نوروسافاری
NEUROSAFARI

Introduction to Machine Learning with Python

Session 1 :
What’s going on there?

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Content

1. Why Machine Learning ?

2. Why Python?

    1. More on python and a little bit about python.

3. Supervised Learning

4. Unsupervised Learning

5. Representing Data and Engineering Features

6. Algorithm Chains and Pipelines

Content

7. Neural Network

    1. Introduction to Artificial Neural Network

    2. Perceptron

    3. BackPropagation

    4. CNN

    5. GAN

    6. RNN

Learn

- Learning is used when:
  - Human expertise does not exist (navigating on Mars),
  - Humans are unable to explain their expertise (speech recognition)
  - Solution changes in time (routing on a computer network)
  - Solution needs to be adapted to particular cases (user biometrics)

What is Machine Learning?

- Machine Learning
  - Study of algorithms that
  - improve their performance
  - at some task
    - with experience
- Optimize a performance criterion using example data or past experience.
- Role of Statistics: Inference from a sample
- Role of Computer science: Efficient algorithms to
  - Solve the optimization problem
  - Representing and evaluating the model for inference

What We Talk About When We Talk About“Learning”

- Learning general models from a data of particular examples

- Data is cheap and abundant (data warehouses, data marts); knowledge is expensive and scarce.

- Example in retail: Customer transactions to consumer behavior

- Build a model that is *a good and useful approximation* to the data.

Supervised Learning: Uses

- Prediction of future cases: Use the rule to predict the output for future inputs
- Knowledge extraction: The rule is easy to understand
- Compression: The rule is simpler than the data it explains
- Outlier detection: Exceptions that are not covered by the rule, e.g., fraud

Unsupervised Learning

- Learning “what normally happens”
- No output
- Clustering: Grouping similar instances
- Other applications: Summarization, Association Analysis
- Example applications
  - Customer segmentation in CRM
  - Image compression: Color quantization
  - Bioinformatics: Learning motifs

Reinforcement Learning

- Topics:
  - Policies: what actions should an agent take in a particular situation
  - Utility estimation: how good is a state (→used by policy)

- No supervised output but delayed reward

- Credit assignment problem (what was responsible for the outcome)

- Applications:
  - Game playing
  - Robot in a maze
  - Multiple agents, partial observability, ...

The machine learning framework

- Apply a prediction function to a feature representation of the image to get the desired output:

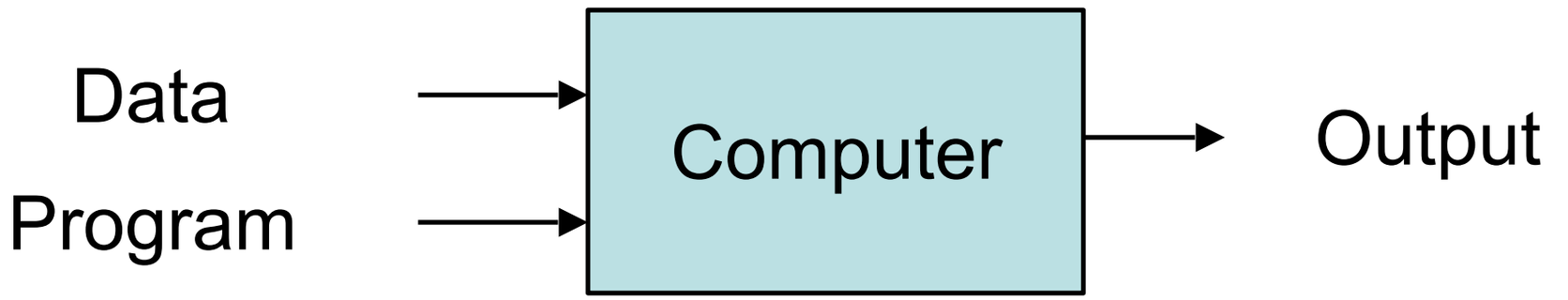
f() = “Goat”

f() = “Pizza”

