Computer Vision
Machine Learning & AI

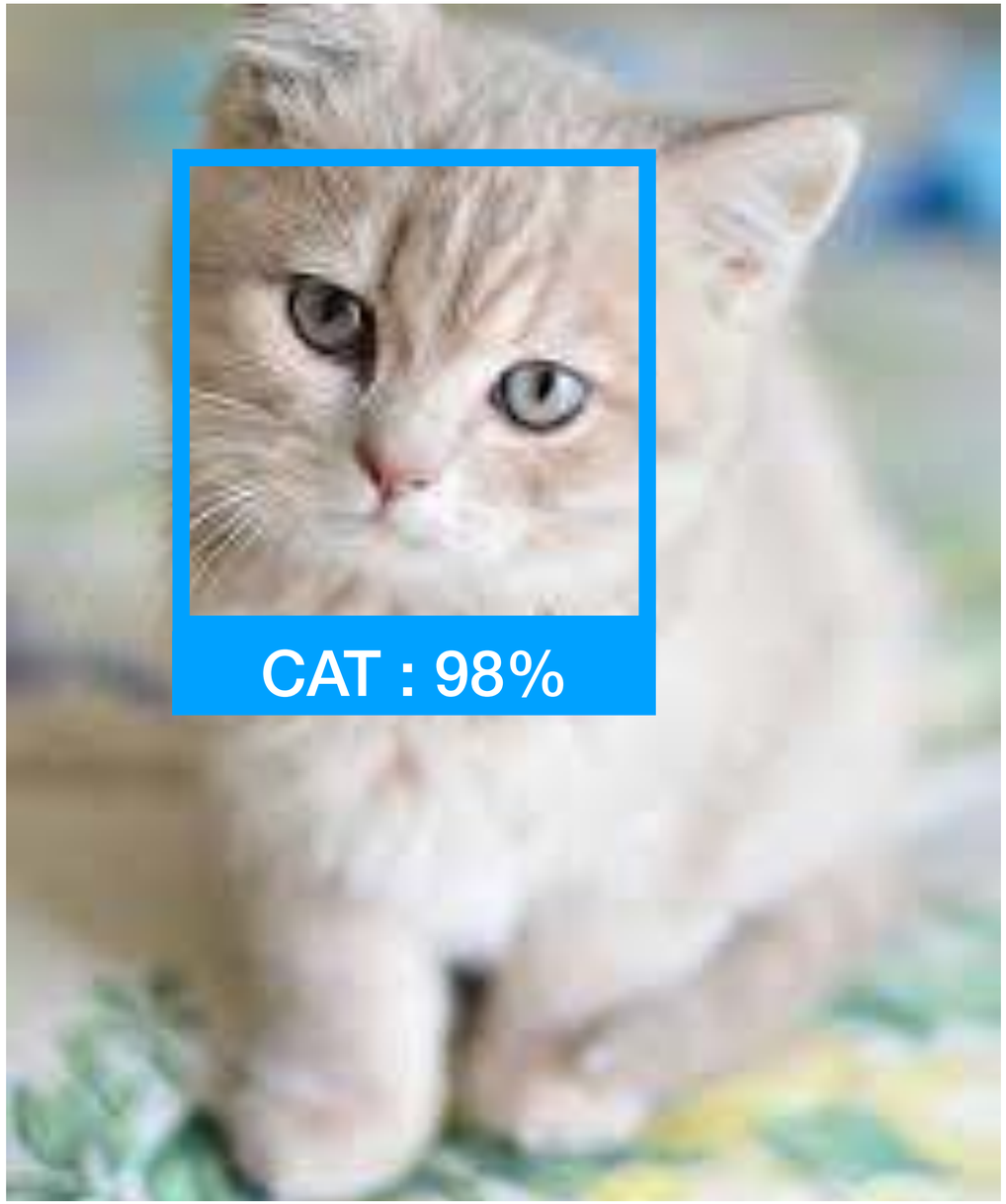
Satya Mallick, Ph.D.
LearnOpenCV.com

What the world thinks I do

What my mom thinks I do

What other Computer Scientists think I do

What I really Do



Background

- Ph.D. from University of California, San Diego, **2006**
- Co-Founder, Sight Commerce Inc. **2007 - 2015**
- Founder, Big Vision LLC **2015**

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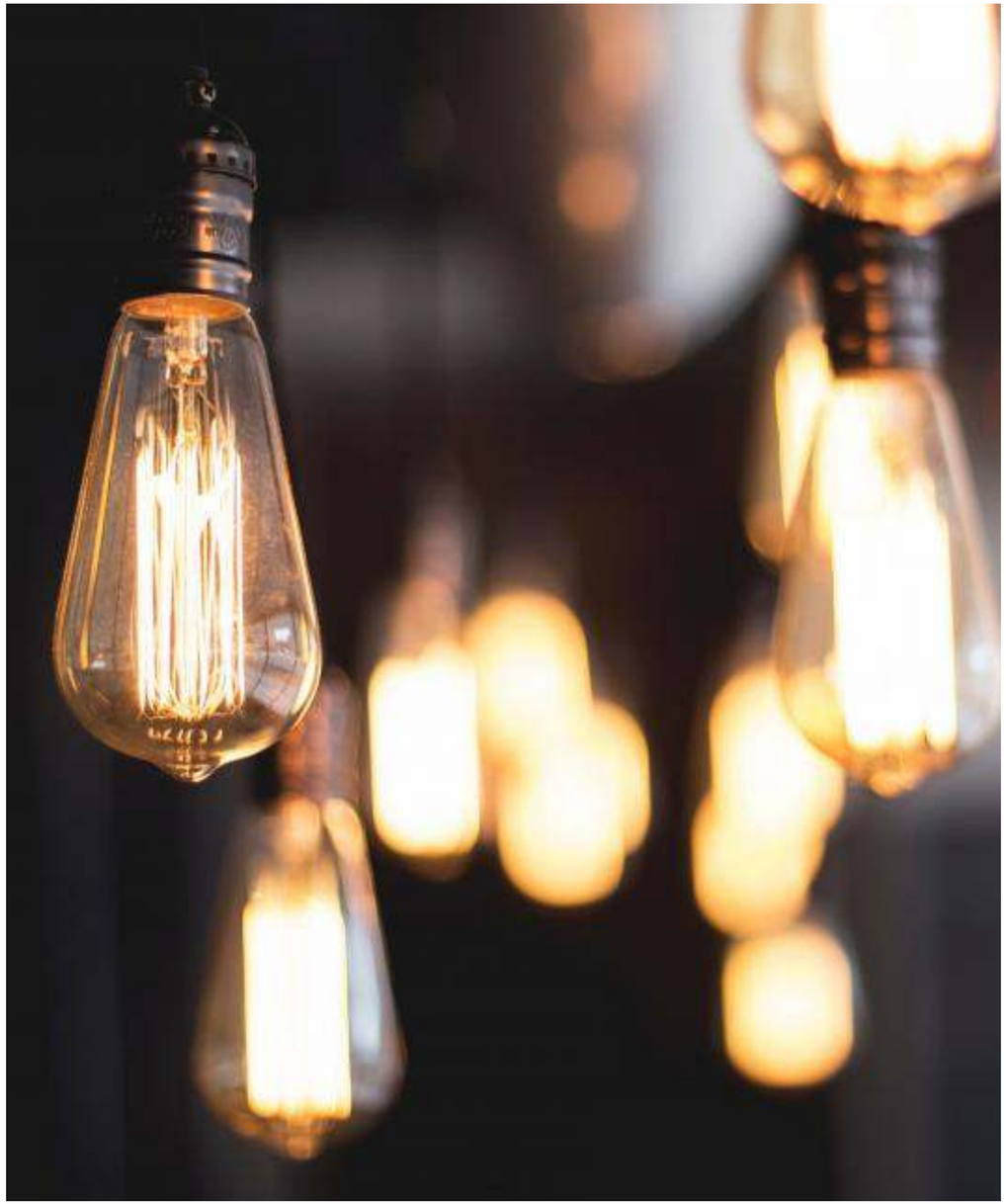
Top 30 most influential AI experts to follow on Twitter, **2017** - IBM AI Blog

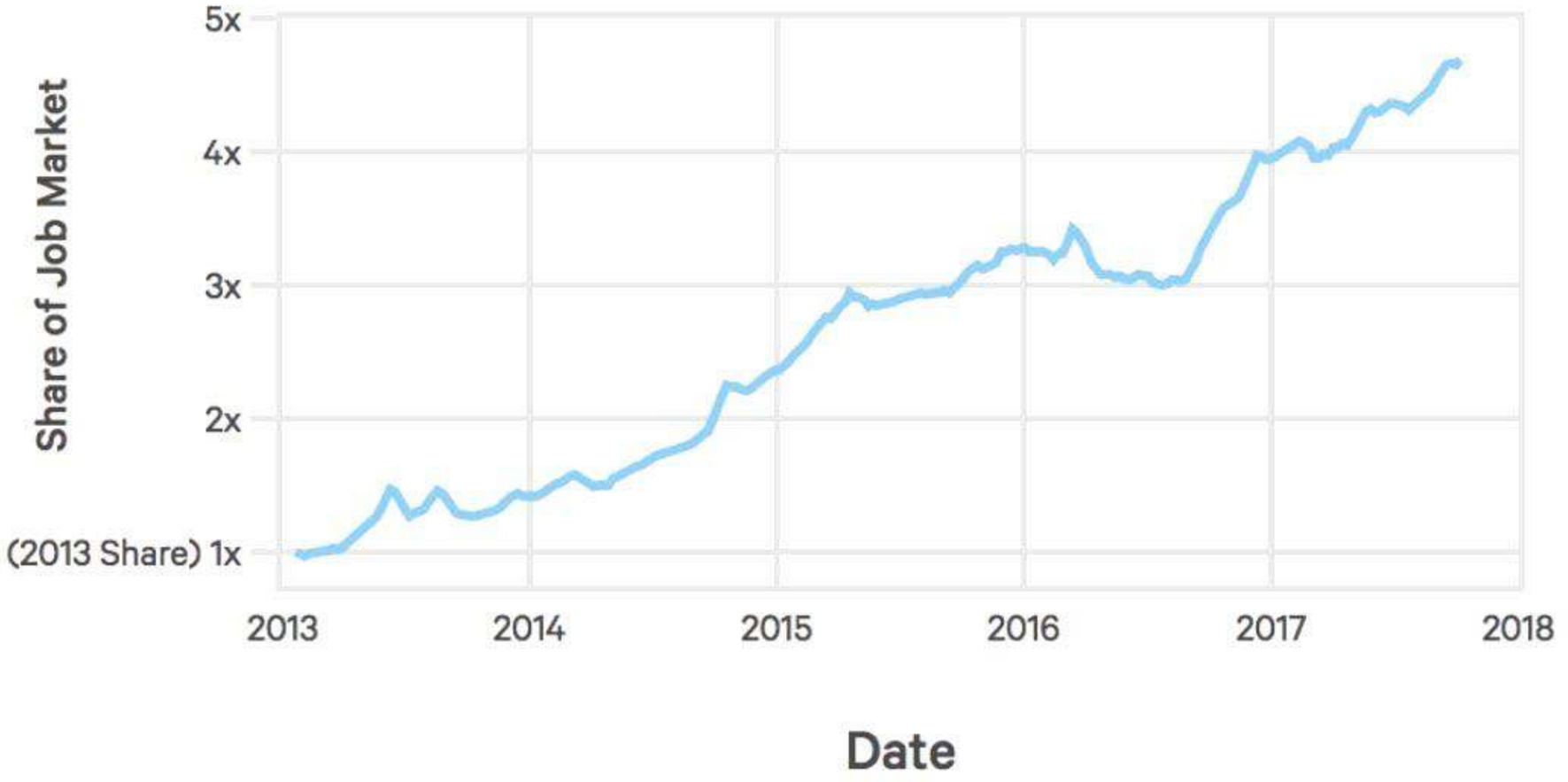
Nothing is as powerful as an idea whose time has come

