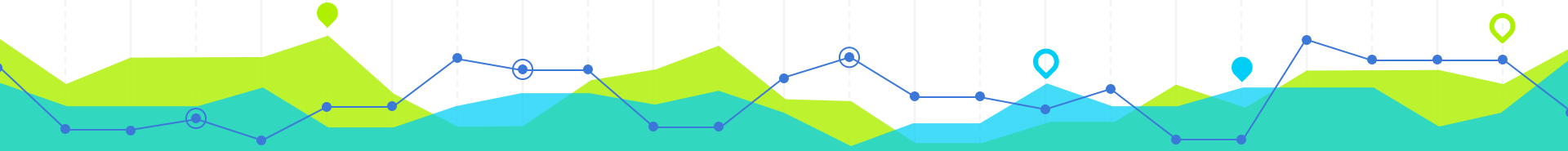
Global Big Data Conference

www.globalbigdataconference.com

Twitter : @bigdataconf

#GBDC



Intro to Image Classification and PYTORCH

DOWNLOAD & INSTALL INSTRUCTIONS

Accel.AI

OFFICIAL DOCS

Python

https://docs.python.org/2.7/

Anaconda

https://www.anaconda.com/download/

PyTorch

https://pytorch.org/

GITHUB LINKS

AI Workshop Installation Guides

https://github.com/AccelAI/AI-Workshop-Installation-Guides

Intro to Image Captioning

https://github.com/latinxinai/Intro-Image-Captioning

Intro to PyTorch
https://github.com/latinxinai/Intro-Image-Captioning/blob/master/Intro_to_CV_in_Pytorch.ipynb

Laura N Montoya

I am a futurist, scientist, engineer, and social impact entrepreneur.

Accel.AI

You can find me at...

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@quickresolute

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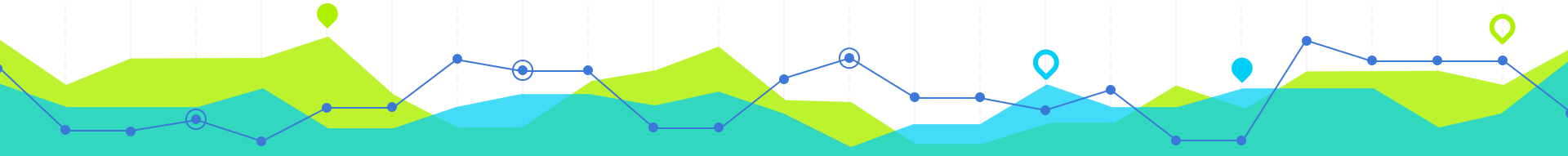
AGENDA

Main Concepts

1. What is computer vision?
2. How do we classify images?
3. What is a classifier?
4. How does a computer classify images?
5. 7 Steps in Machine Learning
6. CV Challenges
7. Models
8. Evaluation & Tuning

Applied AI Lab

1. Intro to PyTorch
2. CNN

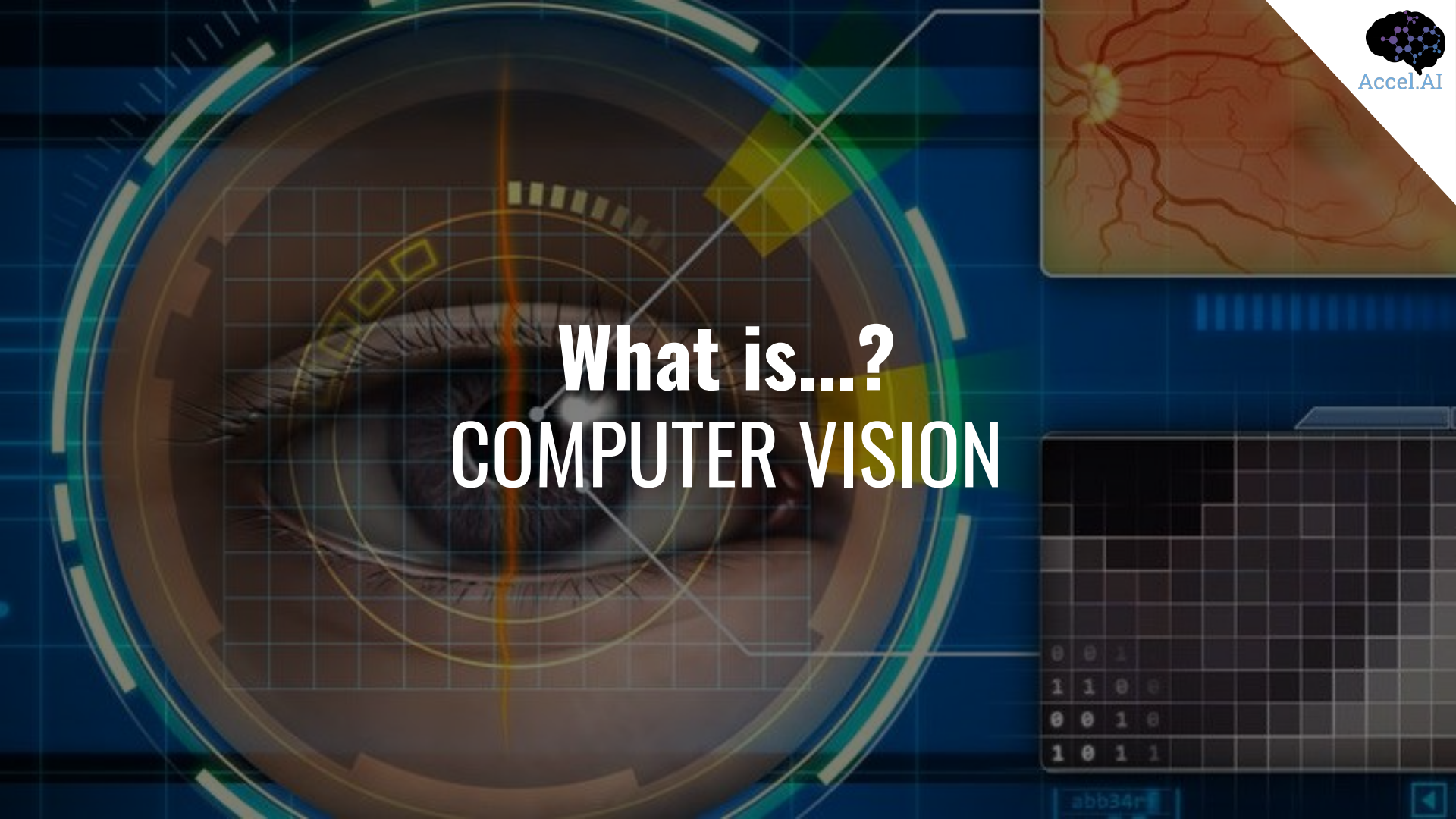


Vision

1

An exponential evolution...