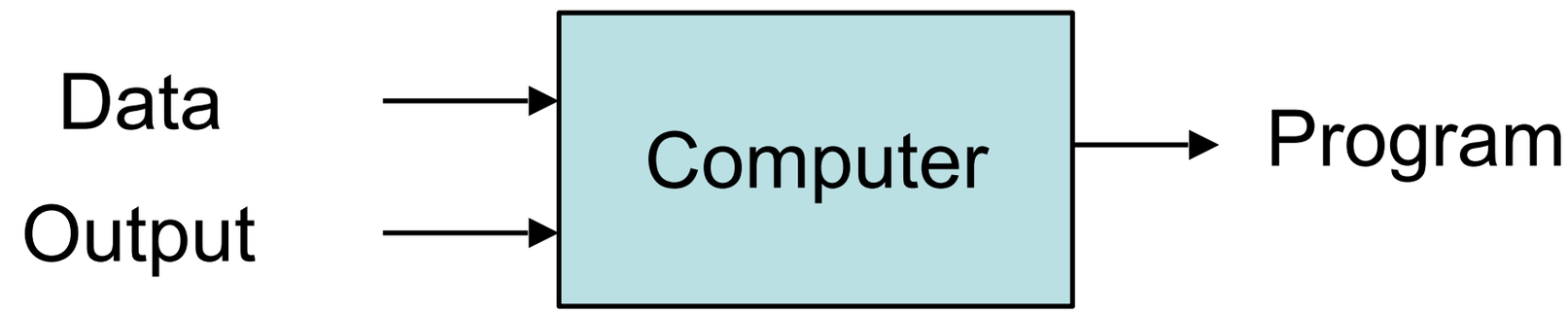
f() = “cow”