AI is the new
ELECTRICITY



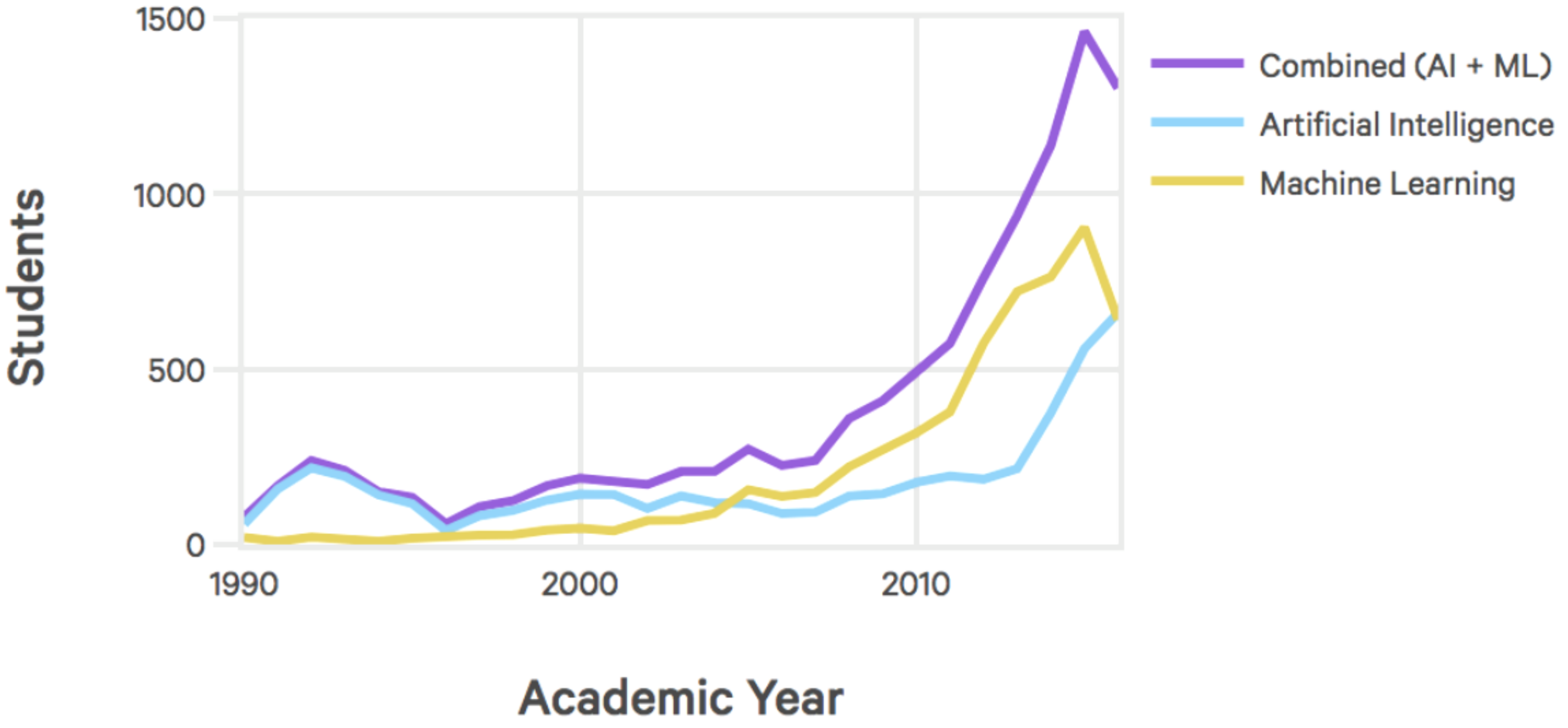

FINTECH

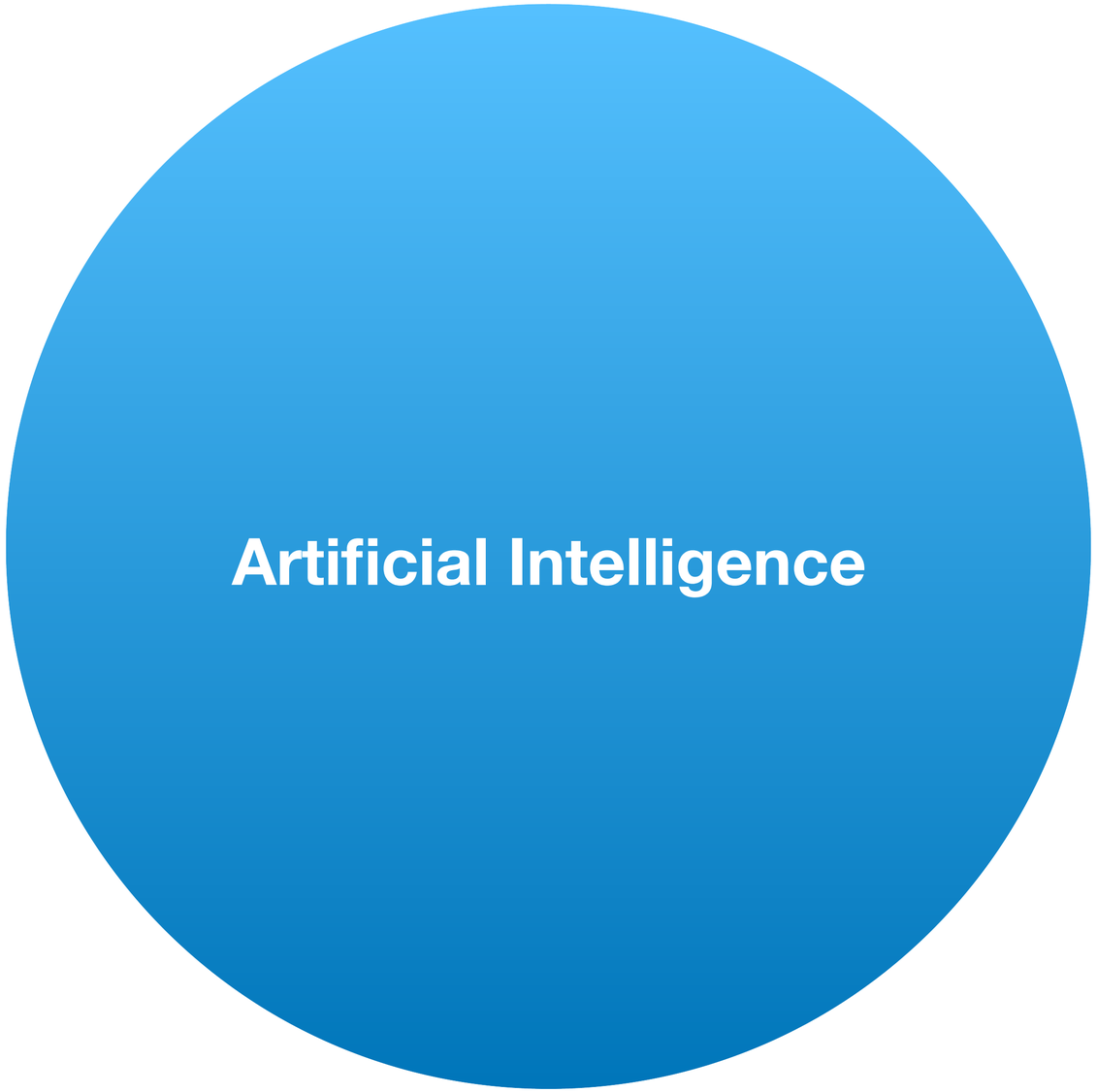
Share of US Jobs Requiring AI Skills (Indeed.com)



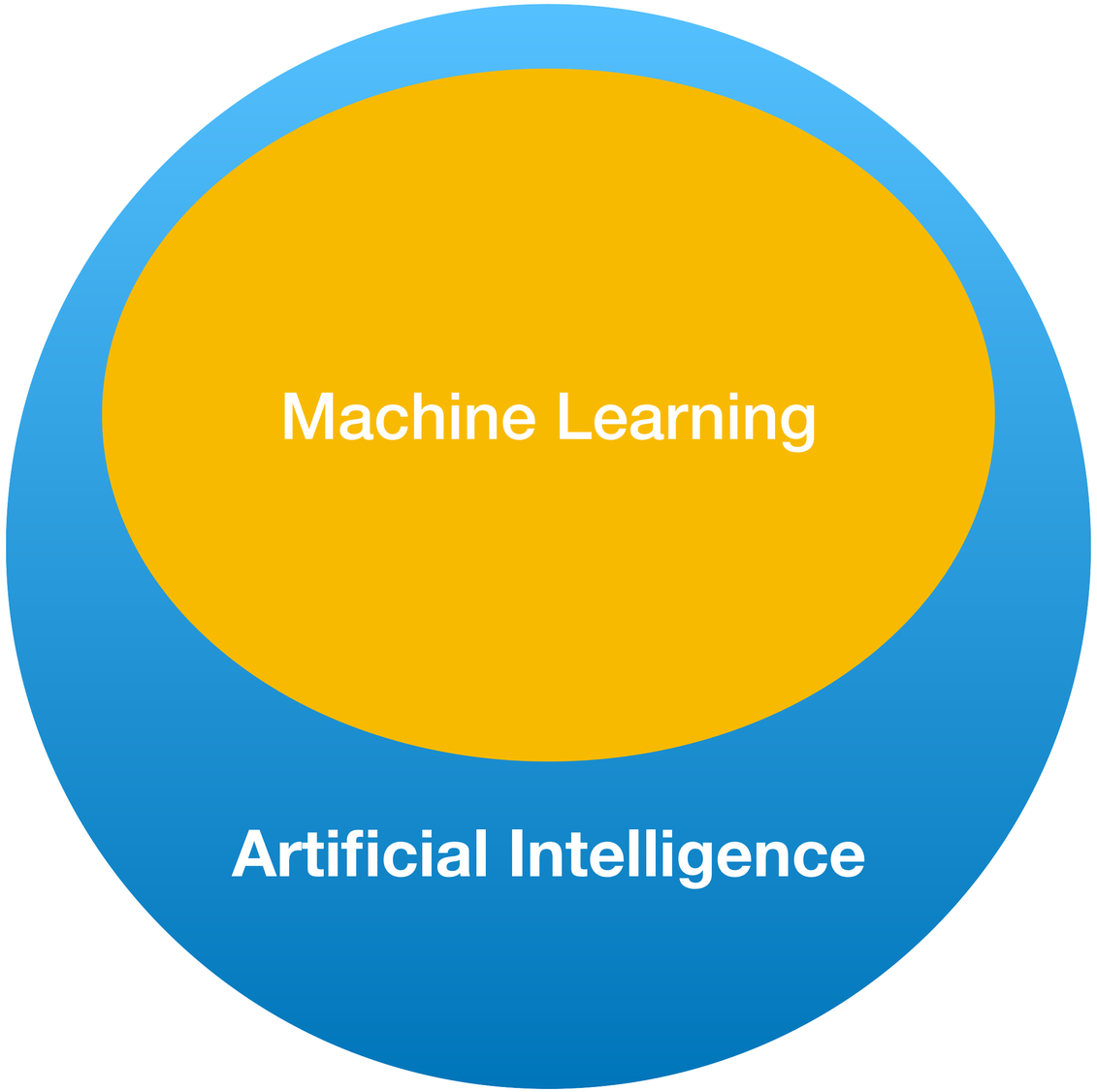
Sources: Indeed.com

Stanford Course Enrollment

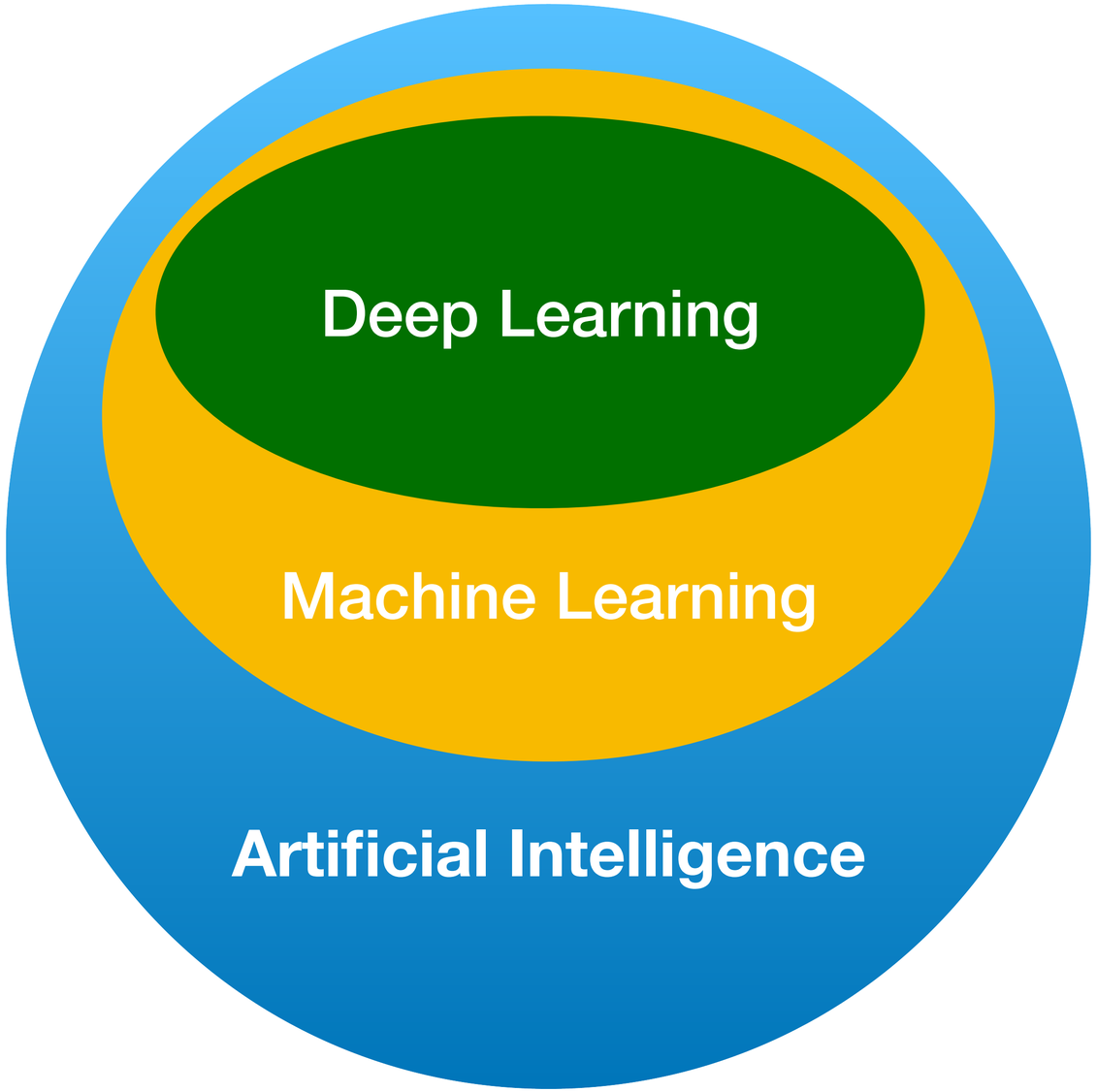




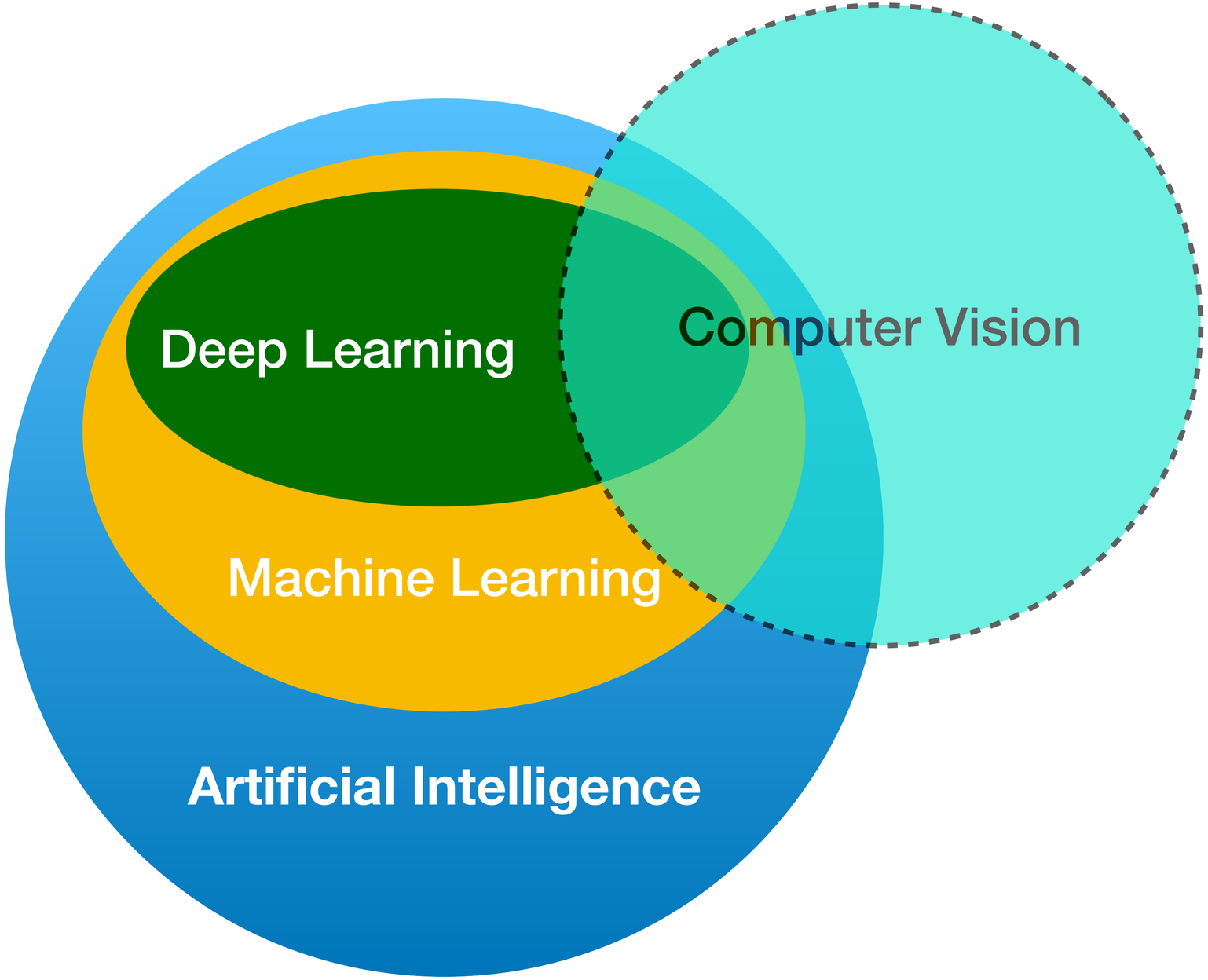
Make machines make decisions
like humans