Accel.AI


What is...?
COMPUTER VISION
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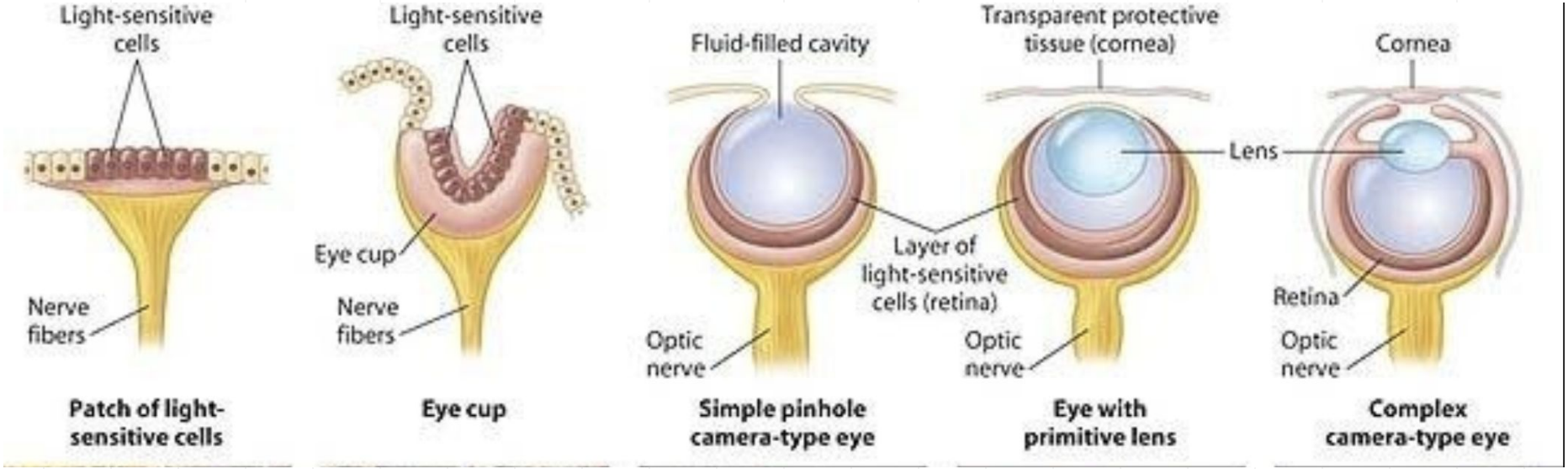
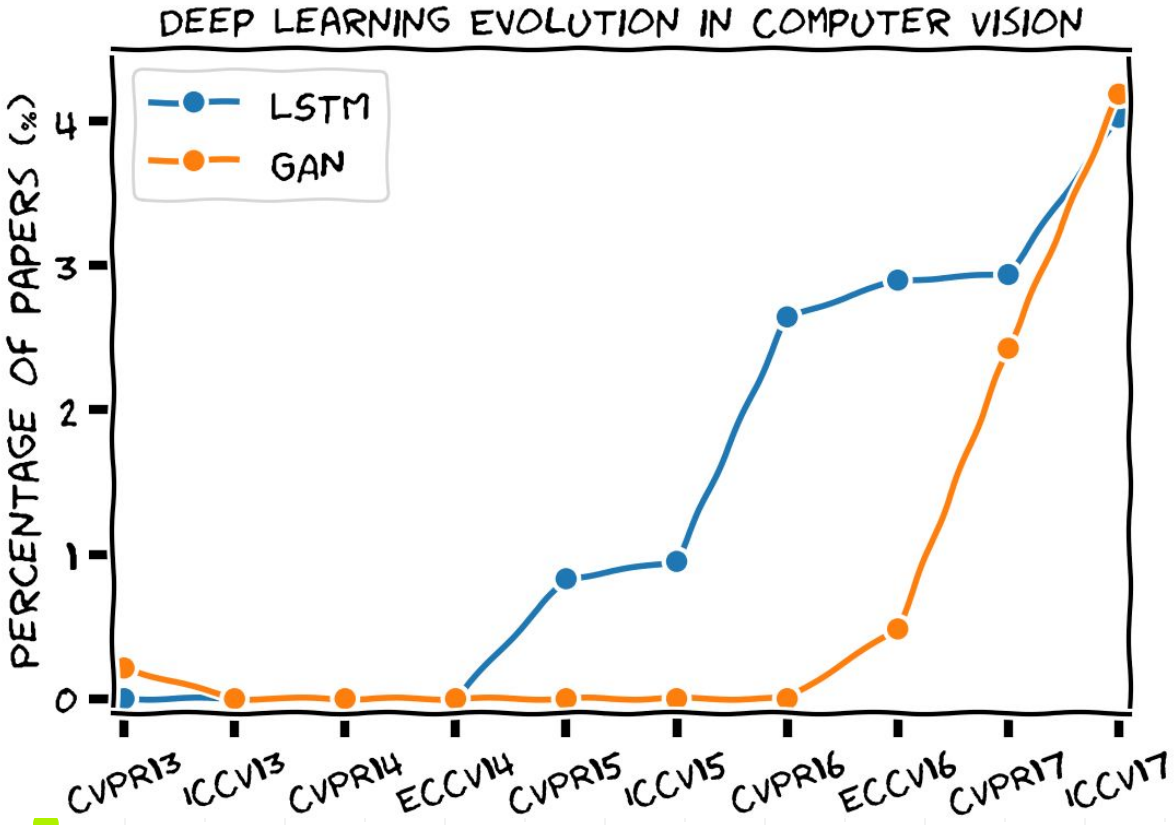
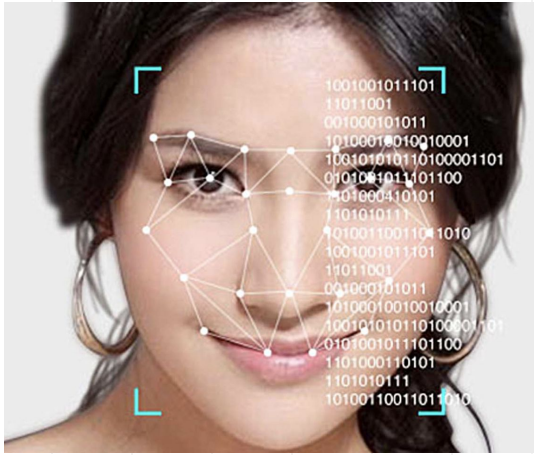

Light-sensitive cells
Nerve fibers
Patch of light-sensitive cells
Light-sensitive cells
Eye cup
Nerve fibers
Eye cup
Fluid-filled cavity
Optic nerve
Simple pinhole camera-type eye
Transparent protective tissue (cornea)
Lens
Layer of light-sensitive cells (retina)
Optic nerve
Eye with primitive lens
Cornea
Retina
Optic nerve
Complex camera-type eye


DEEP LEARNING EVOLUTION IN COMPUTER VISION
PERCENTAGE OF PAPERS (%)
0
1
2
3
4
LSTM
GAN
CVPR13
ICCV13
CVPR14
ECCV14
CVPR15
ICCV15
CVPR16
ECCV16
CVPR17
ICCV17



Computer Vision

Machine Vision

Embedded Systems

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Human Vision

2

How do we see the world?

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MIT neuroscientists find the brain can identify images seen for as little as 13 milliseconds

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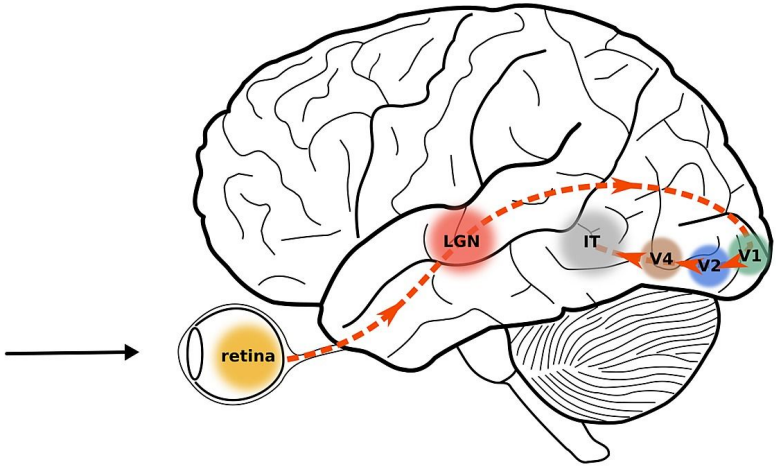
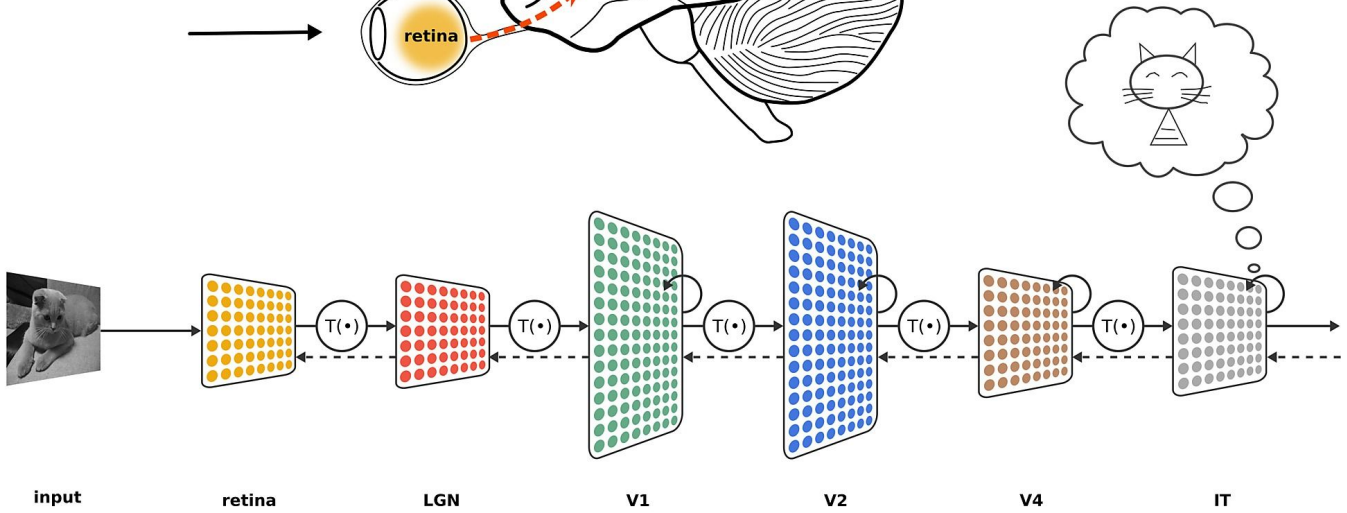