Fashion

Traditional Programming



Machine Learning



Steps

Training

Training Images

Training Labels

Image Features

Training

Learned model

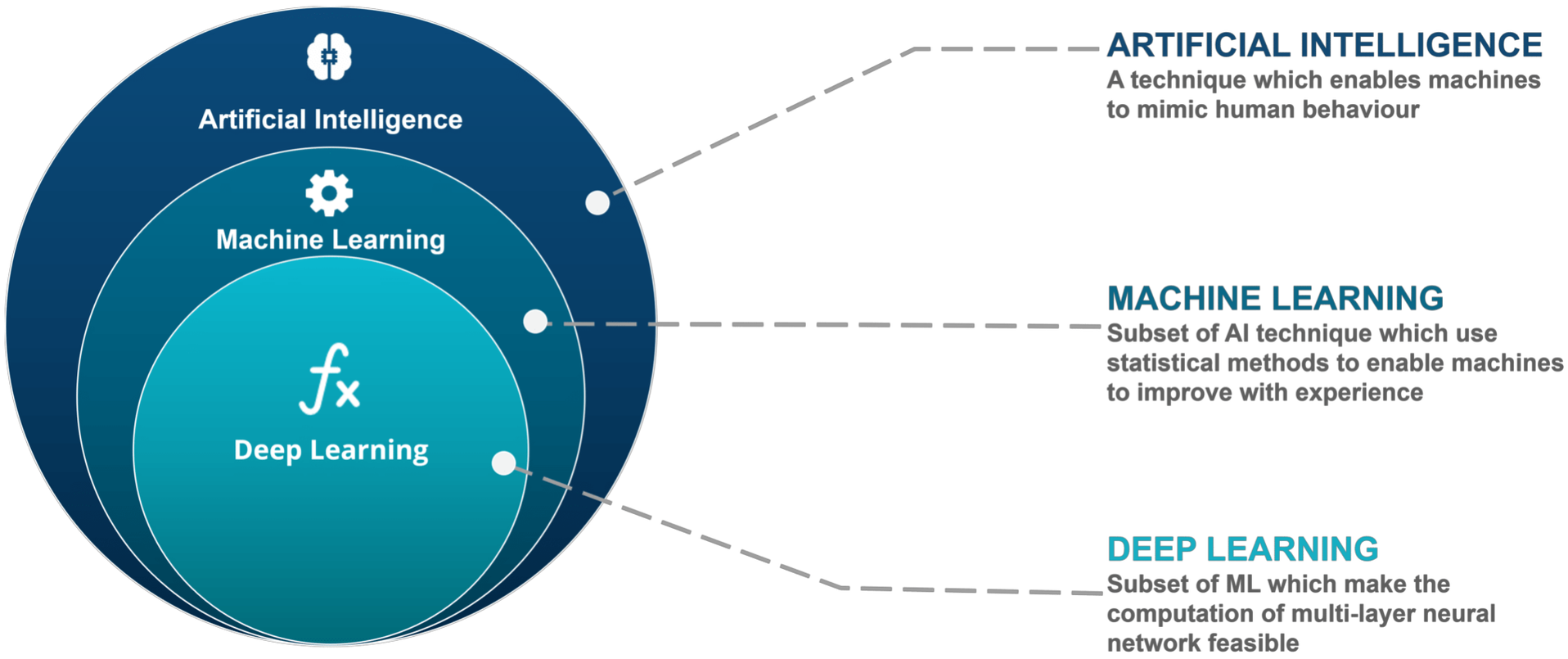
Testing

Test Image

Image Features

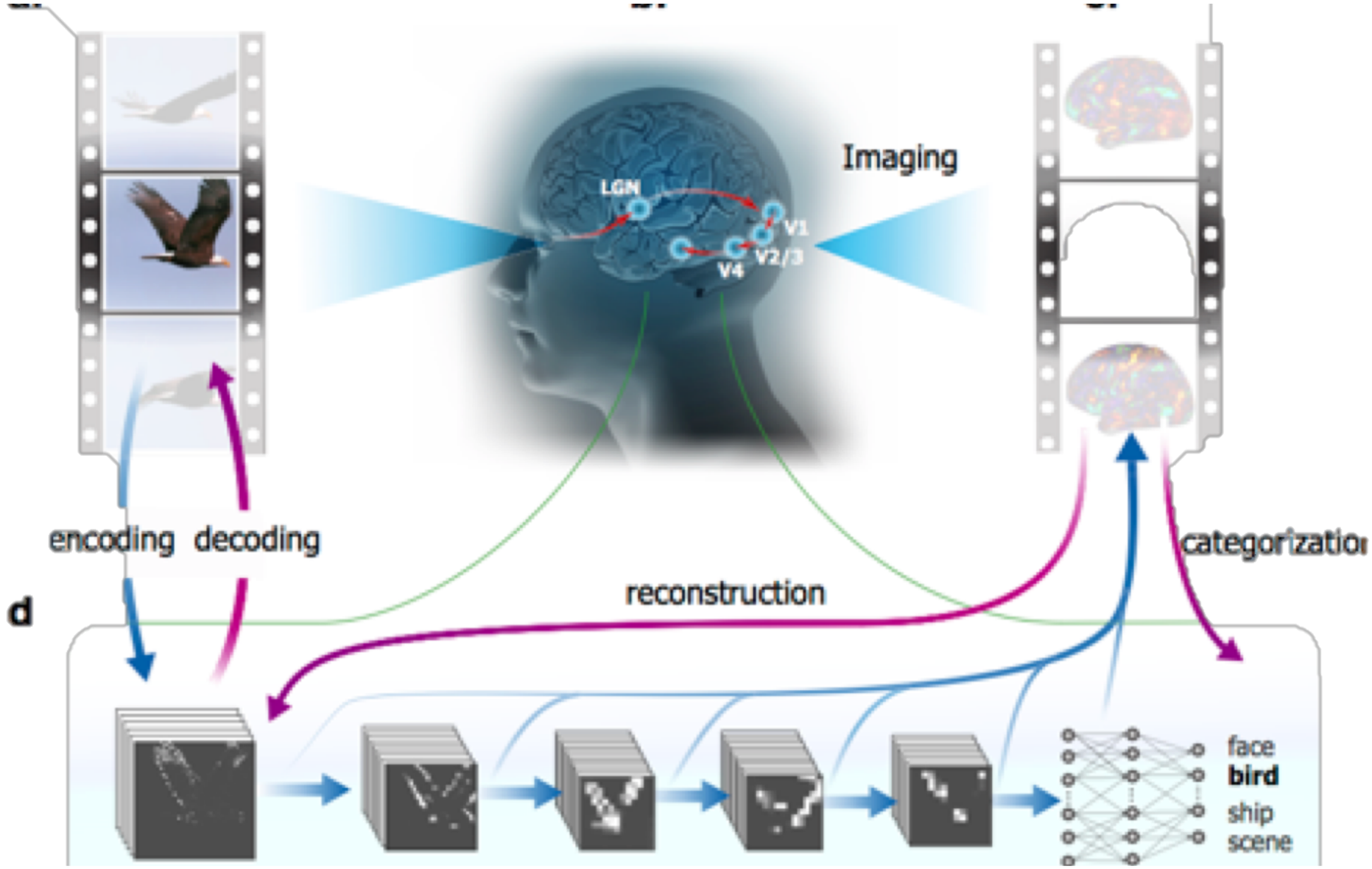
Learned model

Prediction


Artificial Intelligence
Machine Learning
Deep Learning
ARTIFICIAL INTELLIGENCE
A technique which enables machines to mimic human behaviour
MACHINE LEARNING
Subset of AI technique which use statistical methods to enable machines to improve with experience
DEEP LEARNING
Subset of ML which make the computation of multi-layer neural network feasible