Use data to teach machines



A specific kind of
machine learning that uses
“deep” neural networks



Help machines see

Artificial Intelligence

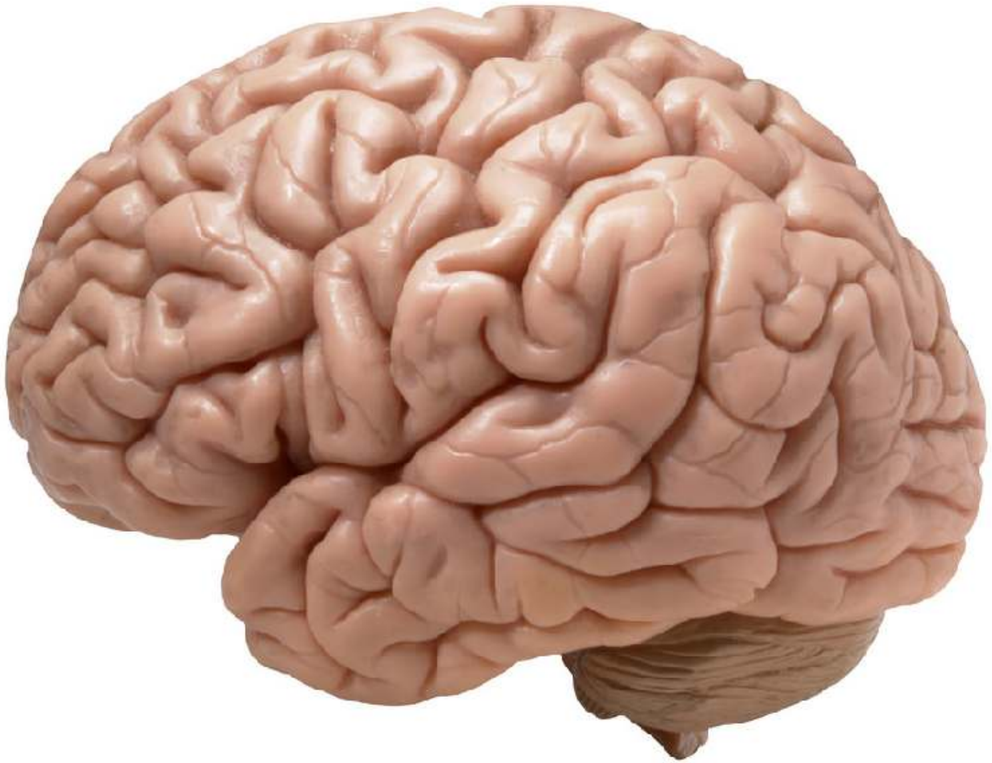
1. Computer Vision
2. Speech
3. Natural Language Processing

Why Computer Vision?

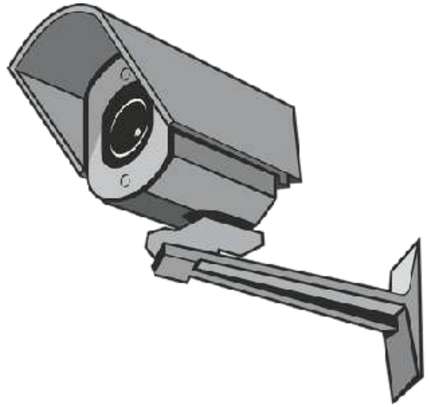
30% Vision

8% Touch

3% Hearing



Cameras are everywhere!

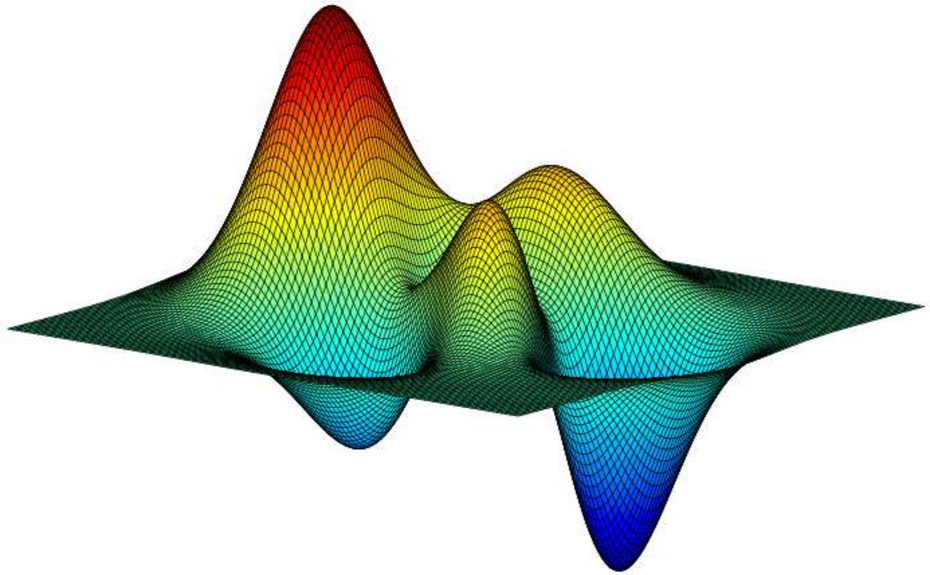


What is an image?

Programmer's View

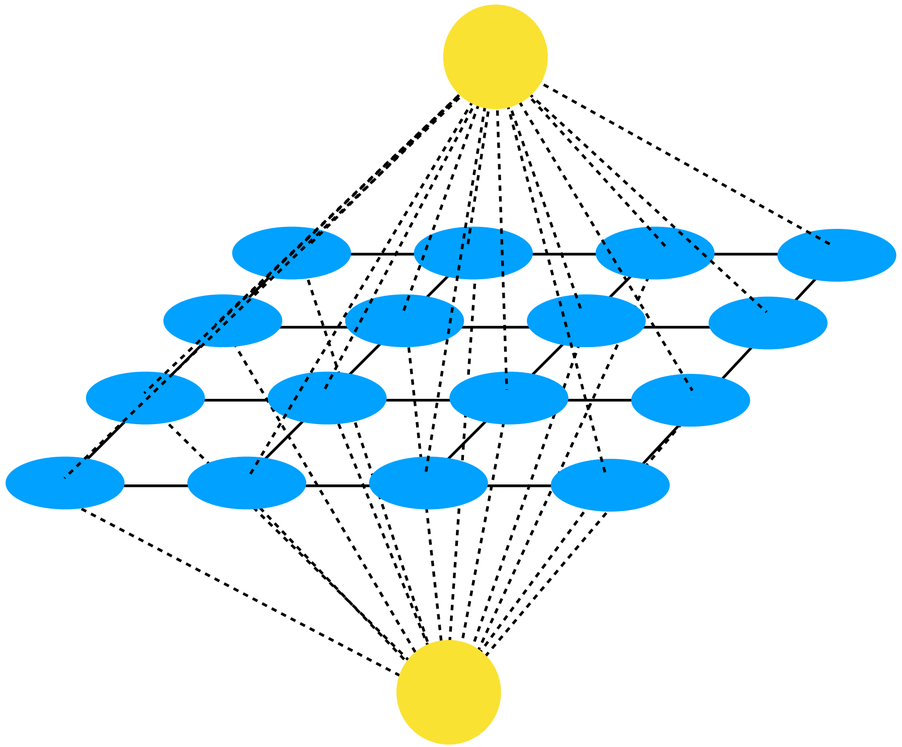
It's a multi-dimensional array!

Electrical Engineer’s View



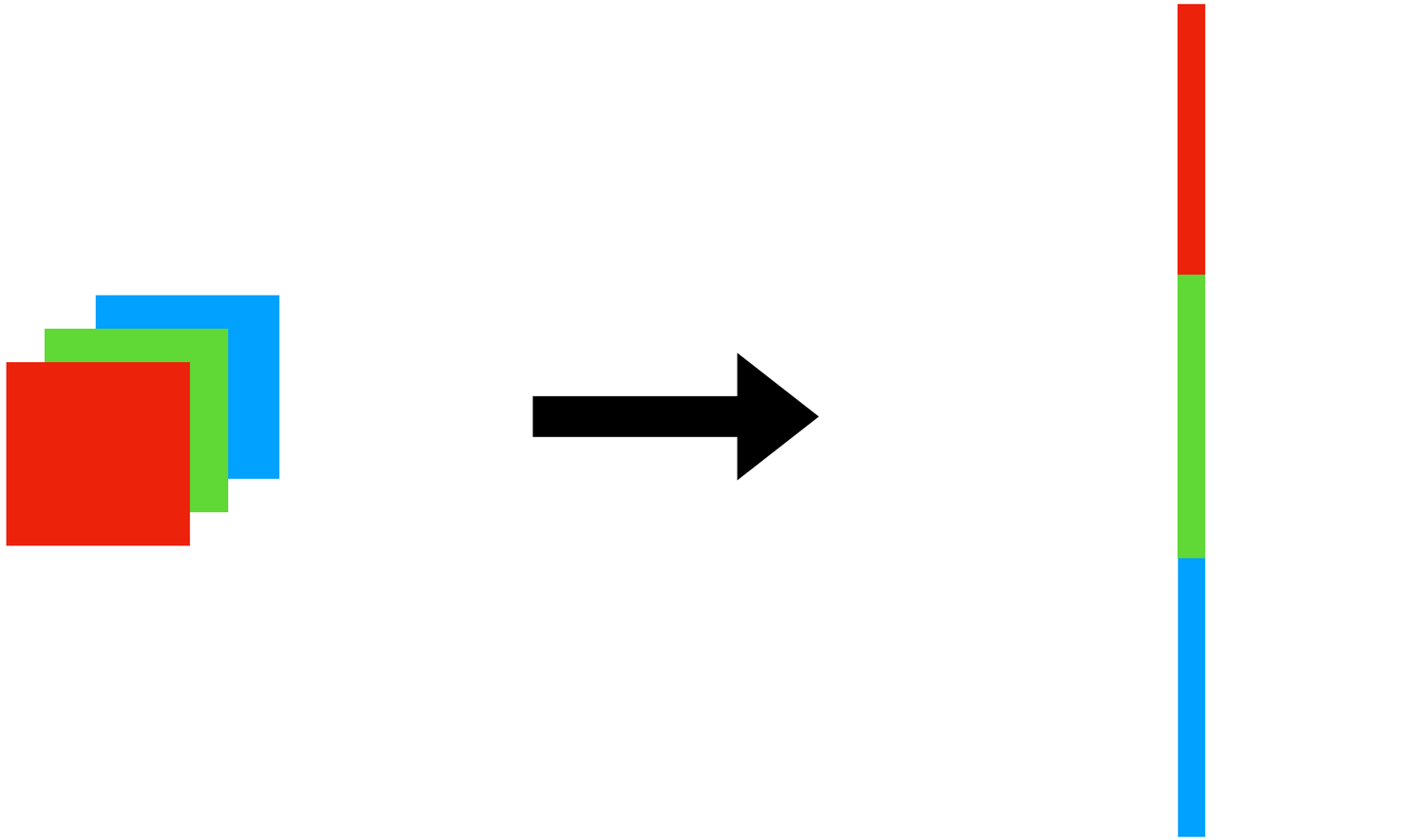
It’s a 2D signal

Computer Scientist’s View

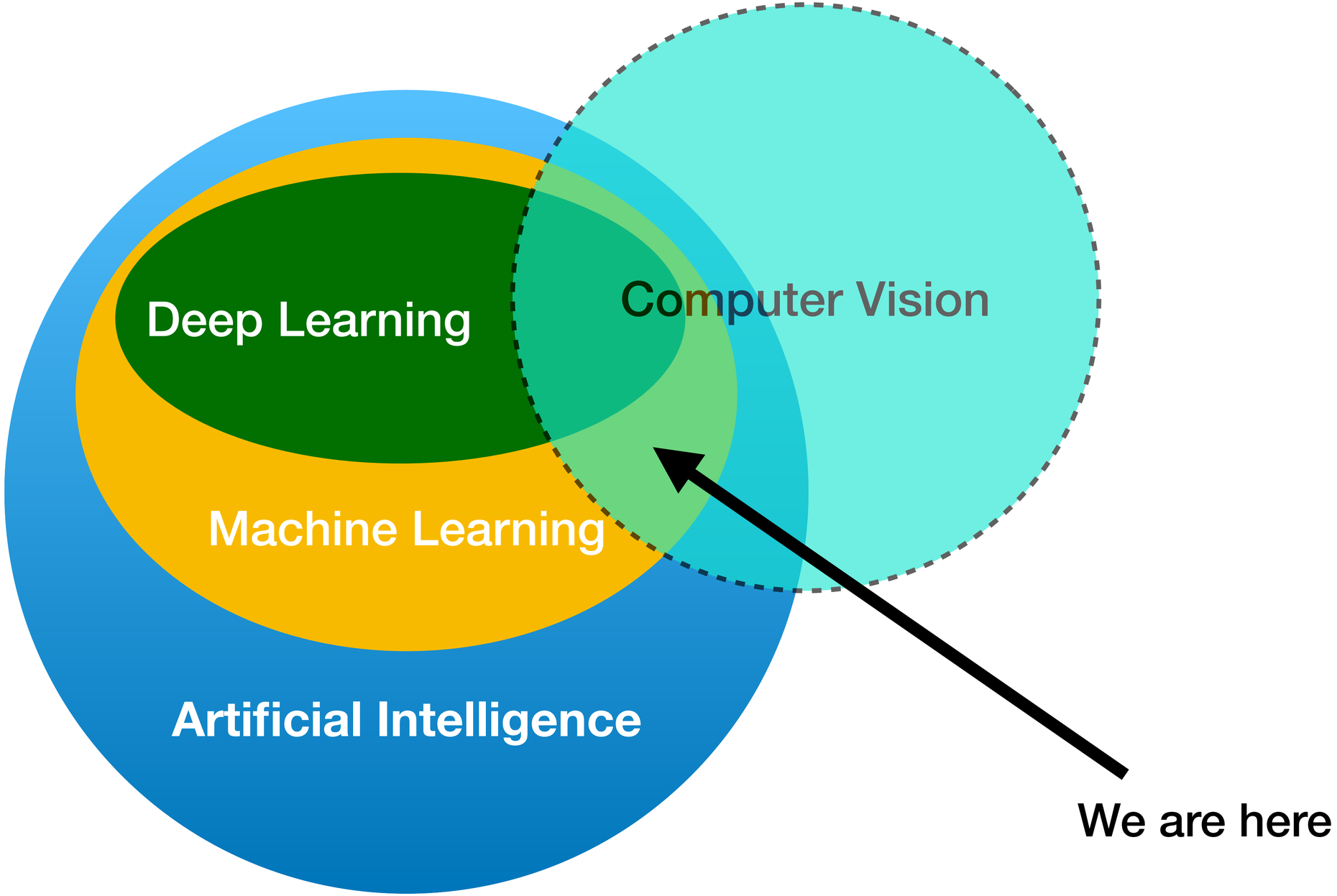


It’s a graph and every pixel is a node!