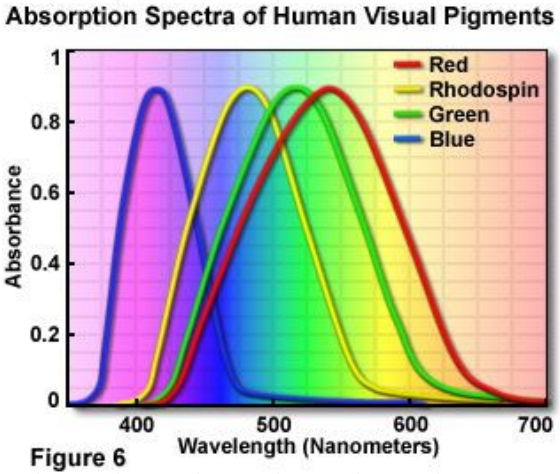
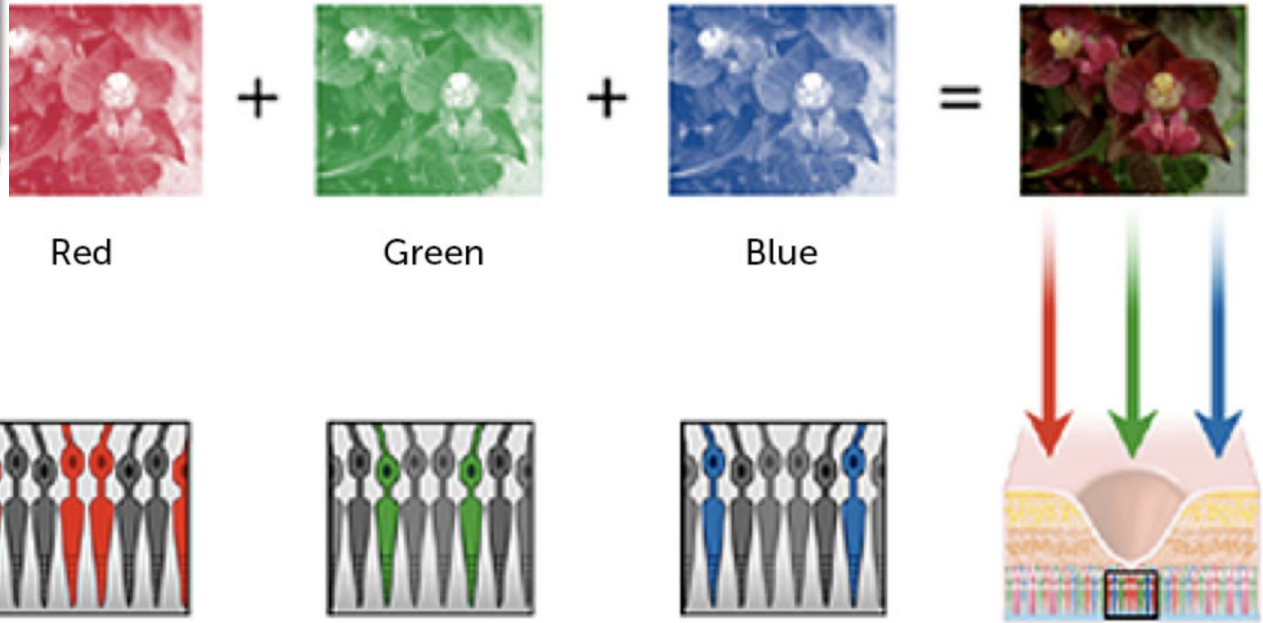
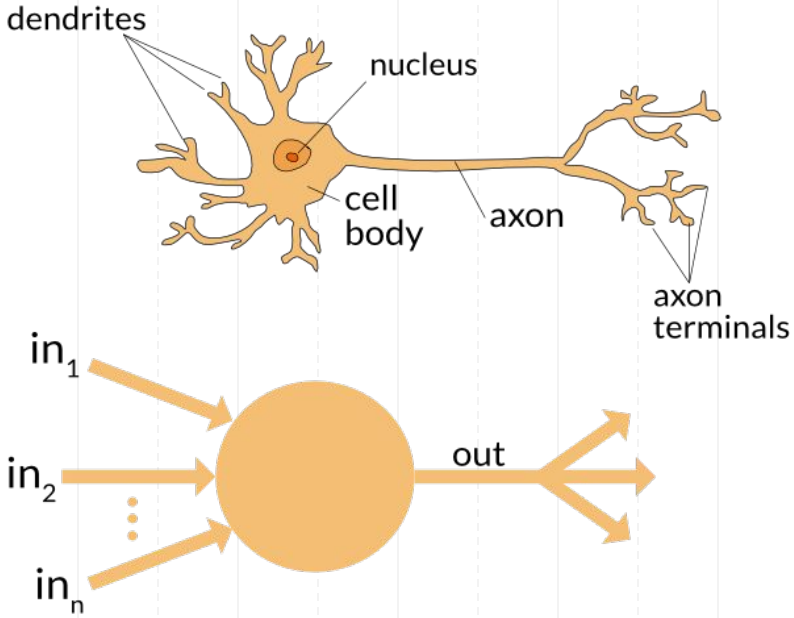


Figure 6



PERCEPTRON = SINGLE LAYER



LIGHT

Human eye

Optical nerve

Brain

INFORMATION

LIGHT

Industrial camera

PC

Machine Vision Software

INFORMATION

Classification

3

What is an ML classifier?

