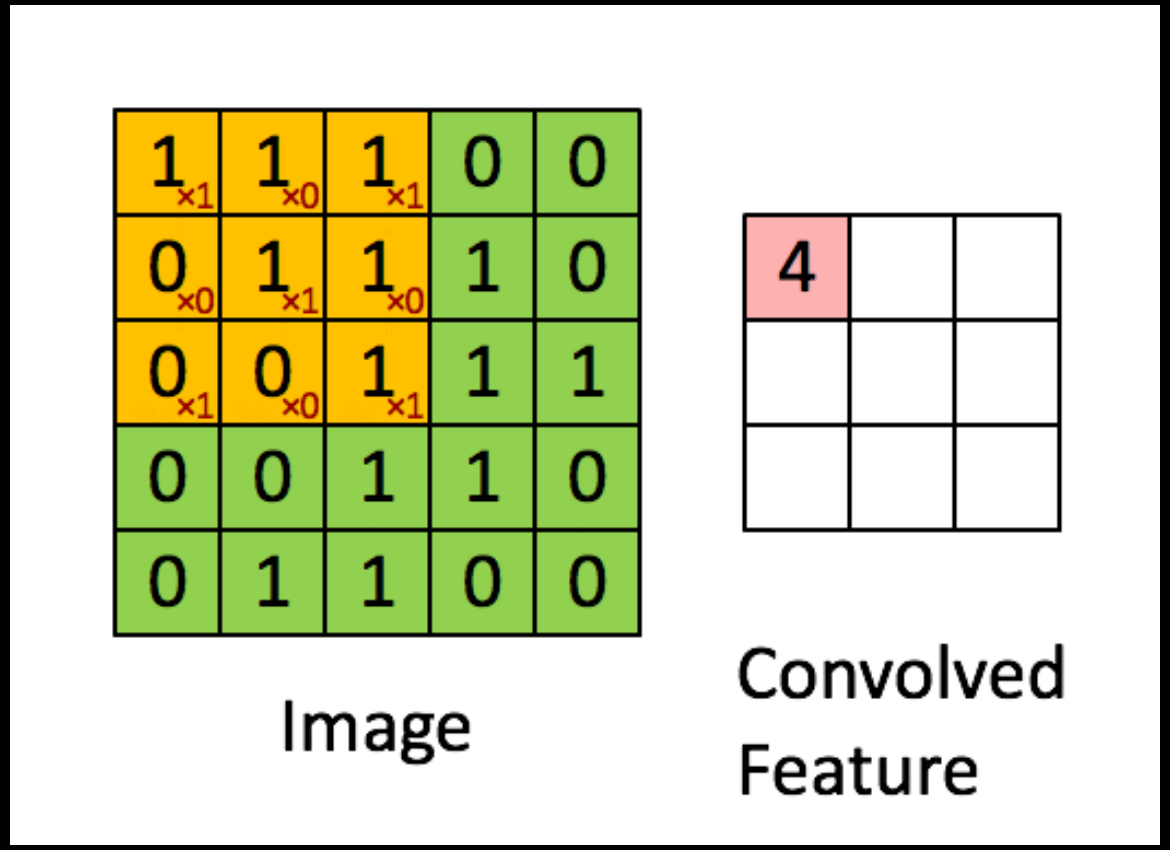
- What are features?
- Choosing good features
- Curse of Dimensionality and Dimensionality reduction
- Metrics: Correlation, mutual information, class separability
- Can we use raw data as features?