Mathematician’s View



It’s a point or vector in high dimensional space!


Deep Learning
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Artificial Intelligence
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Image Classification

Cat

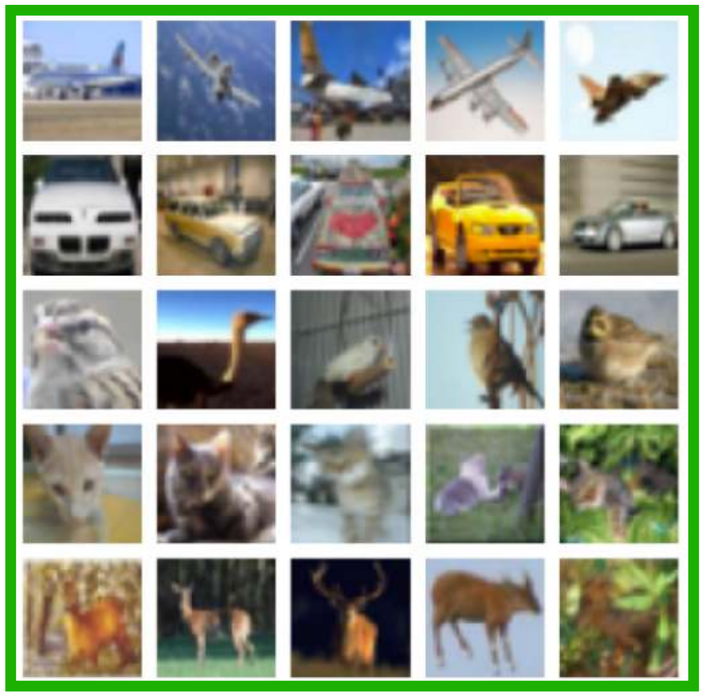
Dog

Other

Data collection

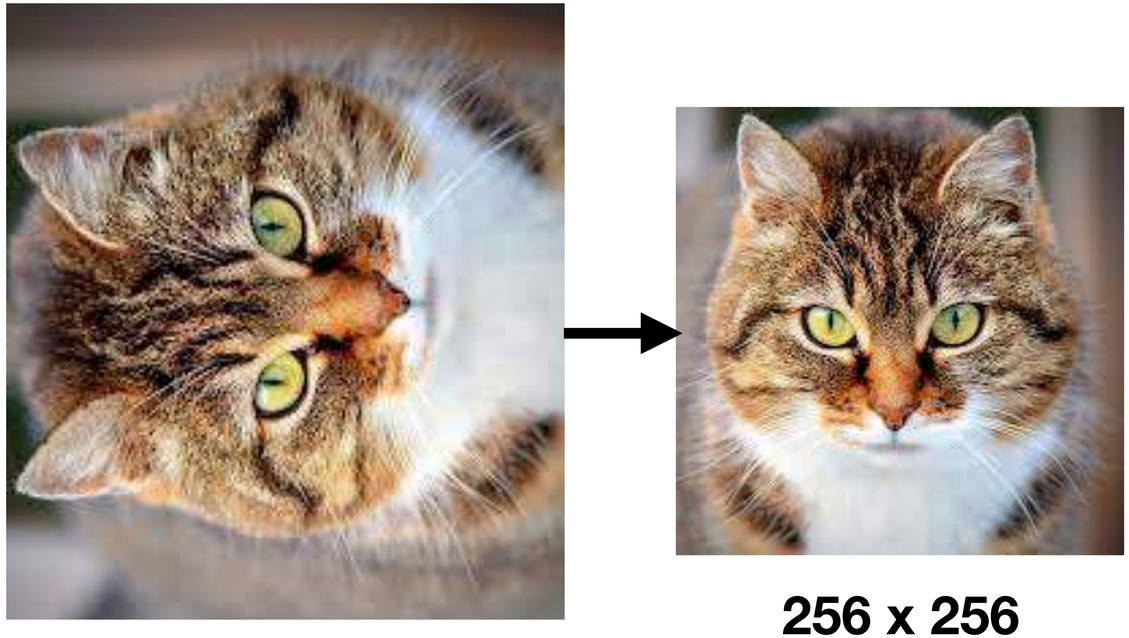
Cat

Dog



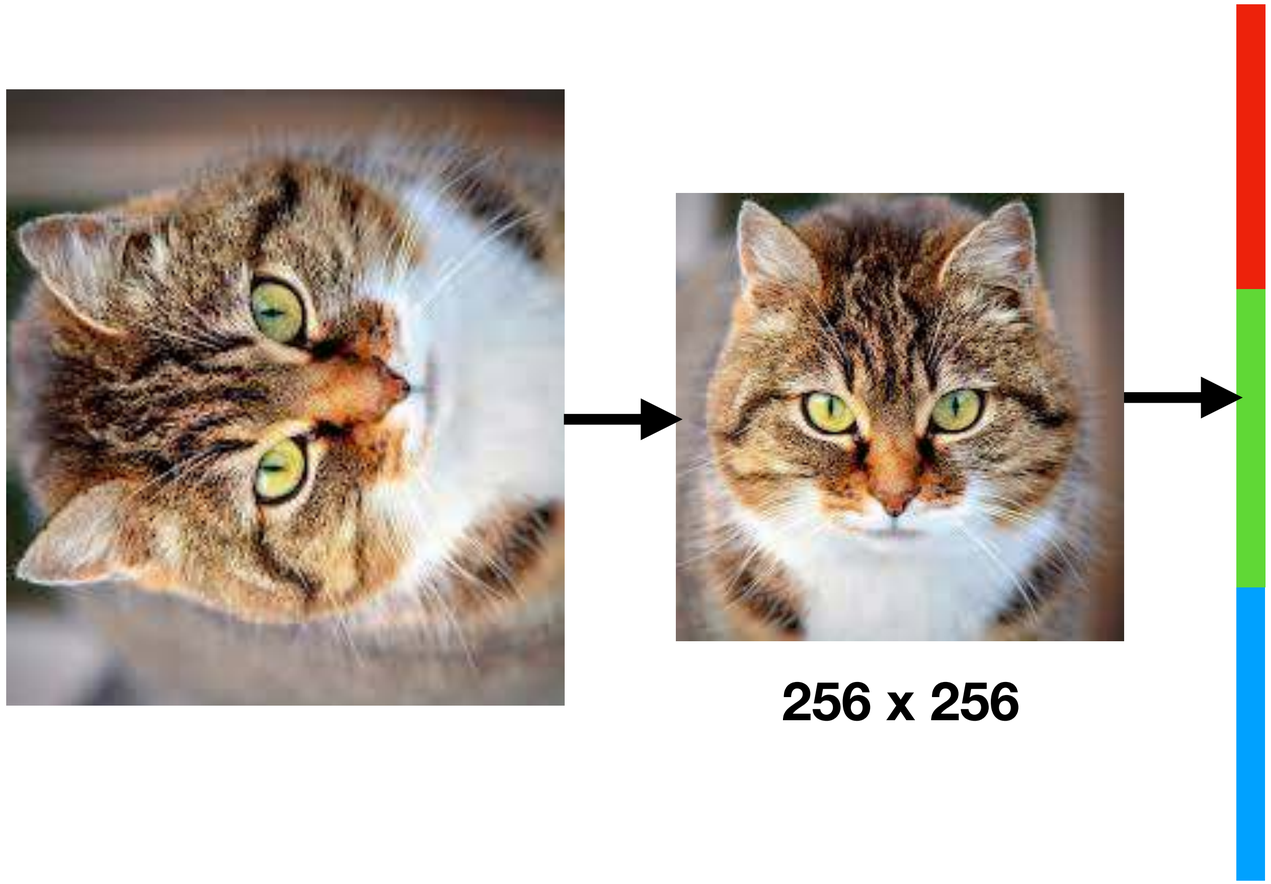
Other

STEP 1: Preprocessing



256 x 256

STEP 2: Image to feature vector



STEP 4: Learning Algorithm

256 x 256

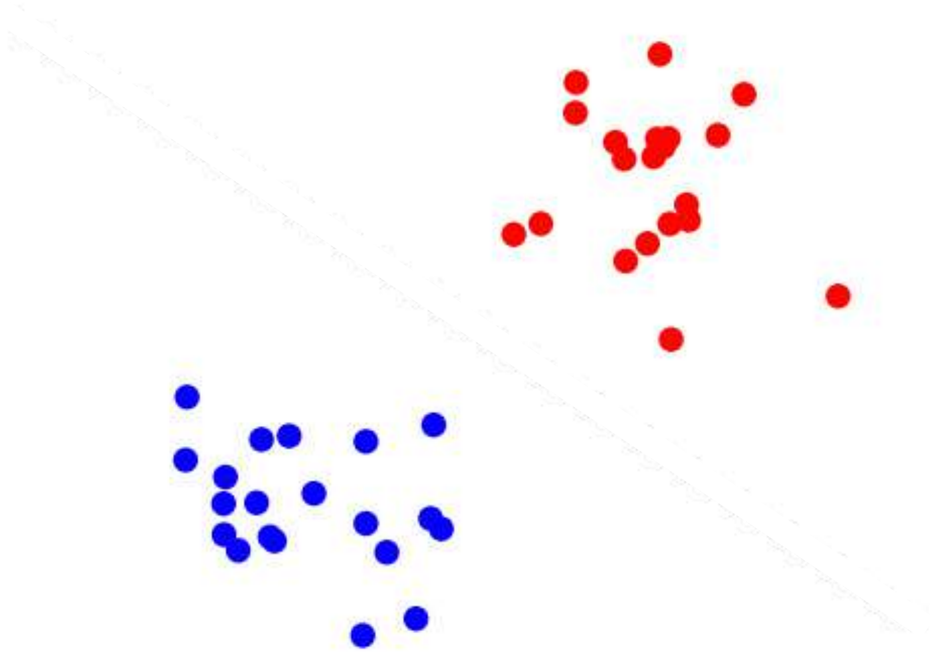