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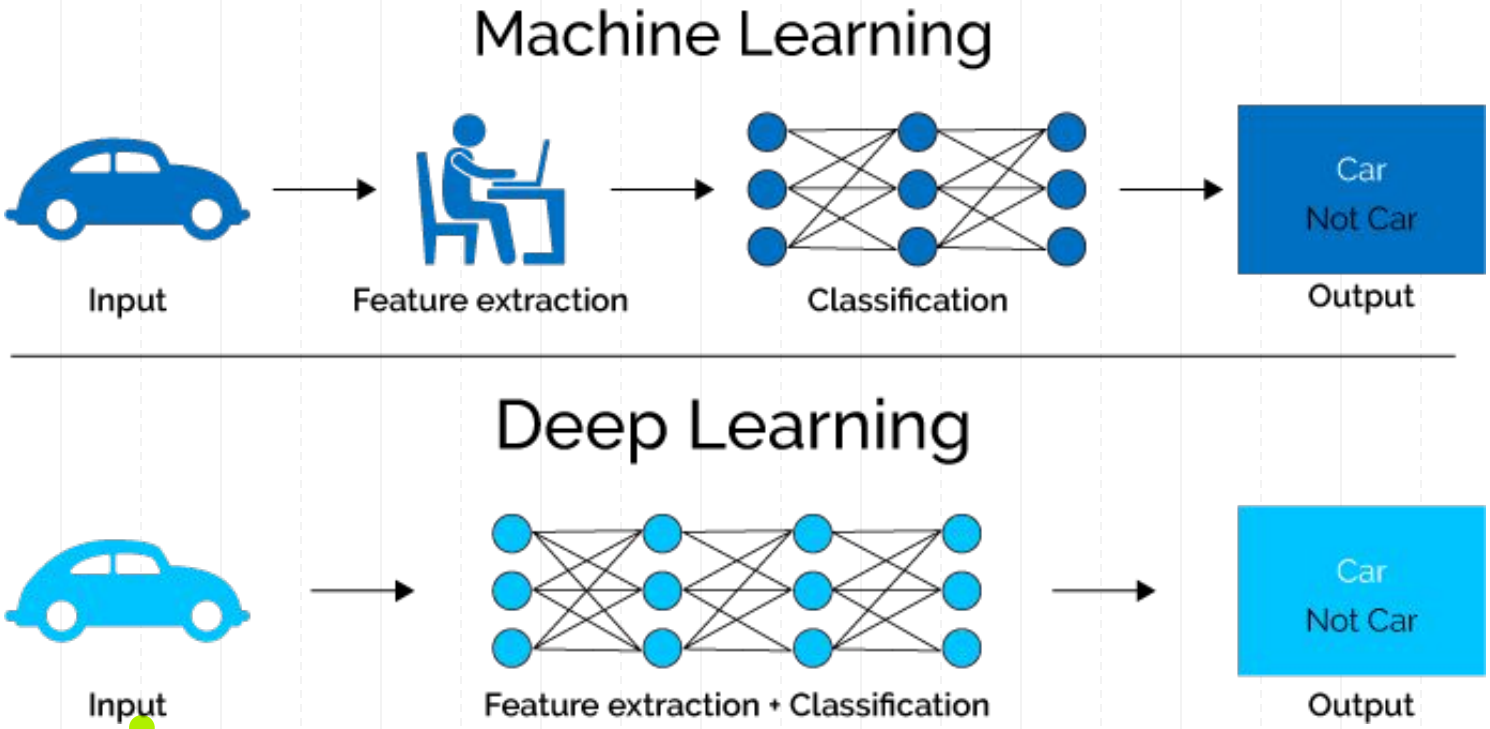
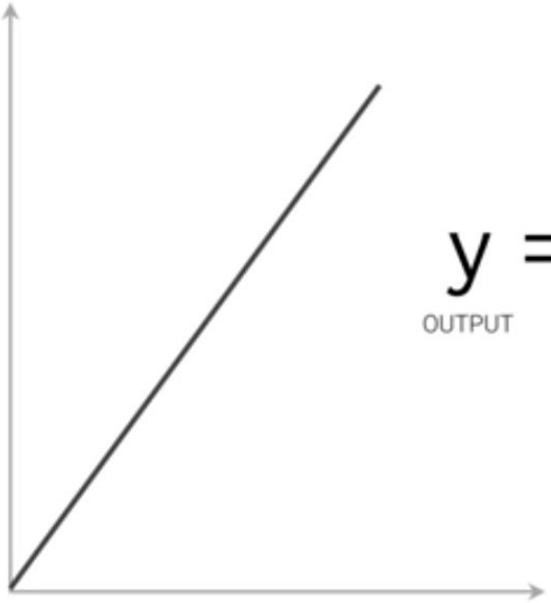
INPUT > CLASSIFIER > OUTPUT