All in One

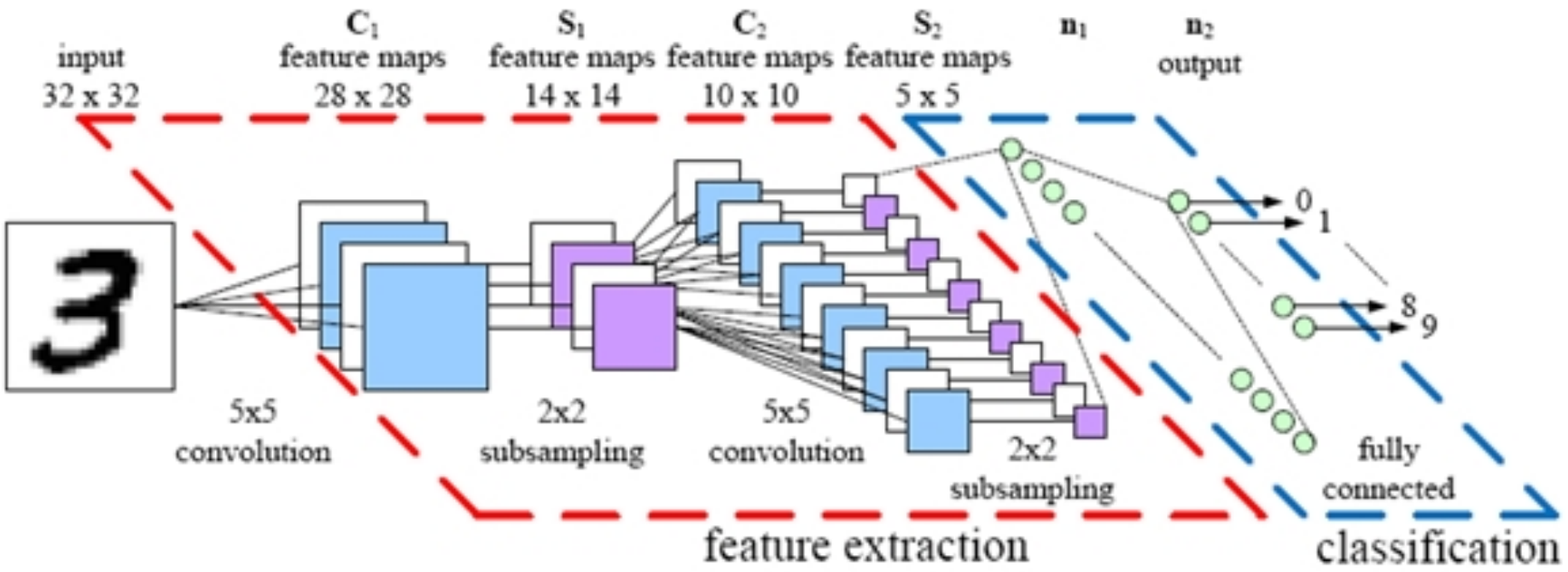
Deep Learning



Idea

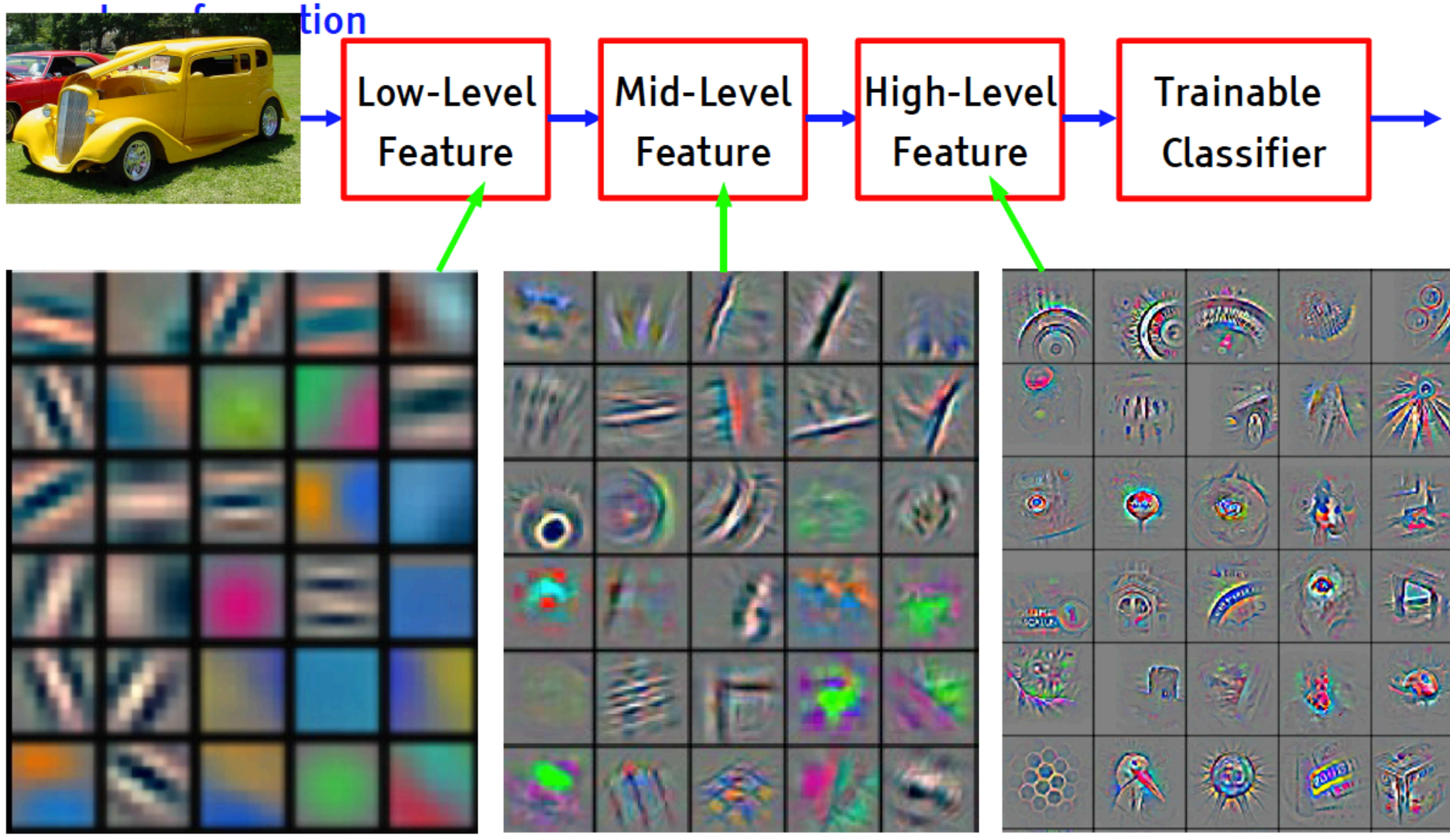
Deep Learning

Wen H, Shi J, Zhang Y, Lu KH, Liu Z. Neural Encoding and Decoding with Deep Learning for Dynamic Natural Vision. 2016 Aug 11