Learning Algorithm

Cat 0.97

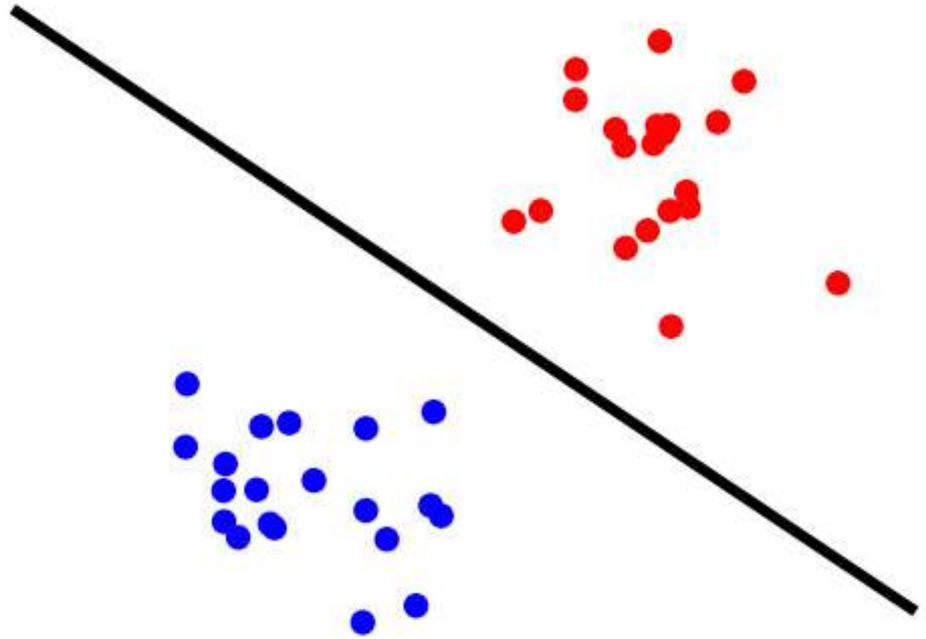
Dog 0.01

Other 0.02

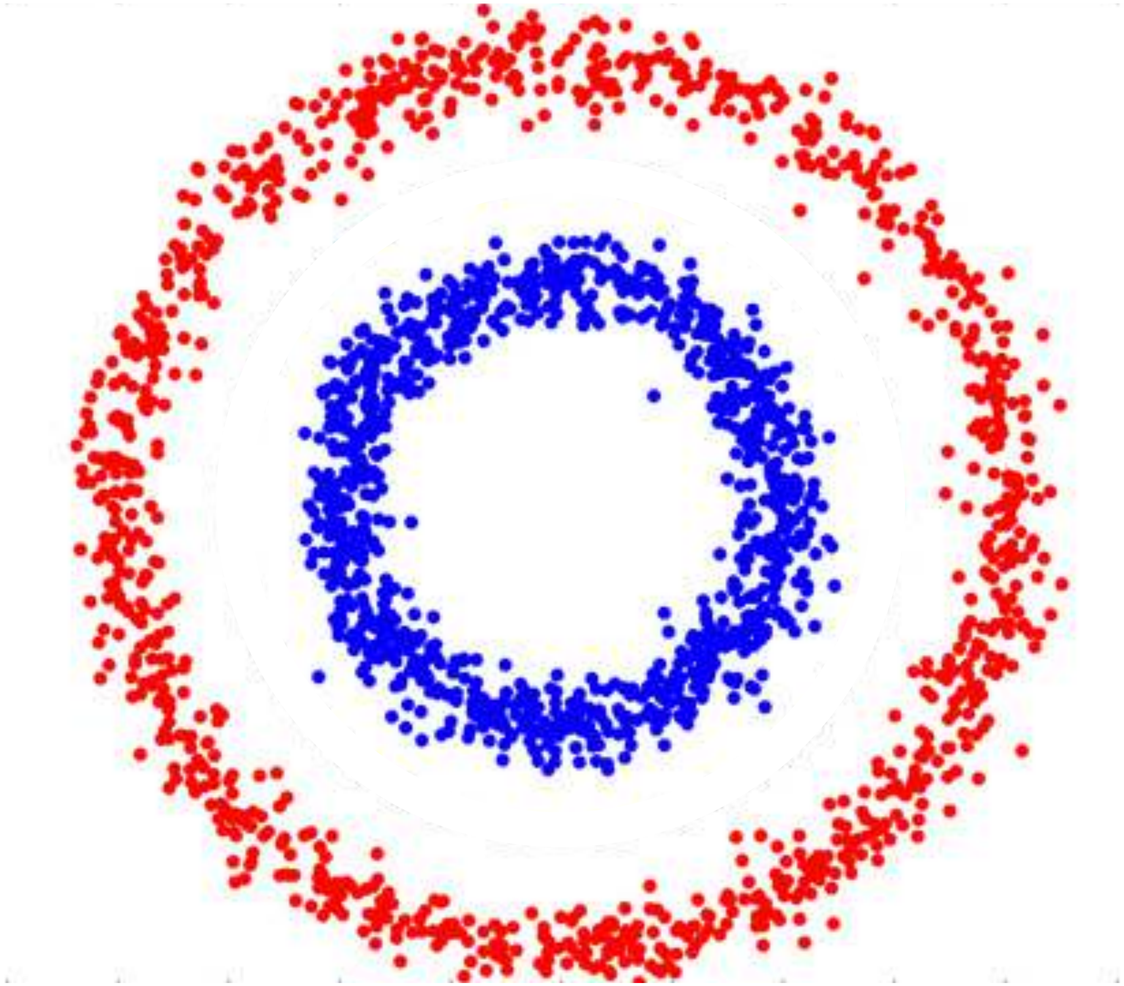
Support Vector Machine



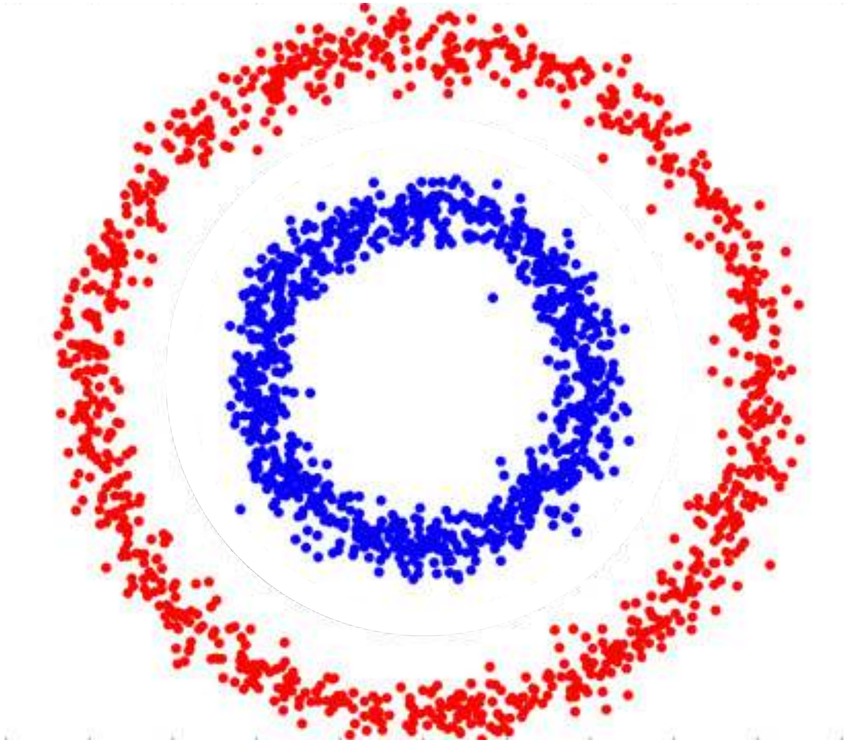
Support Vector Machine



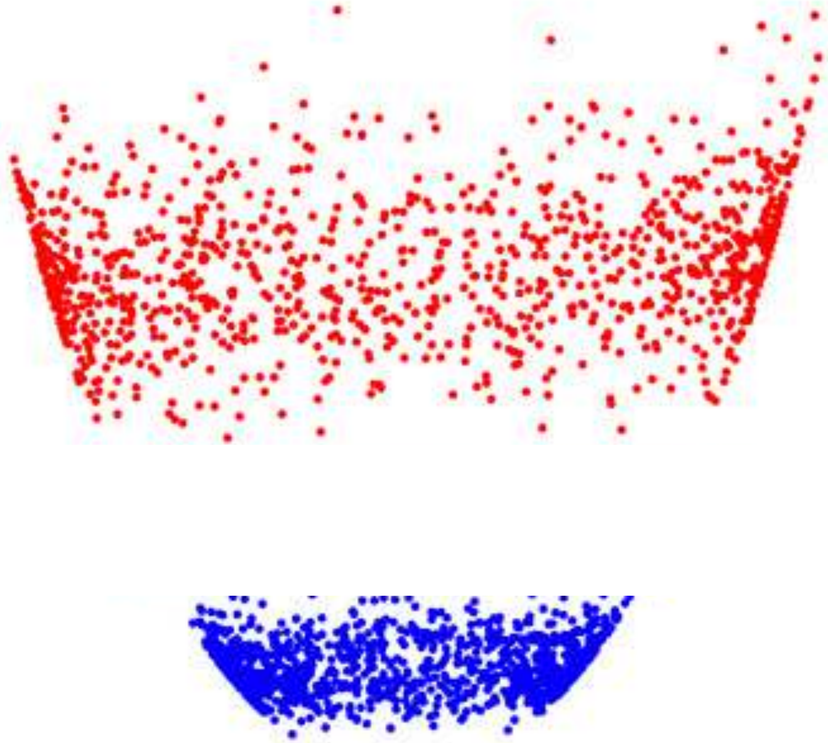
Support Vector Machine



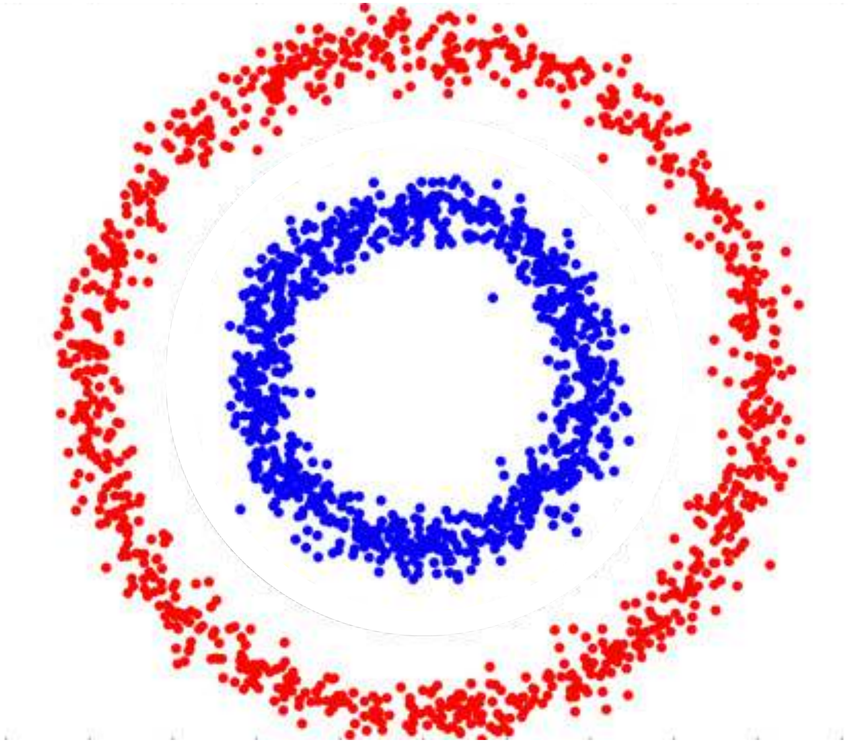
Support Vector Machine



$$z = e^{-\gamma(x^2+y^2)}$$



Support Vector Machine



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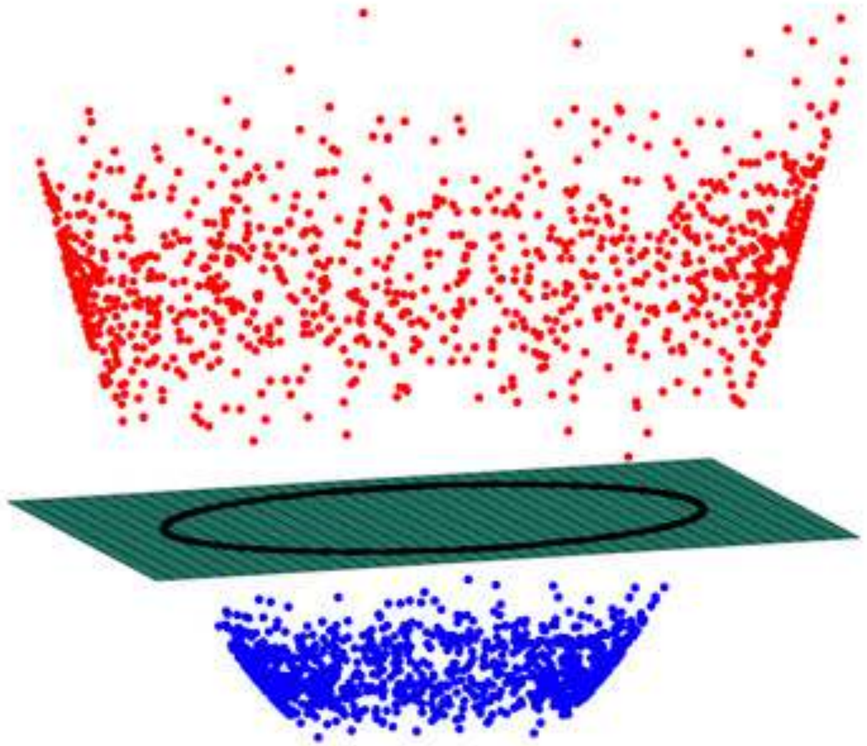
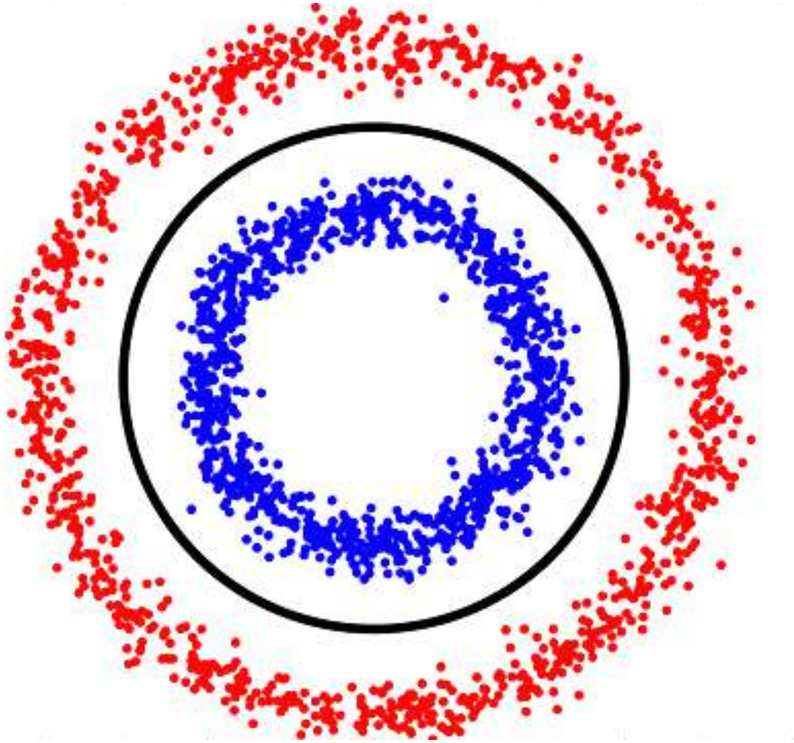