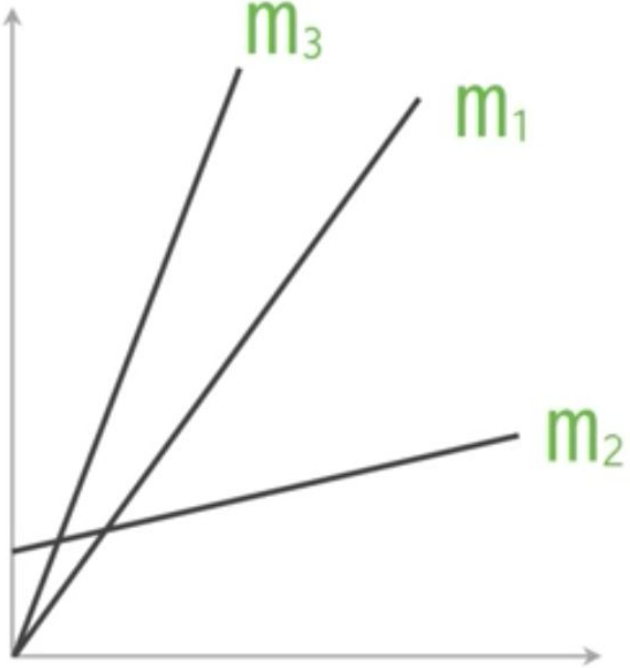


LINEAR CLASSIFIERS

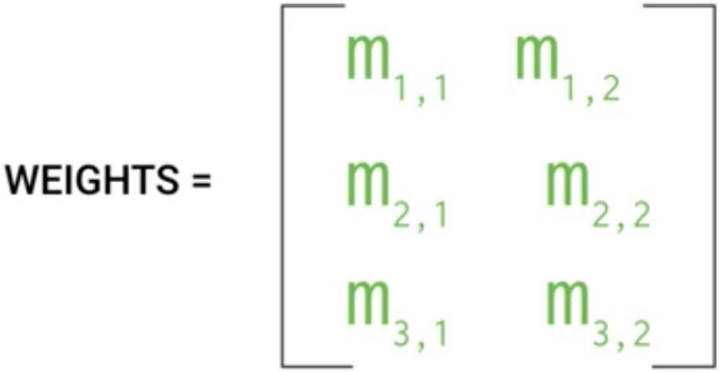


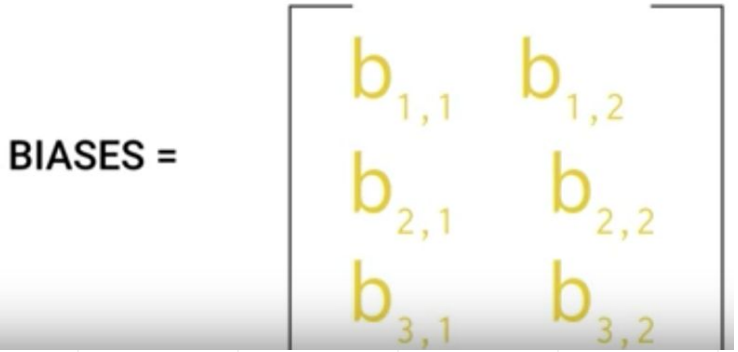
$$y = m * x + b$$

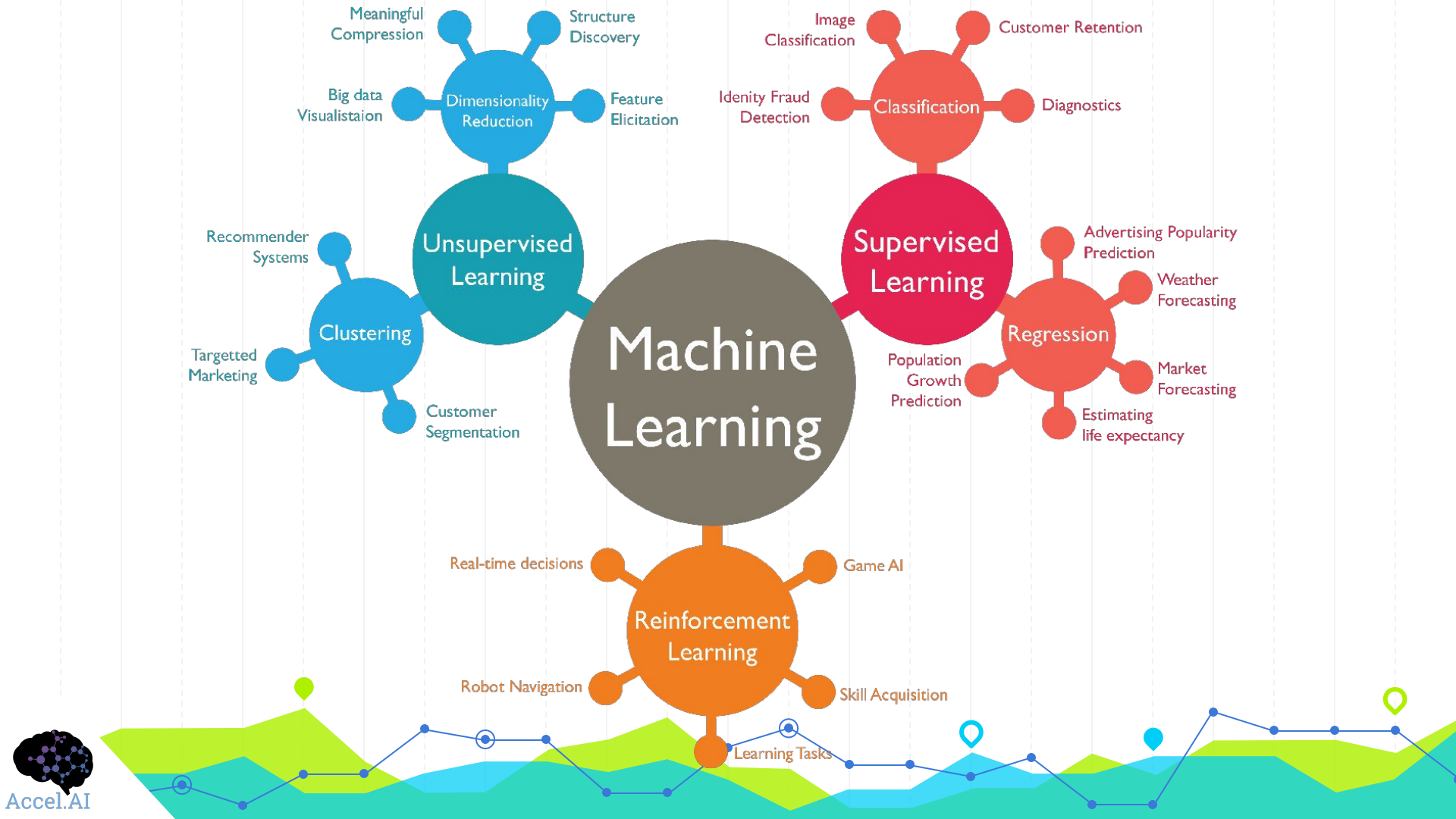
OUTPUT SLOPE INPUT Y-INTERCEPT



WEIGHTS & BIASES






Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

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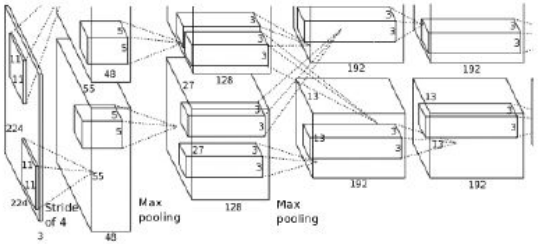
The Deep Learning "Computer Vision Recipe"

Big Data: ImageNet

+



Deep Convolutional Neural Network

+

Backprop on GPU

=

Learned Weights

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Computer Vision

4

How do computers see the world?

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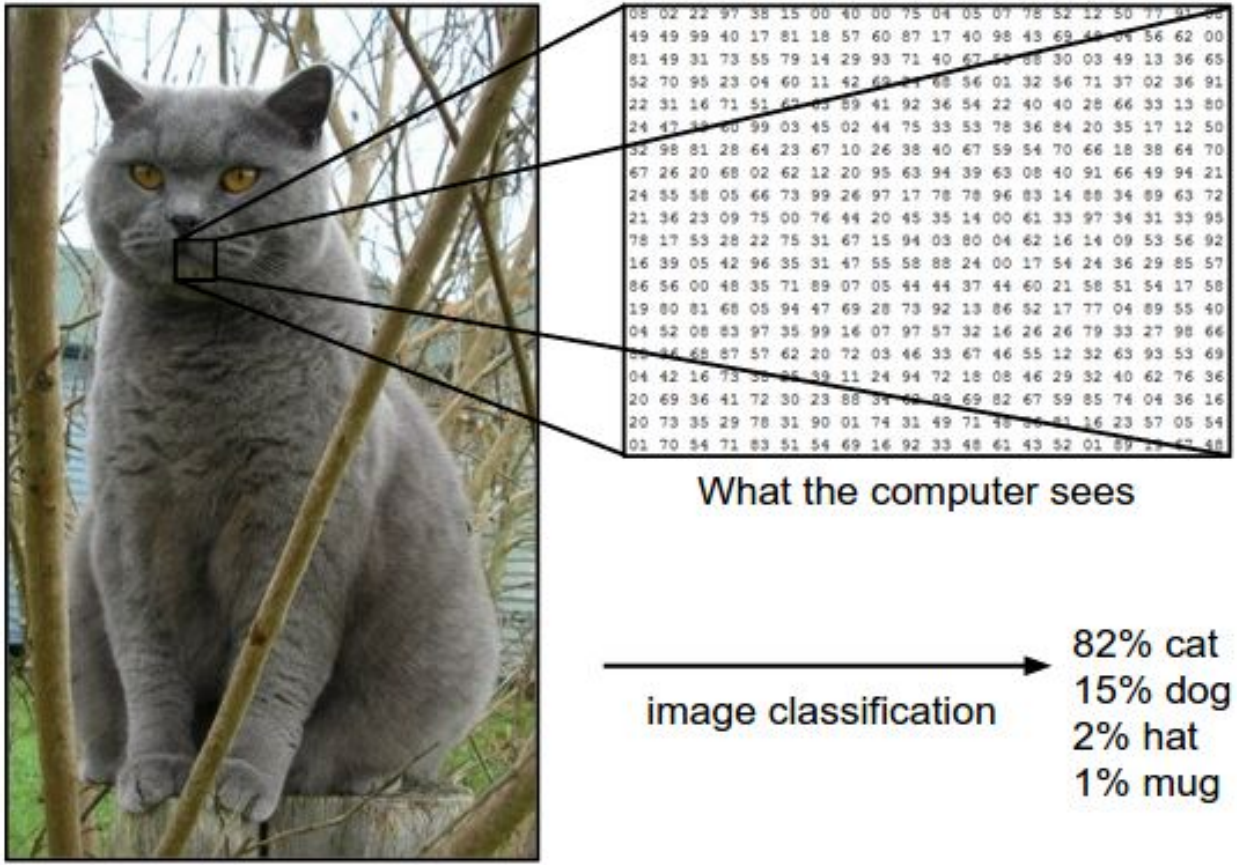

What the computer sees

image classification

82% cat
15% dog
2% hat
1% mug

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ML Steps

7 Steps in Machine Learning

5

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MACHINE LEARNING PROCESS

Training Data

Prediction

Model
[W, b]

Test & Update
[W, b]

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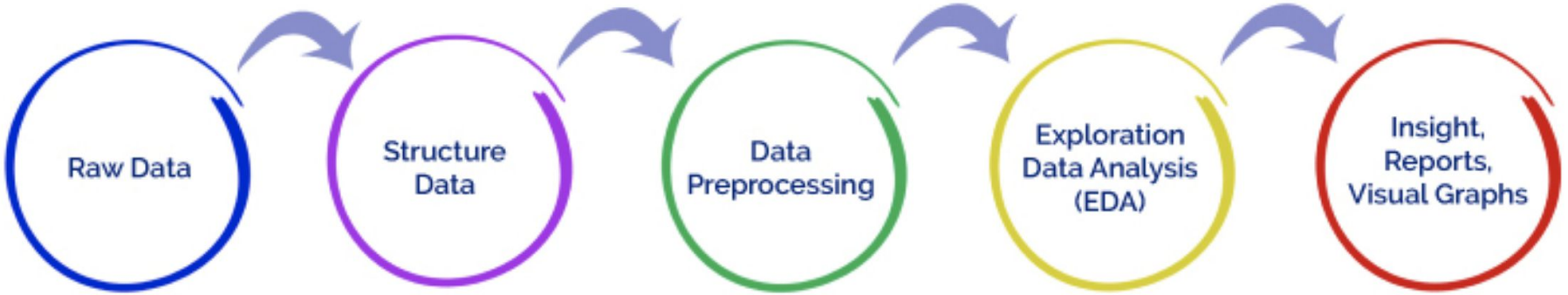
Face	Hair Color	Lips	Nose	Skin Lightness (chromaticities)	Label
1	blonde	slightly vertically thin upper and lower lips	thin to slightly wider nose	Highest % lightness	European
2	black	thicker	wider nose and nostrils	Lowest % lightness	African
3	black	longer upper lip	slightly wider nose and nostrils	Higher % yellow	Asian

DATA PREPARATION



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Challenges

6

What could possibly go wrong?

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VIEWPOINT VARIATION

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ILLUMINATION

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DEFORMATION

OCCLUSION

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BACKGROUND CLUTTER

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VARIATION

Models

7

What is the best model?