Initial Usage

Text and Image Labeling

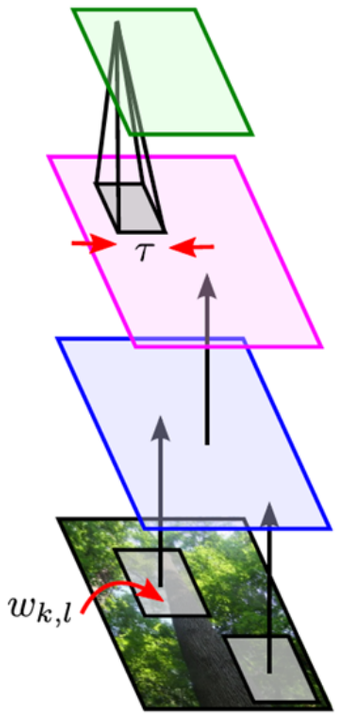


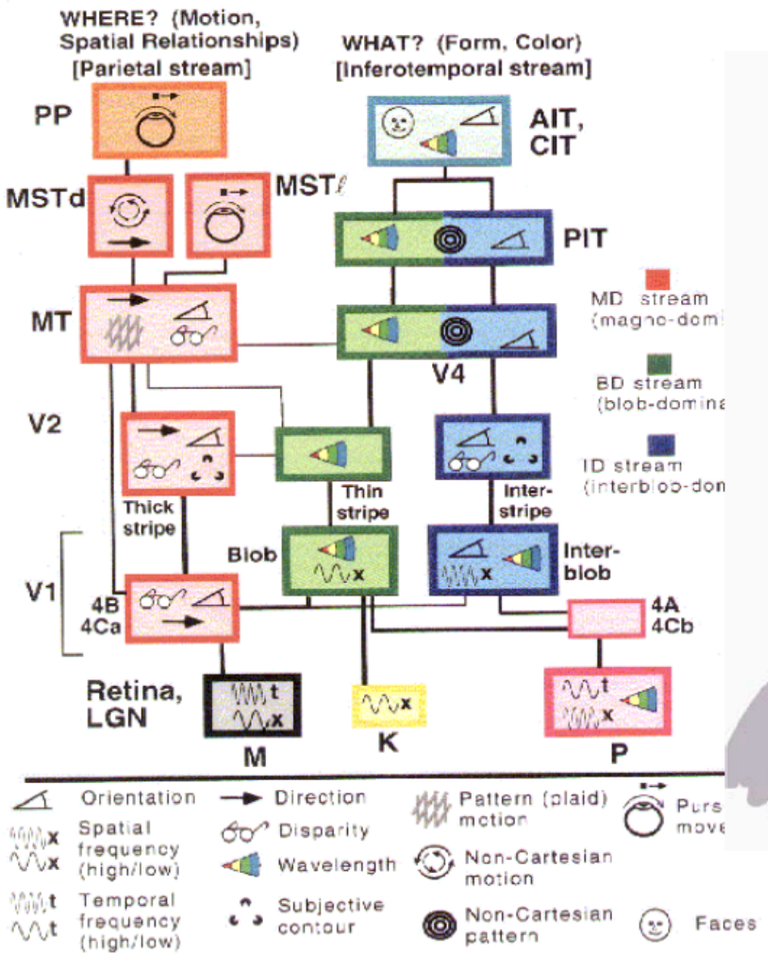
Feature visualization of convolutional net trained on ImageNet from [Zeiler & Fergus 2013]