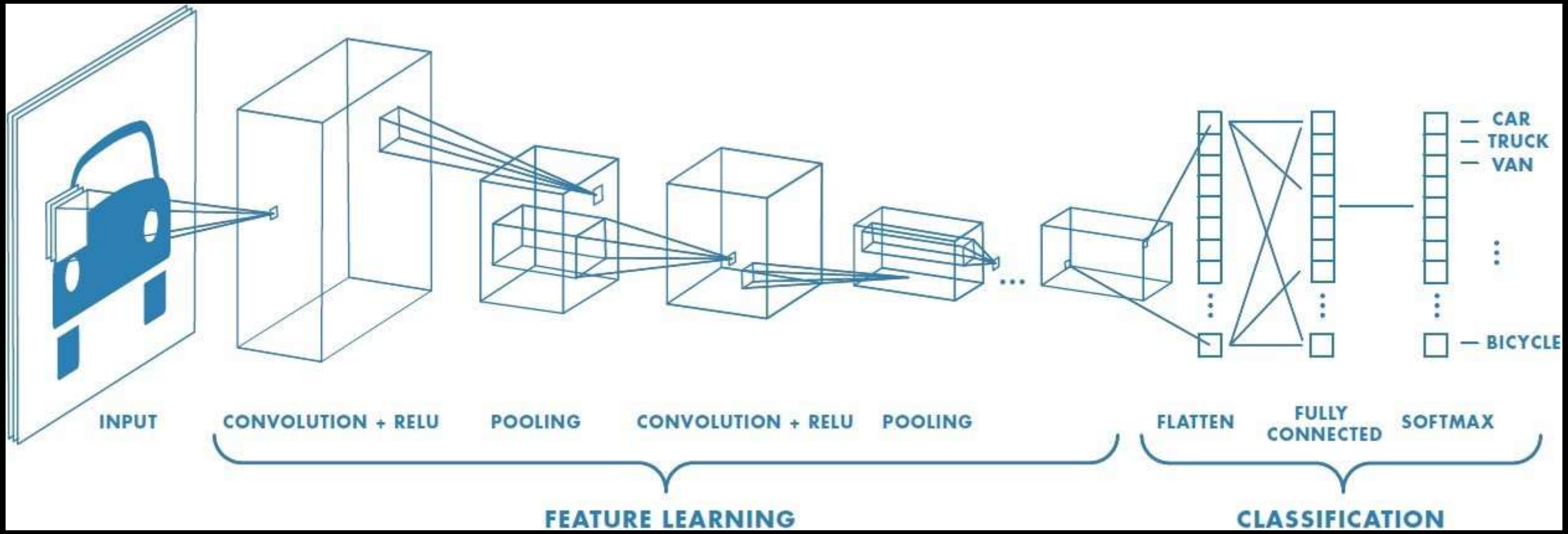
Jargon

- Cross Validation
- Active Learning
- Ensemble Learning
- Oracle
- Overfitting
- Explainability
- Bias

Deep Learning




1×1 1×0 1×1 0 0
0×0 1×1 1×0 1 0
0×1 0×0 1×1 1 1
0 0 1 1 0
0 1 1 0 0
Image
4
Convolved Feature


CAR
TRUCK
VAN
BICYCLE
INPUT
CONVOLUTION + RELU
POOLING
CONVOLUTION + RELU
POOLING
FLATTEN
FULLY CONNECTED
SOFTMAX
FEATURE LEARNING
CLASSIFICATION

Supervised ML

- Classification
- Regression
- Where do we get annotations from?
- Determining the best algorithm
- Bias-variance trade-off
- Complexity of algorithm

Classification

- Decision Trees
- Bayesian Classifiers
- Neural Networks
- K-Nearest Neighbour
- Support Vector Machines
- Deep neural networks

Regression

- Linear regression
- Logistic regression

Unsupervised ML

- Clustering
- Anomaly Detection
- Expectation Maximization
- Topic Models
- Parameters
- Chinese restaurants and Indian buffets

Neural Networks in Unsupervised

- Autoencoders
- Generative Adversarial Networks
- Deep belief network

Discussion

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An introduction to Python

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What is coding?

- What is a language? What is an algorithm?
- Various kinds of languages
- Compilers and interpreters
- Why use Python? Which Python?
- Everyone installs Python
- IDLE
- Using the command line in your OS

Basic Python commands

- Comments
- Keywords, identifiers
- print() and input()
- + - * /
- ** %
- Data types and type conversion
- Strings
- Overloading of operators
- String as a list, len(), indexing etc
- split() and join()

Comparisons

- Comparison operators > < >= <= == !=
- Assignment vs comparison
- += -= etc
- if, else, elif
- Boolean variables TRUE FALSE
- Boolean operators and or not
- Identity (is) and membership (in)

Data, loops and functions

- More on lists, set, tuple, dict
- for, with list, range etc, loop in a list itself
- while, types of while
- break and continue
- A basic function
- iteration and recursion

Discussion