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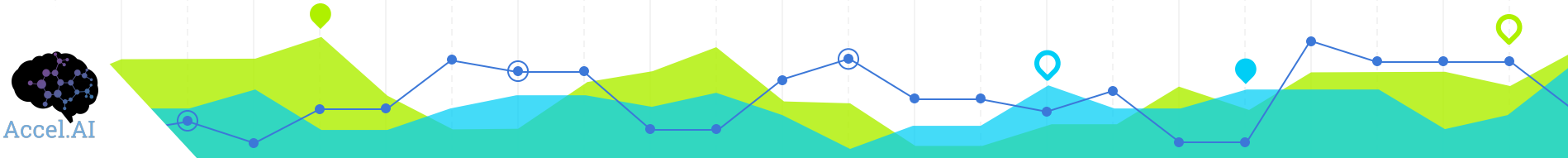
CHOOSING A MODEL

PyTorch Models

https://pytorch.org/docs/stable/torchvision/models.html

- AlexNet
- VGG
- ResNet
- SqueezeNet
- DenseNet
- Inception v3



TRAINING YOUR OWN MODEL

- Millions of images in hundreds of categories
- Access to multiple GPUs
- A few weeks (2-3 for Image Net) to spare

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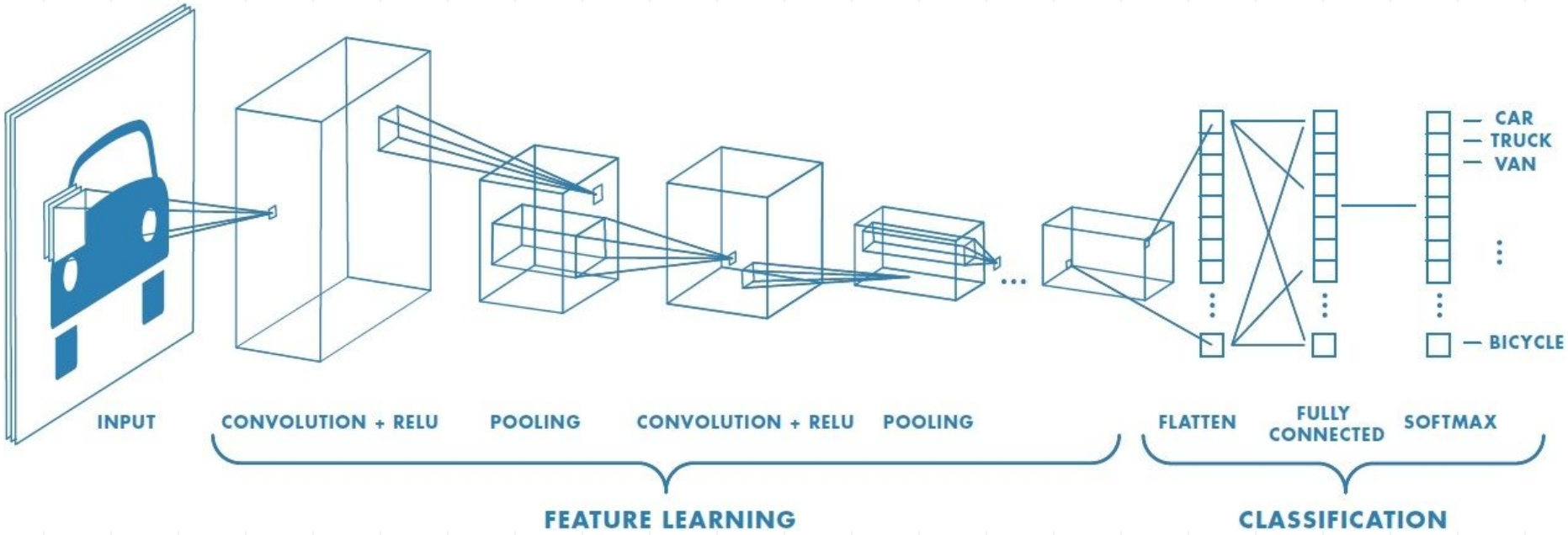
CAR
TRUCK
VAN
BICYCLE
INPUT
CONVOLUTION + RELU
POOLING
CONVOLUTION + RELU
POOLING
FLATTEN
FULLY CONNECTED
SOFTMAX
FEATURE LEARNING
CLASSIFICATION

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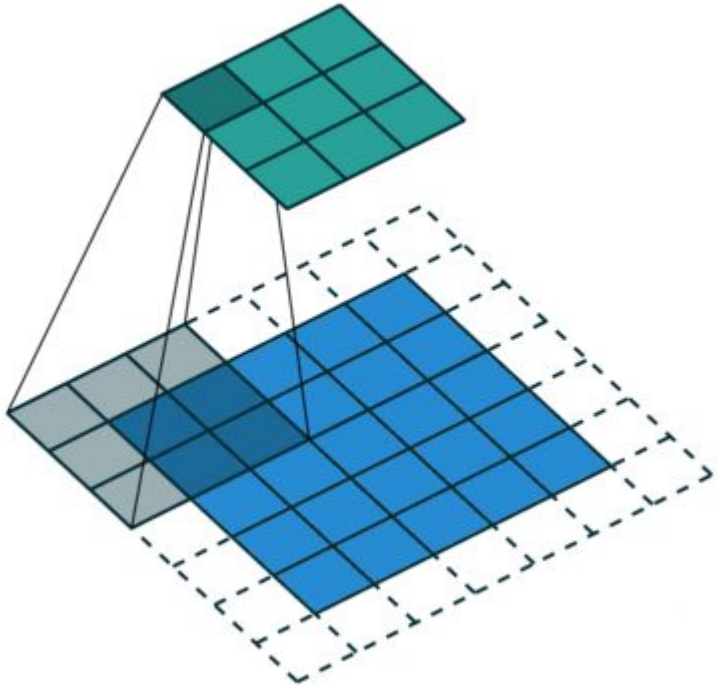
Convolutional Arithmetic



https://github.com/vdumoulin/conv_arithmetic

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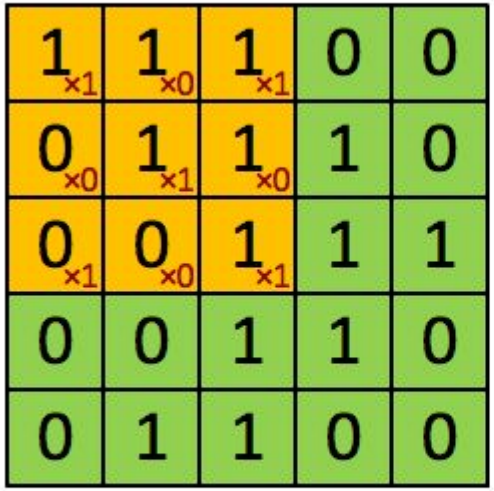
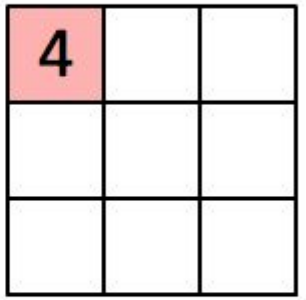
Convolutional Arithmetic





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Evaluation & Tuning

8

How do we improve accuracy?

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EVALUATION

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HYPERPARAMETERS

Choices about the algorithm that we set rather than learn.

Problem Dependent

Trial and Error Experimentation

- Idea #1 - Choose parameters that work best on Dataset
- Idea #2 - Split data into **train** and **test**, choose hyperparameters that work best on test data
- Idea #3 - Split data into **train**, **validation**, and **test**; choose hyperparameters on validation and evaluate on test

Which option will tell you how your algorithm is performing on unseen data?