Support Vector Machine



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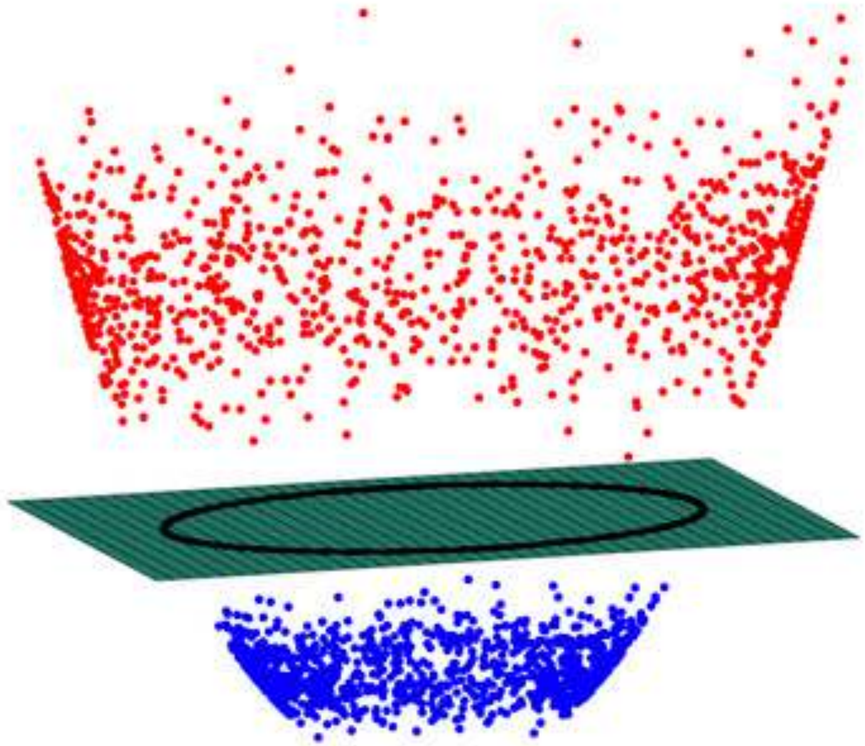
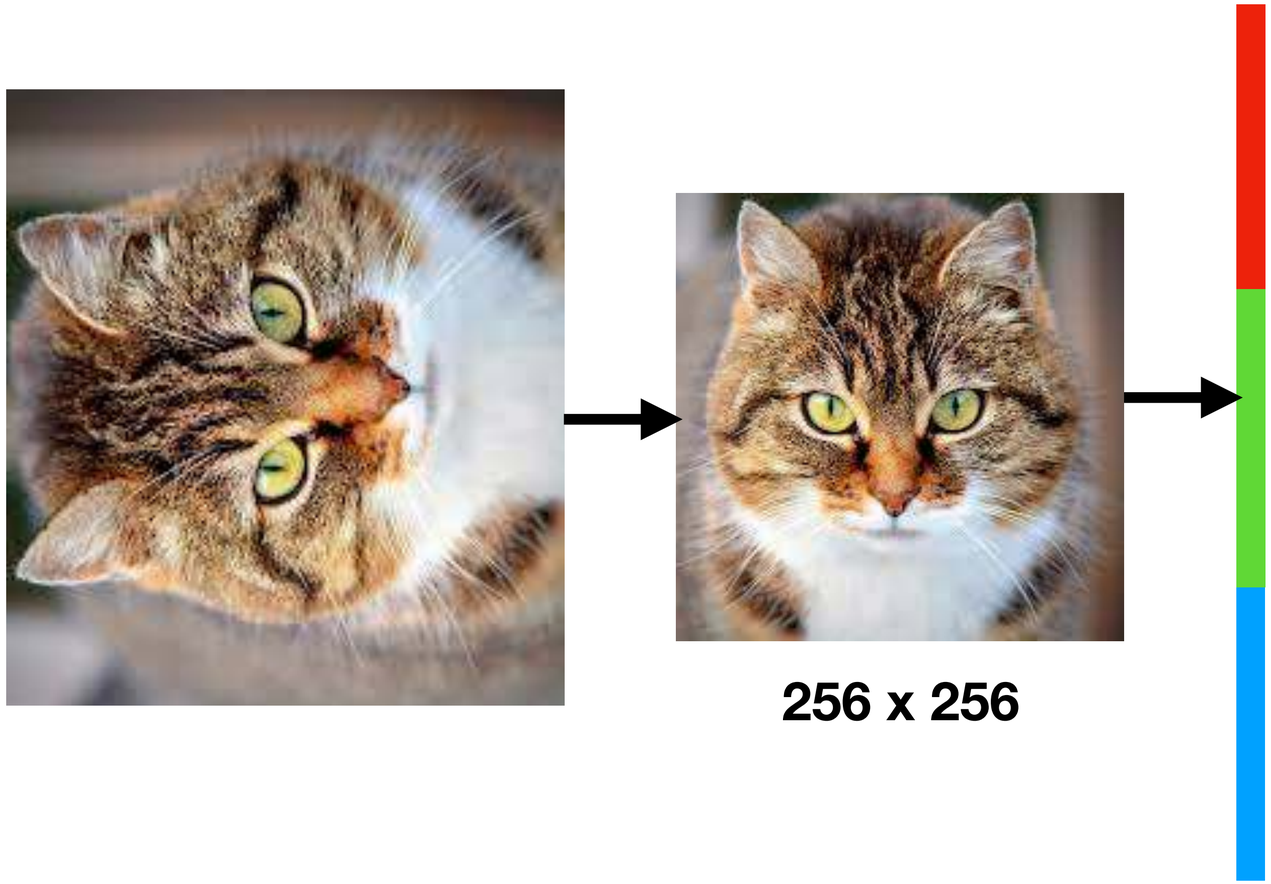


STEP 3: Image to feature vector



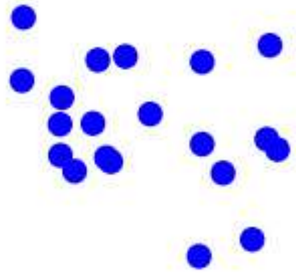
What makes a good feature vector?

What makes a good feature vector?

- Data points in the same class should cluster together

What makes a good feature vector?

- Data points in the same class should cluster together
- Data points belonging to different classes should be far away



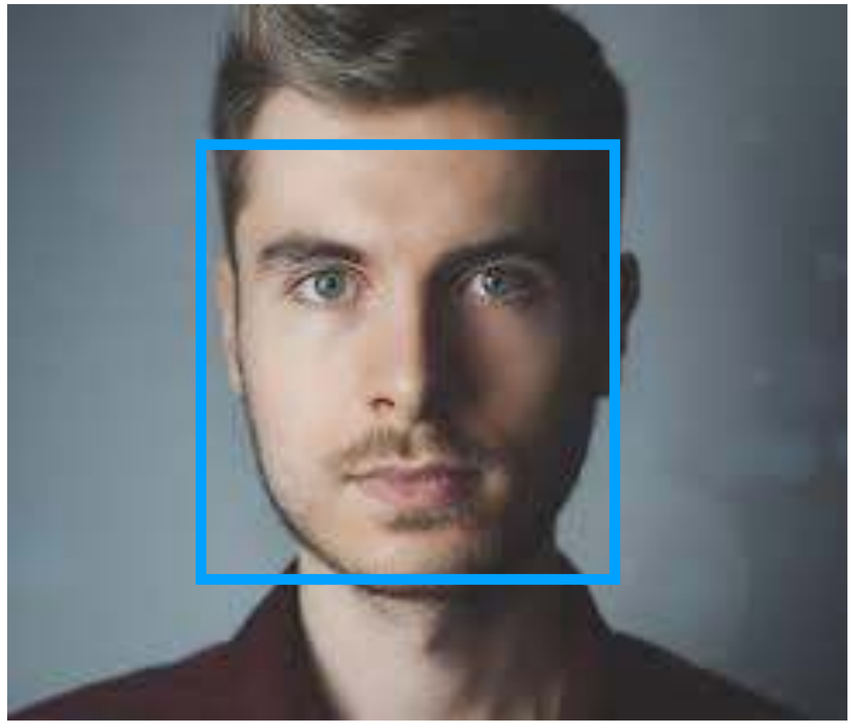
What makes a good feature vector?

- Keeps essential information
- Throws away extraneous information

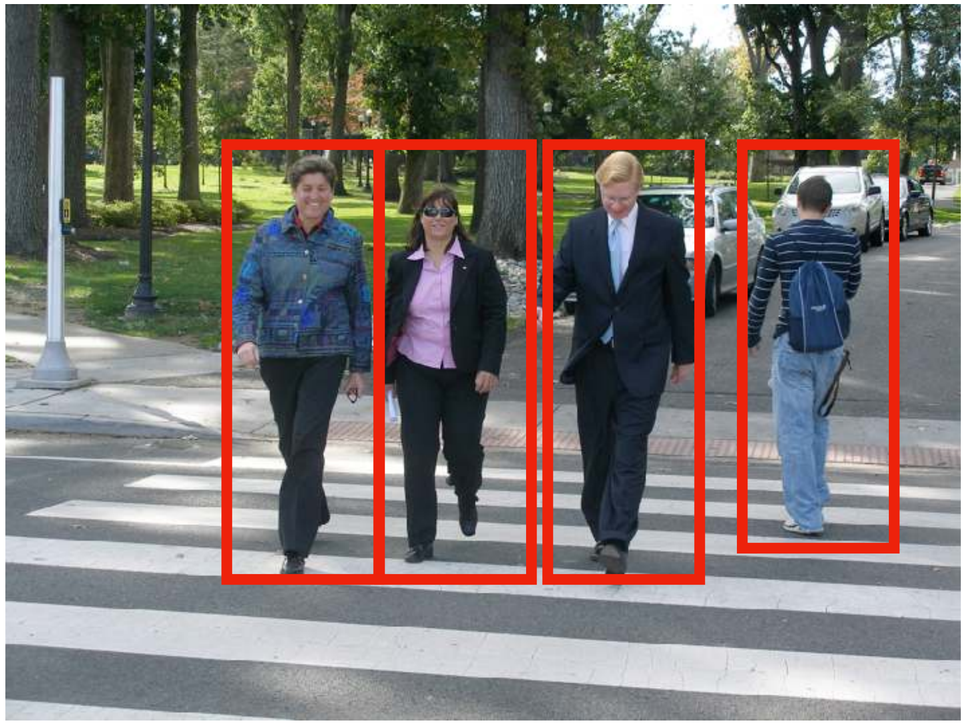
What makes a good feature vector?