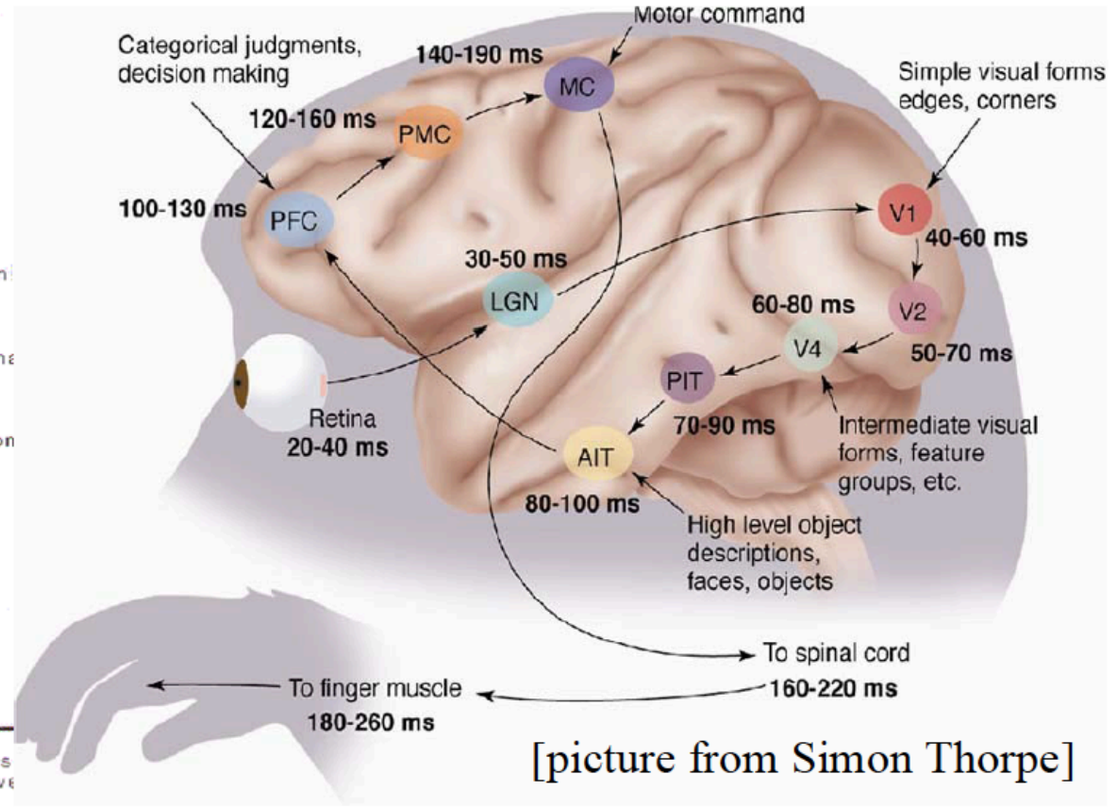
Image Analysis

Detection

- The ventral (recognition) pathway in the visual cortex has multiple stages
- Retina - LGN - V1 - V2 - V4 - PIT - AIT ....
- Lots of intermediate representations