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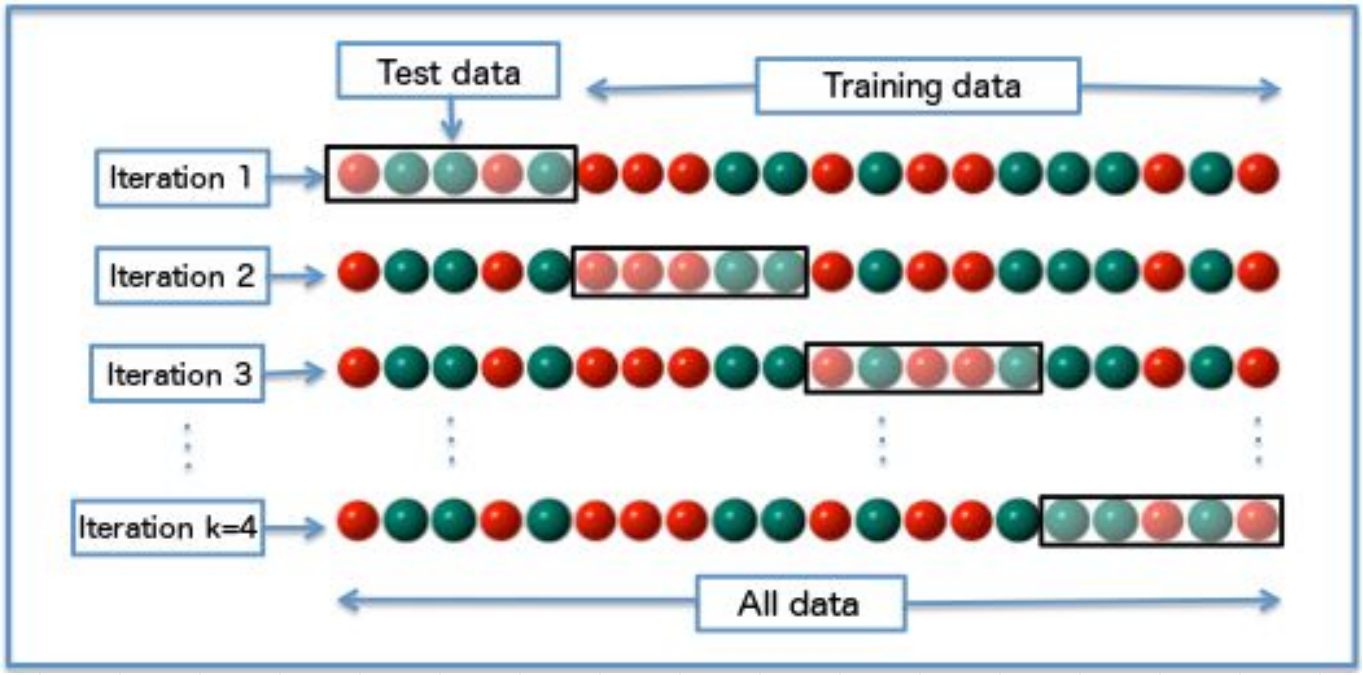
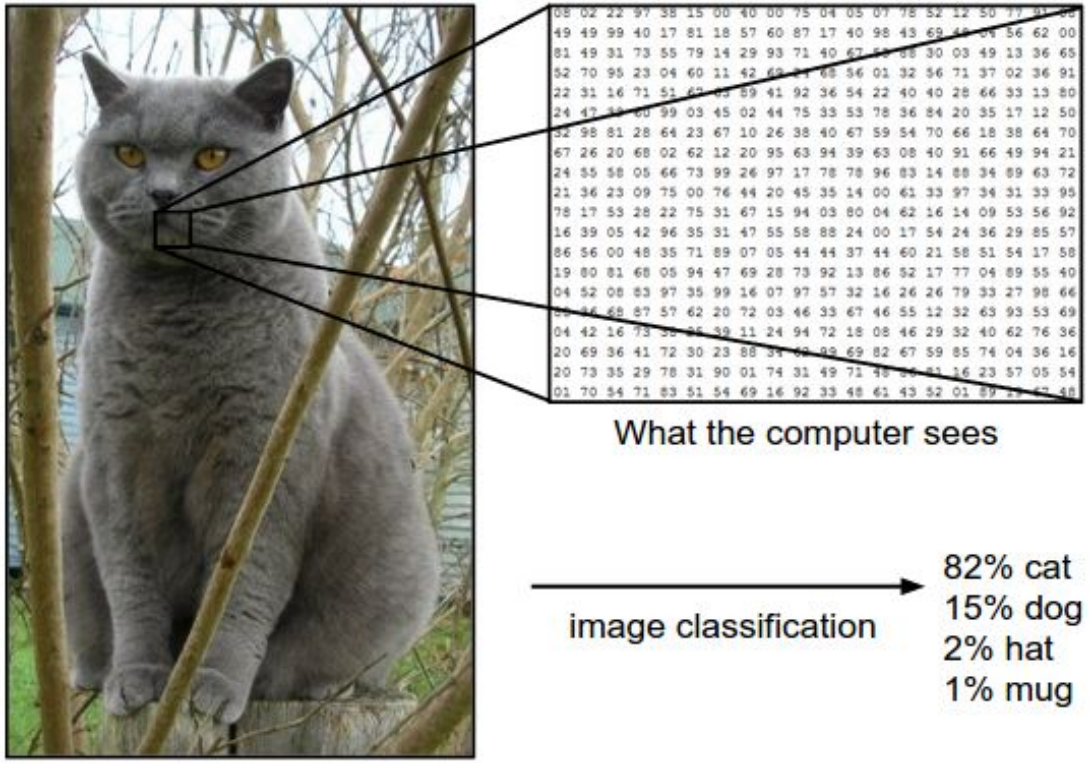
CROSS VALIDATION



INFERENCE


What the computer sees
image classification
82% cat
15% dog
2% hat
1% mug

Applied Lab

What are we working on today?

9

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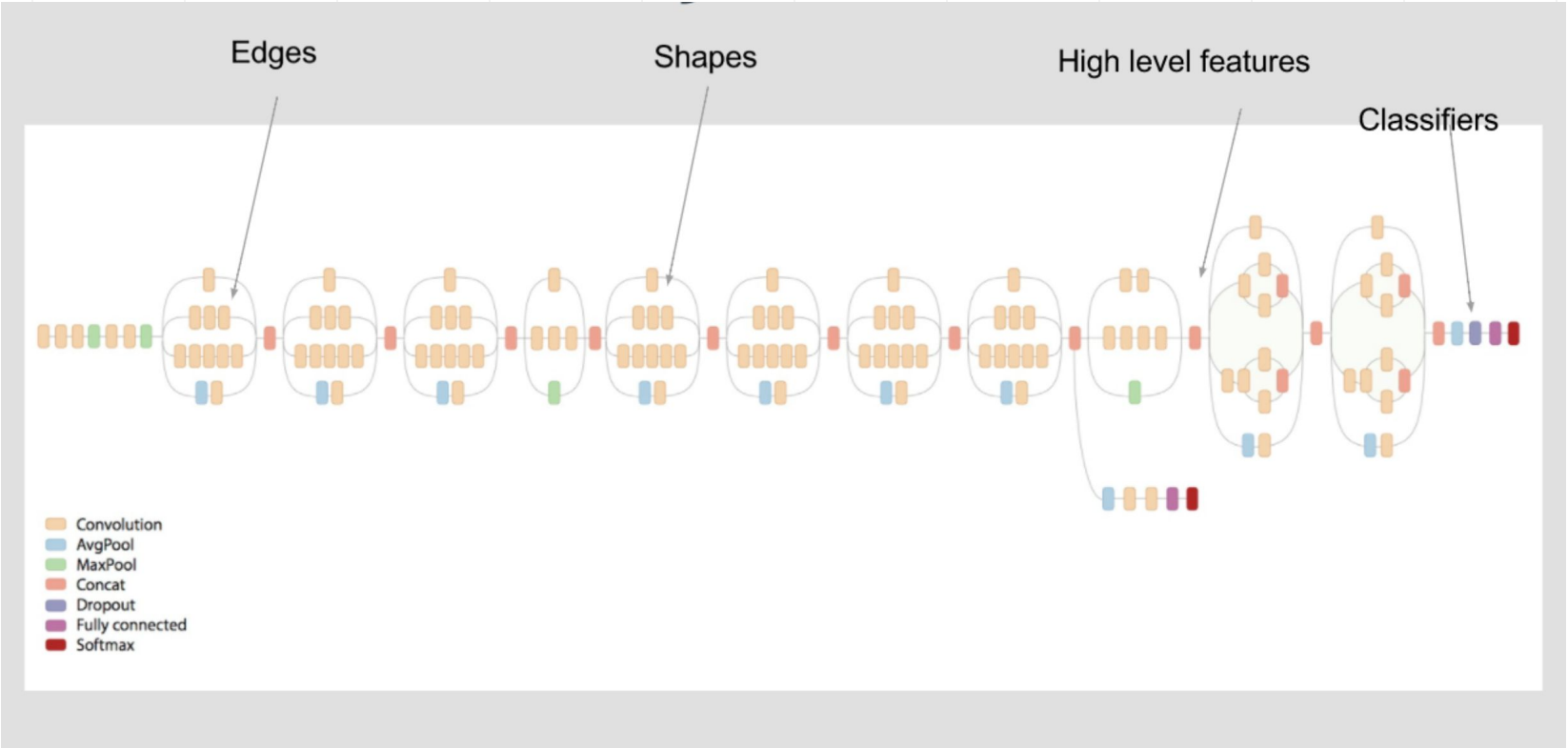
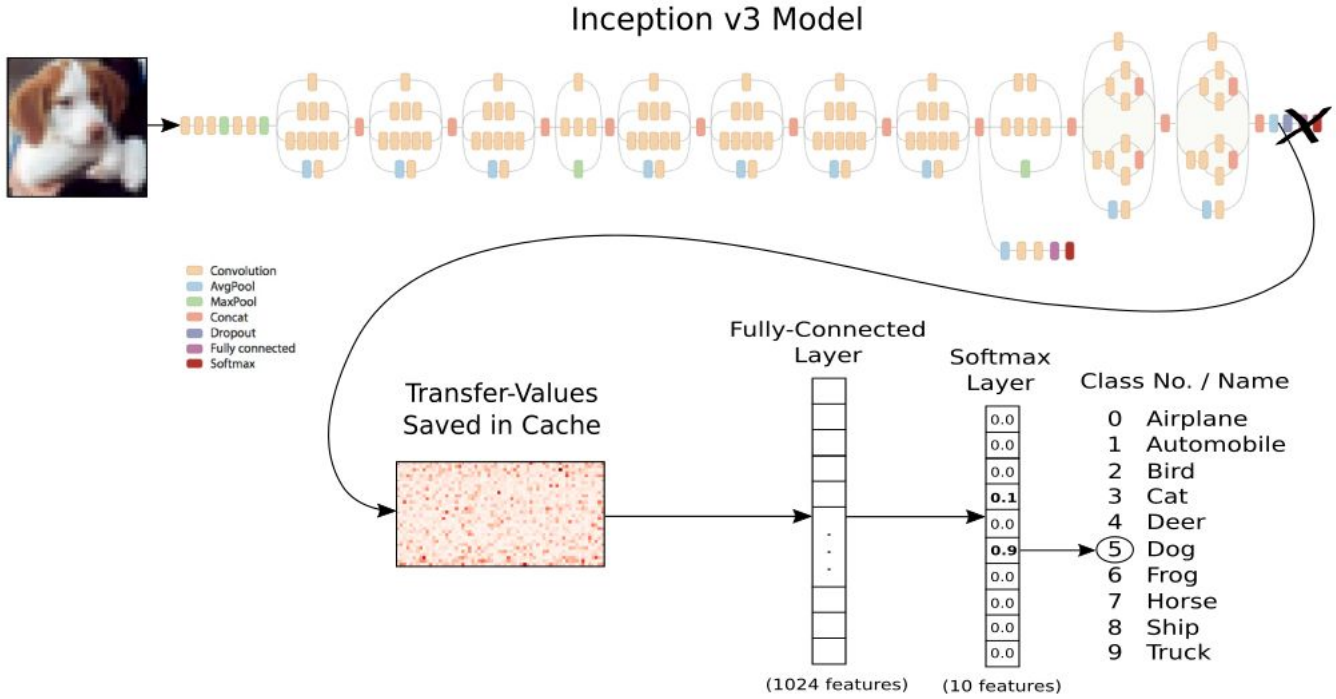