- Keeps essential information
- Throws away extraneous information

Different Features for Different Problems

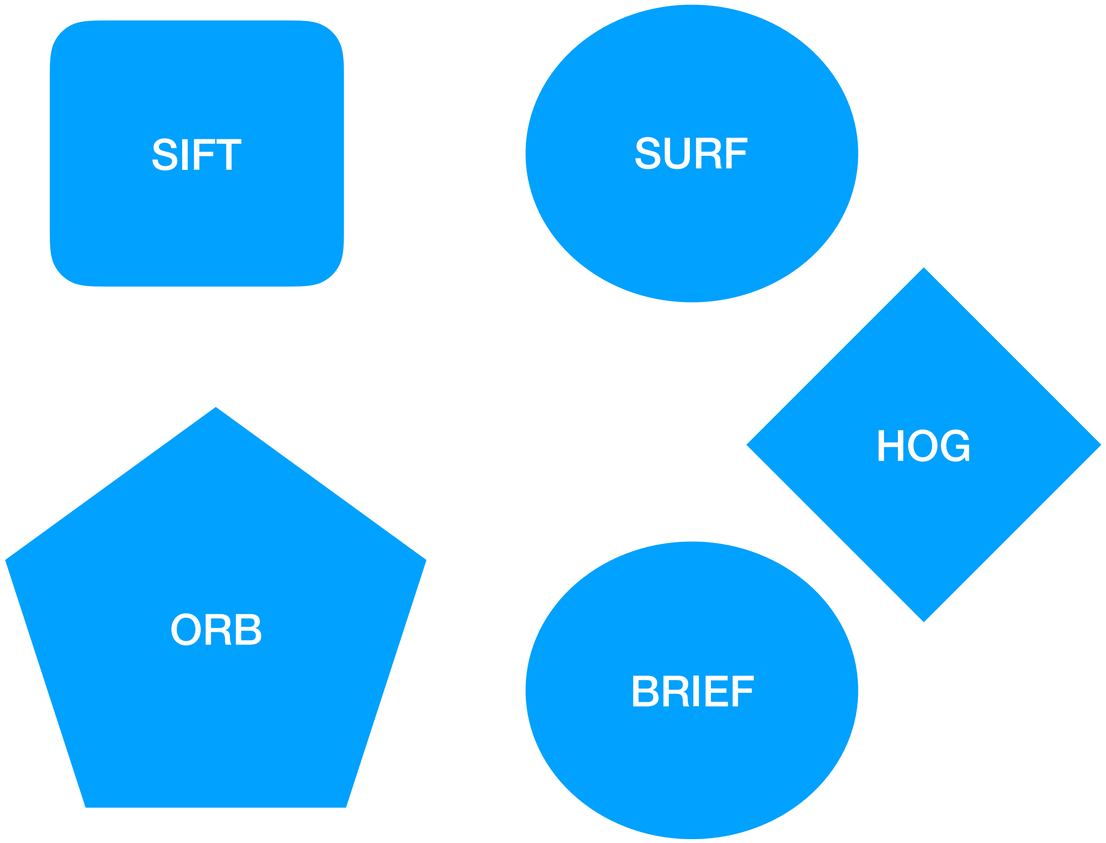


HAAR Features



HOG Features

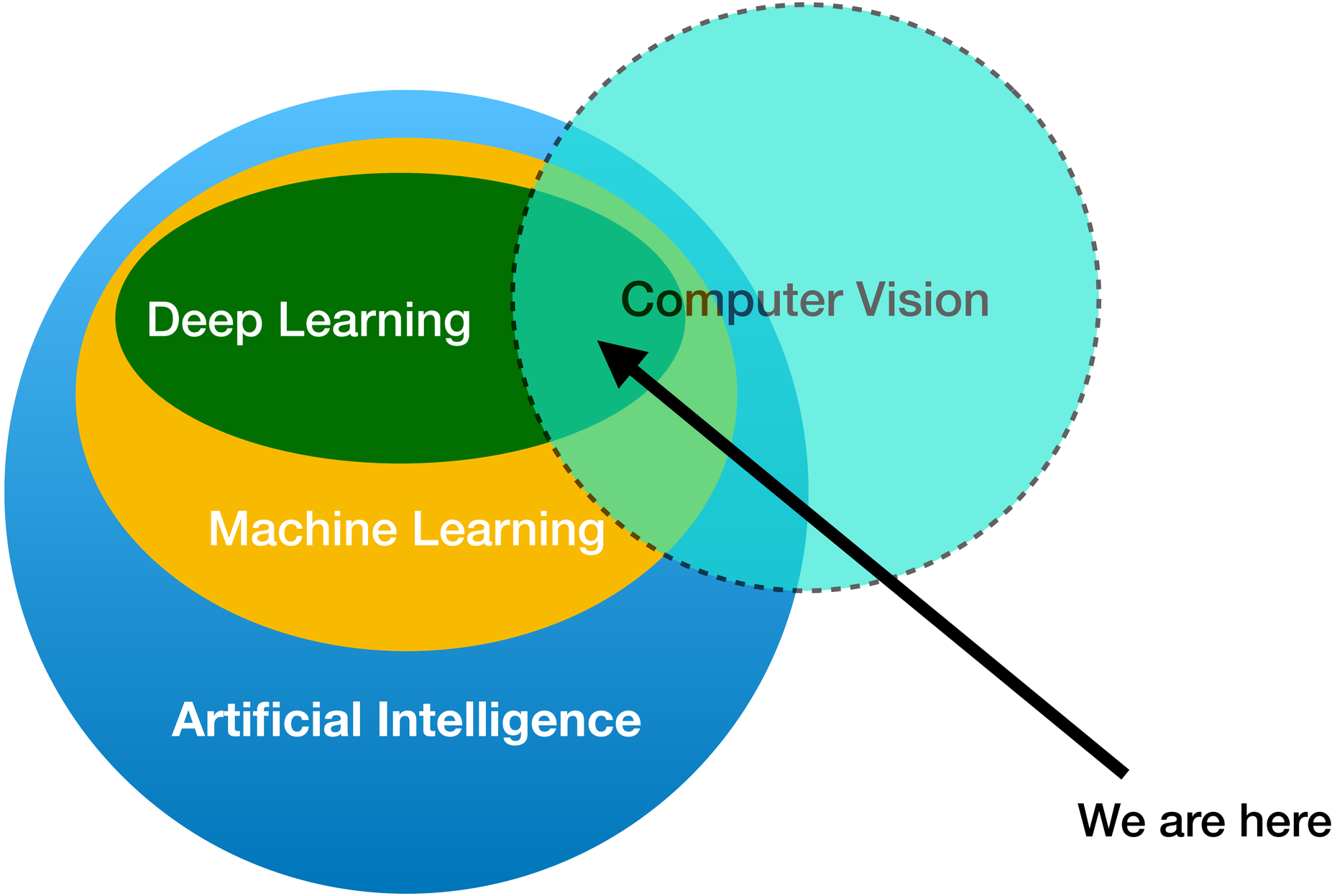
Which feature descriptor to choose



Learning > Designing

from data

by hand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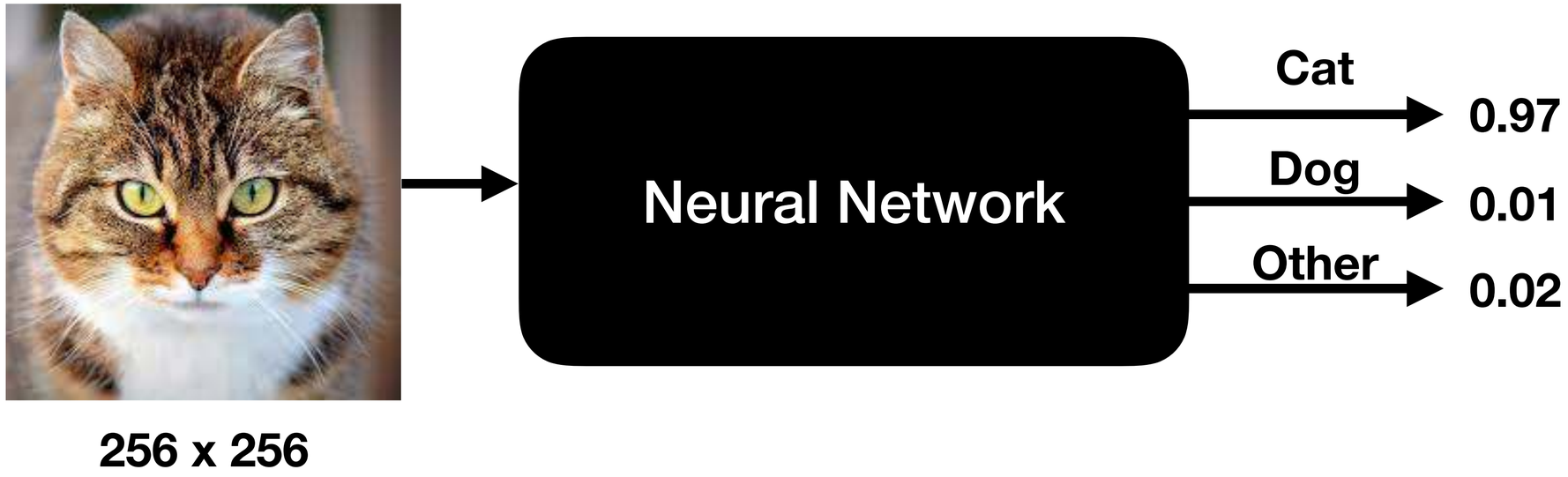
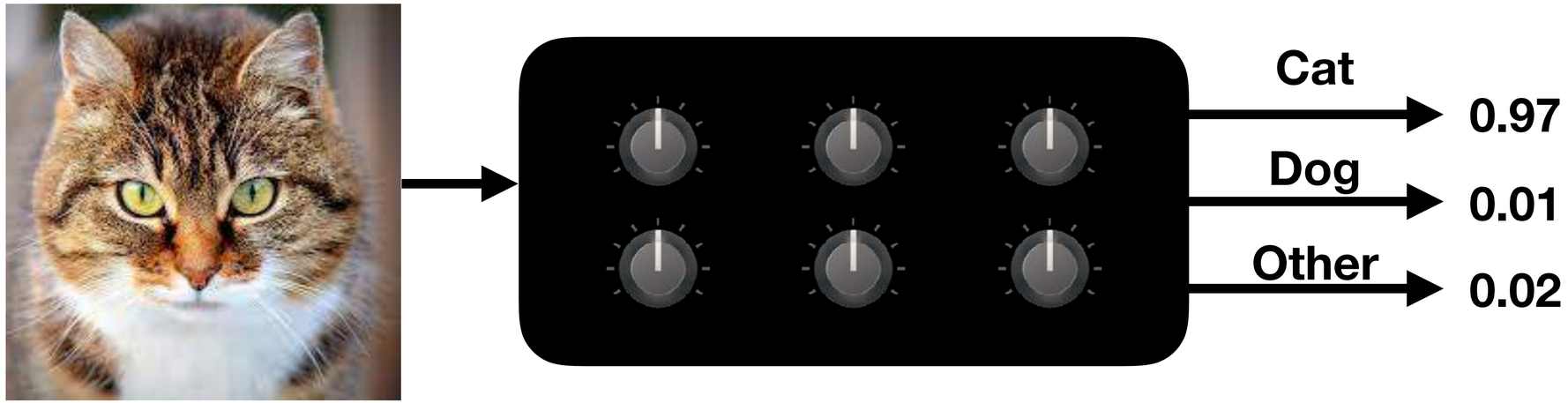
Neural Network

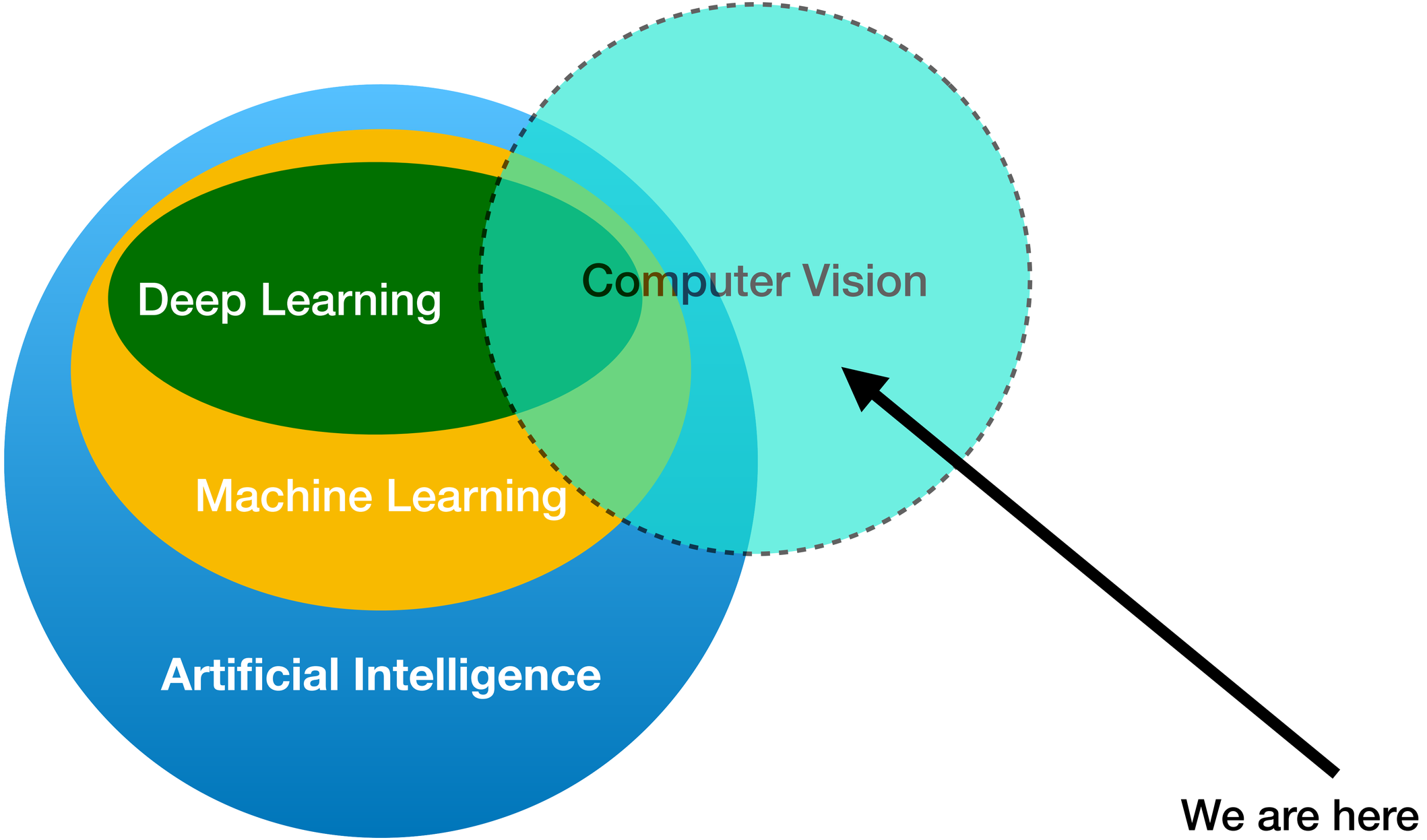


Neural Network : Weights



256 x 256

Features are selected from a large set as part of training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Computer Vision for Faces

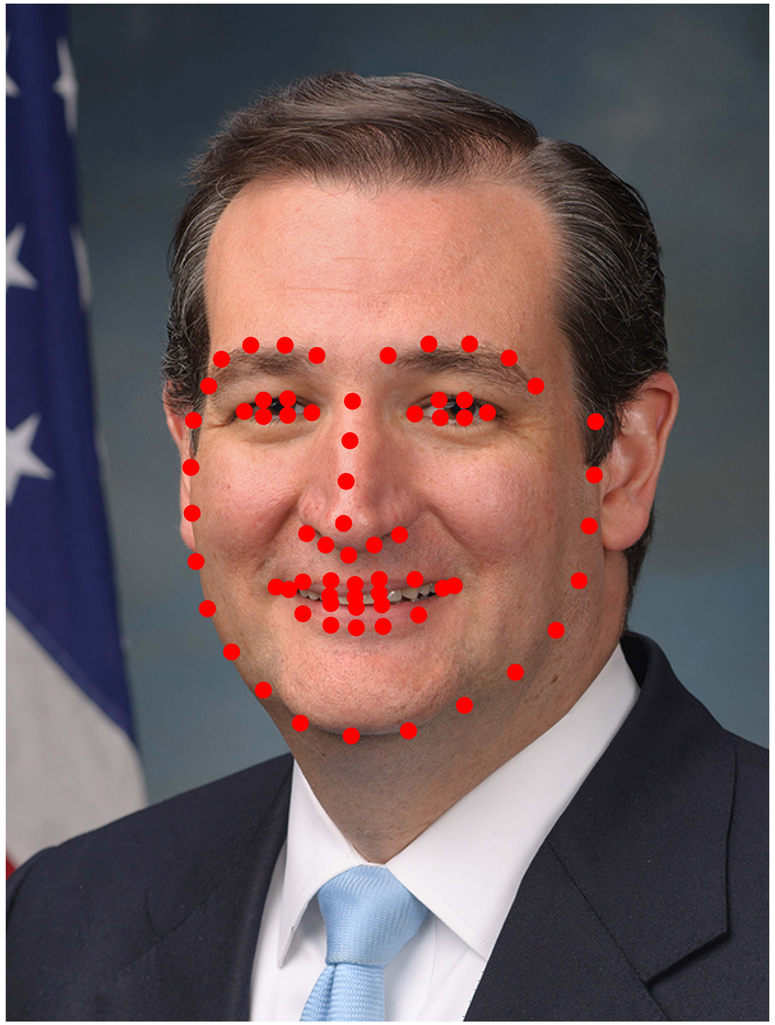
Let’s have some fun!

Face Swap

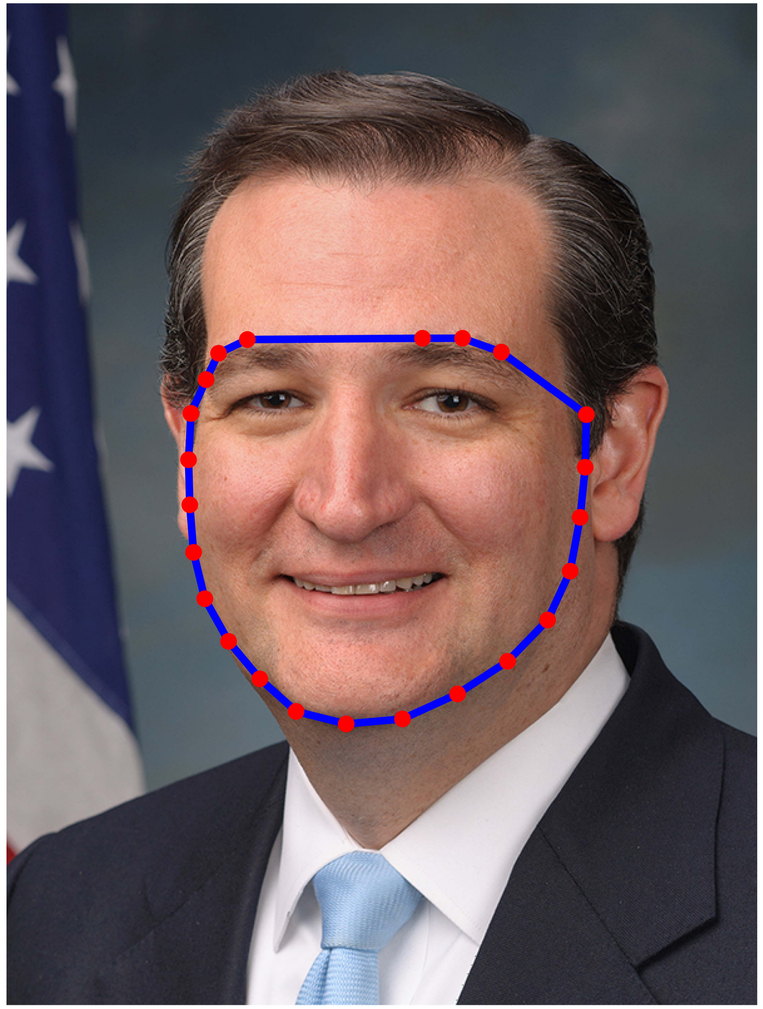
Disturbing!