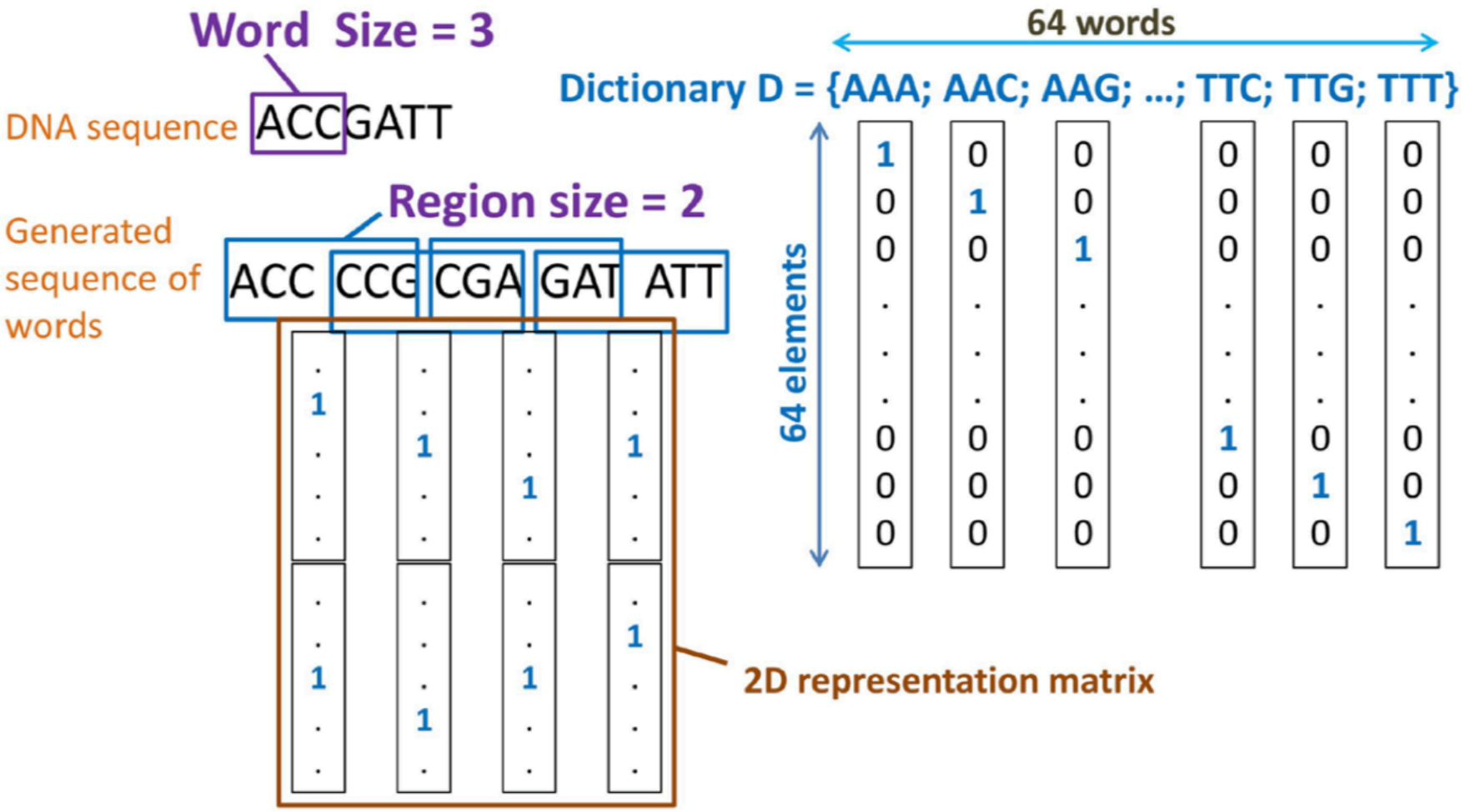




[Gallant & Van Essen]

Neuroscience

Brain Modeling



DNA

Combination of textmining and matrix analysis

DNA Sequence Classification by Convolutional Neural Network, Ngoc Giang Nguyen