Inception V3 Google Research

(Re)TRAINING - TRANSFER LEARNING



Object Detection

Photo by Juanedc (CC BY 2.0)

Finegrain Classification

Photo by HarshLight (CC BY 2.0)

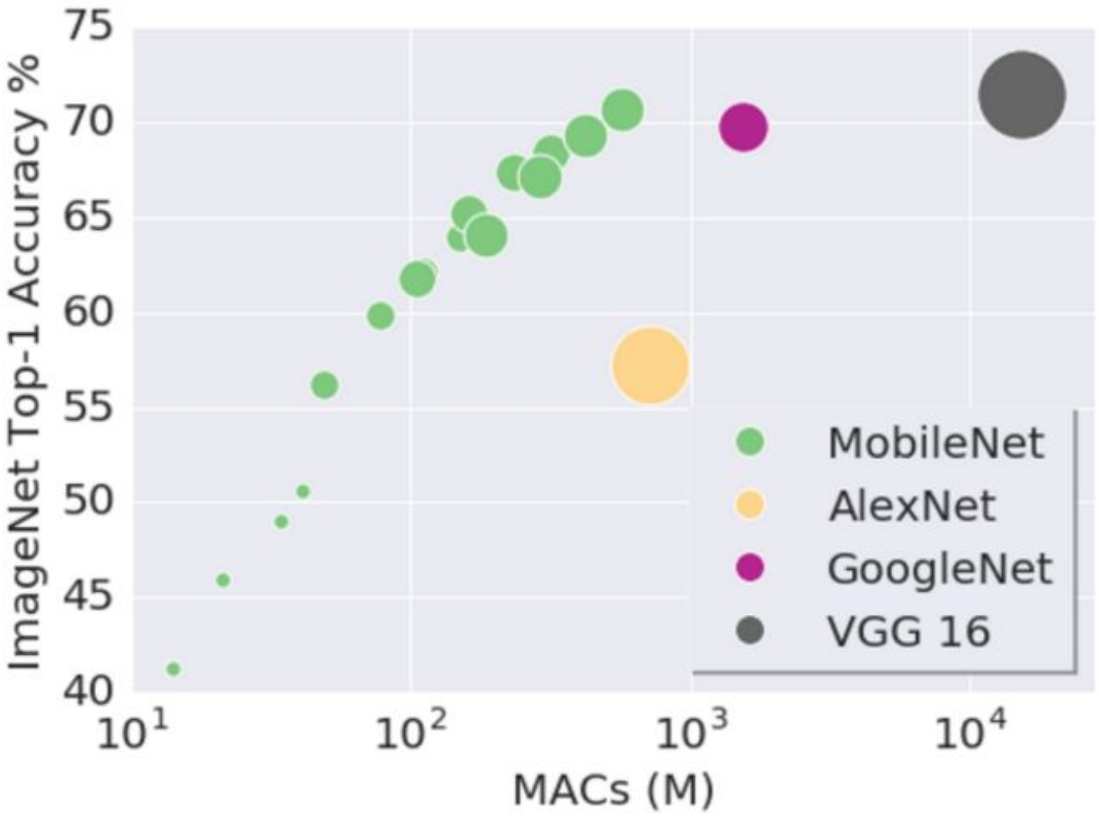
Face Attributes

Google Doodle by Sarah Harrison

Landmark Recognition

Photo by Sharon VanderKaay (CC BY 2.0)

[MobileNets: Open-Source Models for Efficient On-Device Vision]


ImageNet Top-1 Accuracy %
75
70
65
60
55
50
45
40
10^1
10^2
10^3
10^4
MACs (M)
MobileNet
AlexNet
GoogleNet
VGG 16

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APPLIED AI LAB

Image Classification in PyTorch
https://github.com/latinxinai/Intro-Image-Captioning

Lowering the barriers to entry in engineering artificial intelligence...

We focus on integrating AI and Social Impact through training, study sessions, and events with a focus on mindfulness and Applied AI engineering.

Our target audience includes underrepresented groups in tech, social justice advocates, and those experiencing job loss due to automation.

Accel.AI

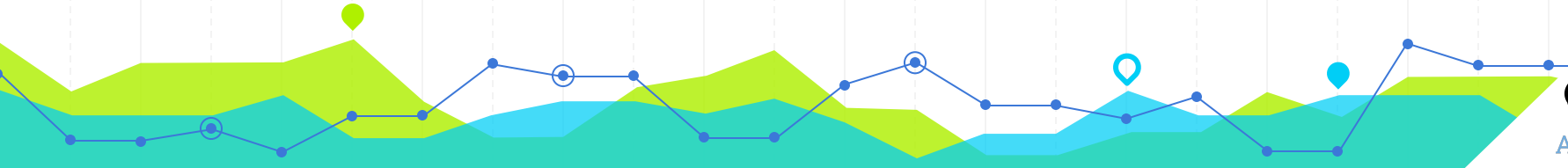
www.accel.ai | info@accel.ai

THANKS!

Any questions?

You can find me at

@quickresolute / info@accel.ai



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REFERENCES

Irene Chen A Beginner's Guide to Deep Learning PyCon 2016

MobileNets: Efficient Convolutional Neural Networks for Mobile Vision Applications

Stanford CS231n: Computer Vision

http://news.mit.edu/2014/in-the-blink-of-an-eye-0116

How Vision Works

Deep Learning Book

The genetics of the human face: identification of large effect single gene variants

Characterising the variations in ethnic skin colours: a new calibrated data base for human skin

Beauty Analysis: Face Variations by Ethnic Group