Facial Landmark Detection

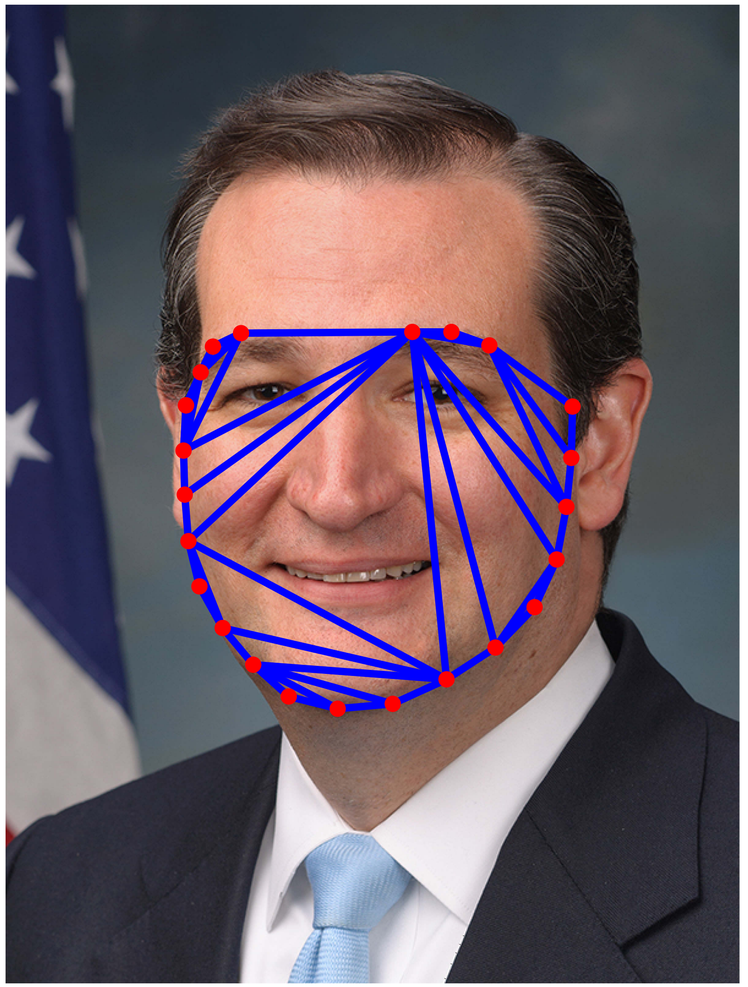
Dlib (Machine Learning Library)

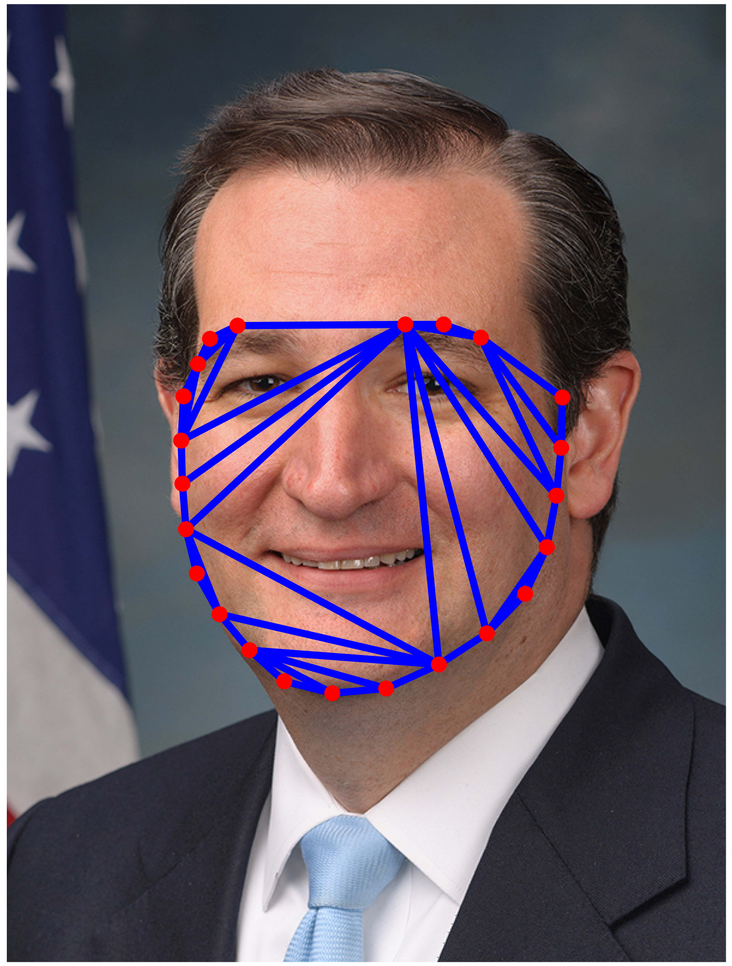


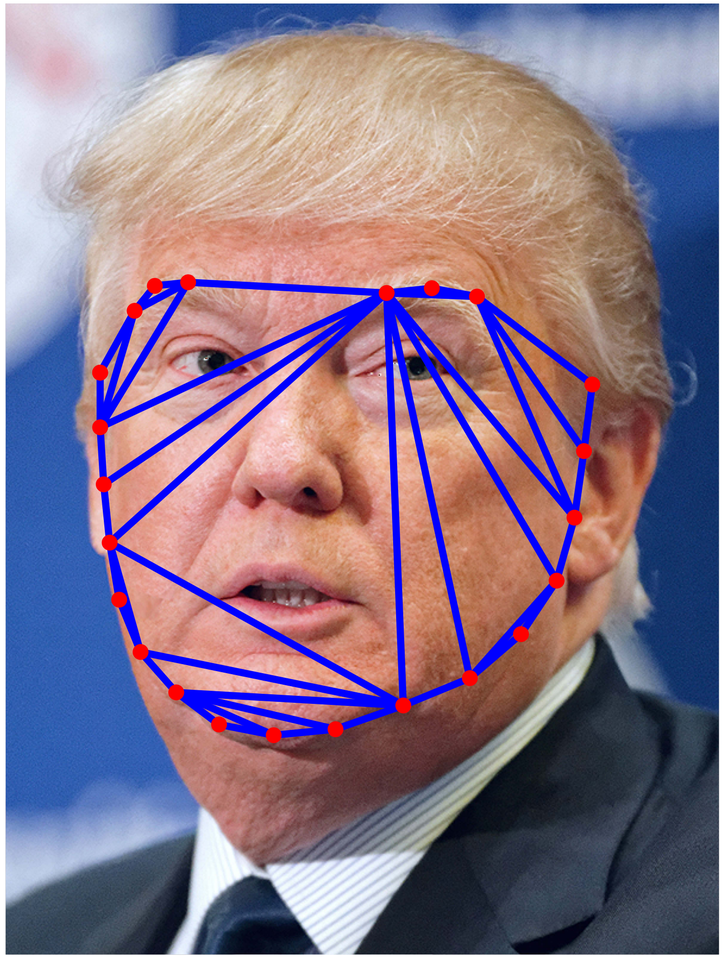
Find Convex Hull



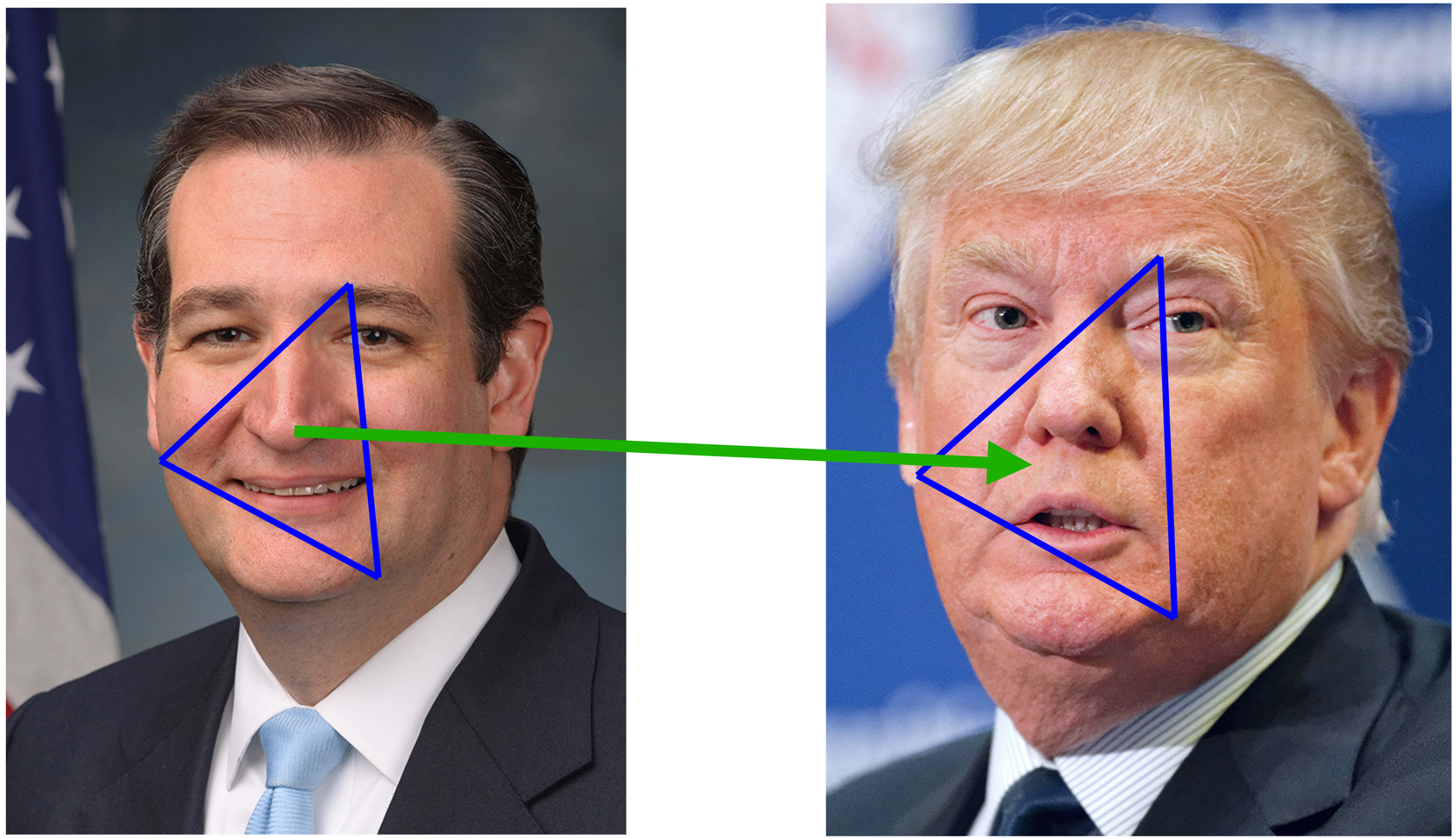
Delaunay Triangulation



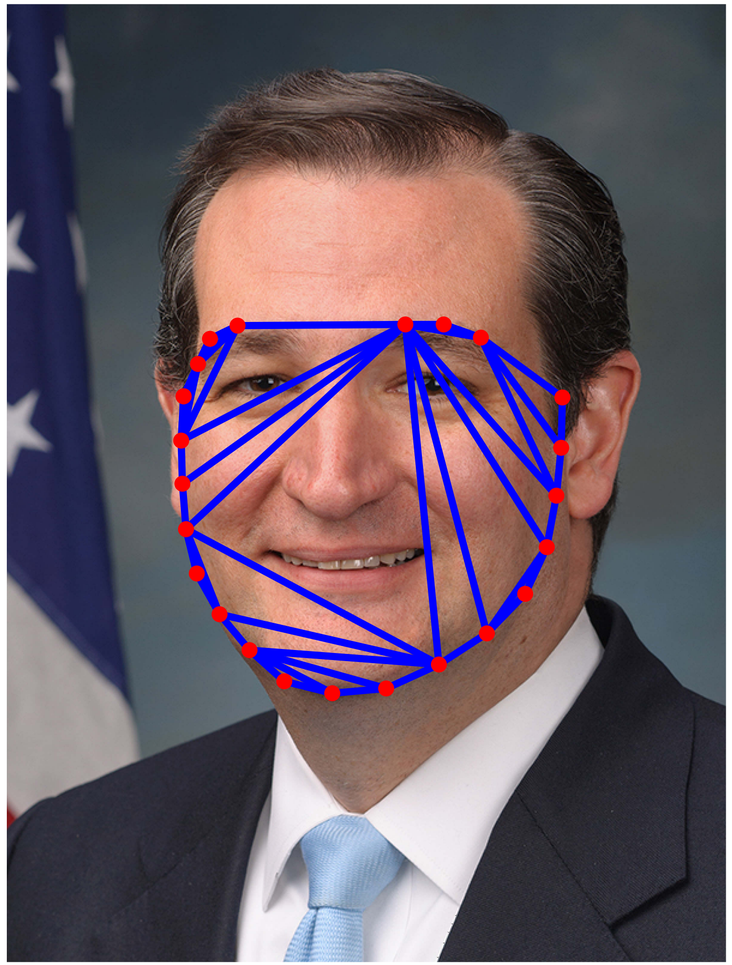




Piecewise Linear Warp



Piecewise Linear Warp



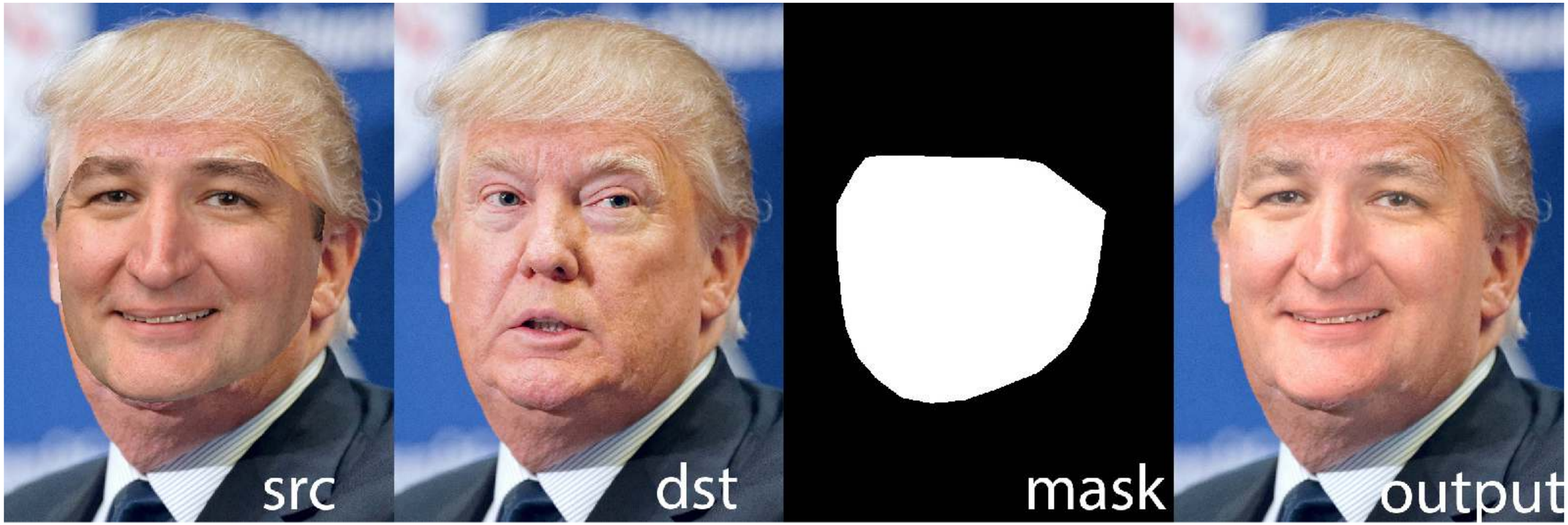
Warp the Face
One Triangle at a Time

Seamless Cloning


epsos.de


JAL


JAL



Seamless Cloning

Face Morphing

Face Average

Python is the language of AI

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Join the

REVOLUTION

Thank You!

Start your journey!

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