

# Visual Computing at AI - Spielplatz

ScaDS.AI, May 2025

Prepared and presented by Natasha Hrycan

# Our plan

Intro

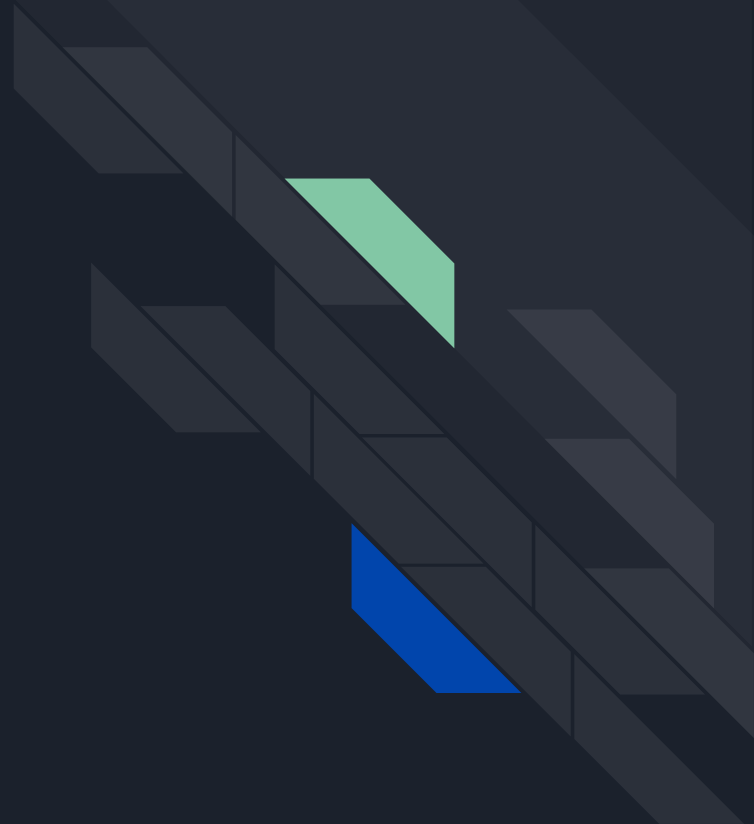
On images: How can computers see?

Filters, convolution layers

Let's move to hands-on!

- Camera setup with RPi
- Check on live-detection

Metrics / Process of custom training





# Intro

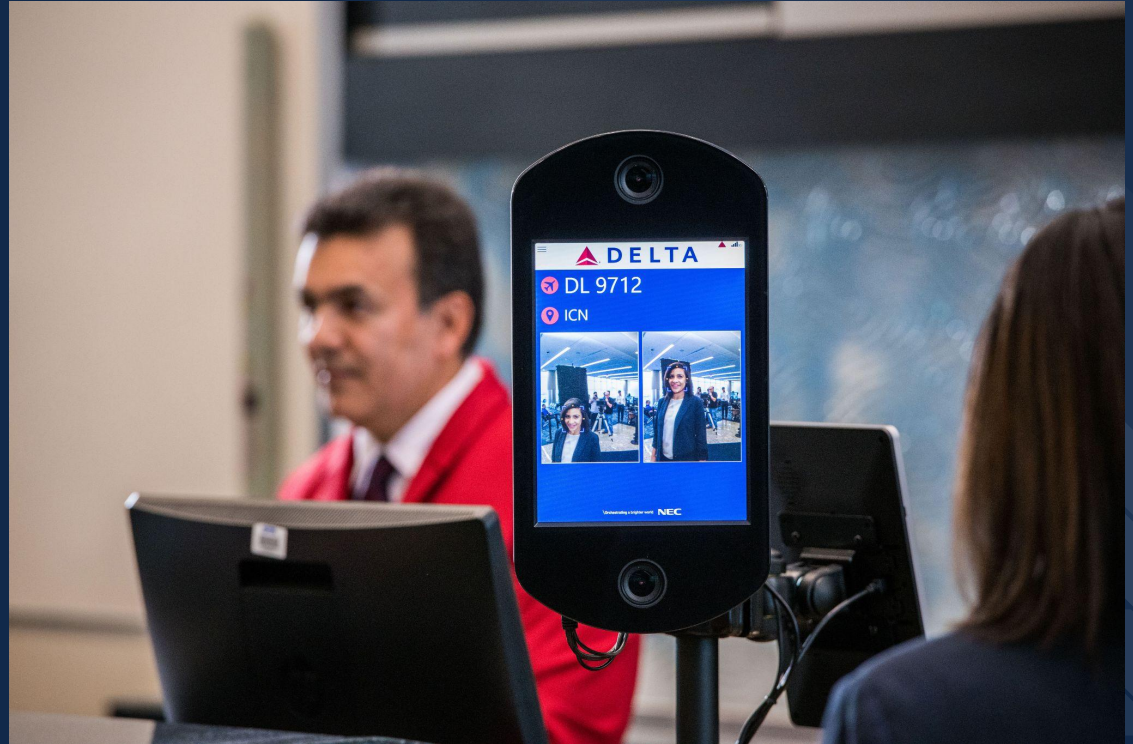
Object Detection/Visual Computing/whatever has some cool real world applications (and for the theoretical people, it's also a field with great development for the processes of recognizing images).

Let's take a look at how it could be used in some fields.

# Face recognition

Delta Air Lines reveals their new biometric scanning technology at Hartsfield-Jackson International Airport in Atlanta, Ga. on Monday, November 19, 2018.

(Credit: John Paul Van Wert/Rank Studios 2018)



# Medical imaging

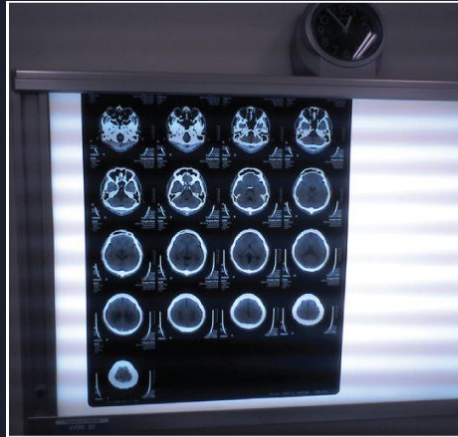
(a) The results of a CT scan of the head are shown as successive transverse sections.

(b) An MRI machine generates a magnetic field around a patient.

(c) PET scans use radiopharmaceuticals to create images of active blood flow and physiologic activity of the organ or organs being targeted.

(d) Ultrasound technology is used to monitor pregnancies because it is the least invasive of imaging techniques and uses no electromagnetic radiation.

(Credit a: Akira Ohgaki/flickr; Credit b: "Digital Cate"/flickr; Credit c: "Raziel"/Wikimedia Commons; Credit d: "Isis"/Wikimedia Commons)



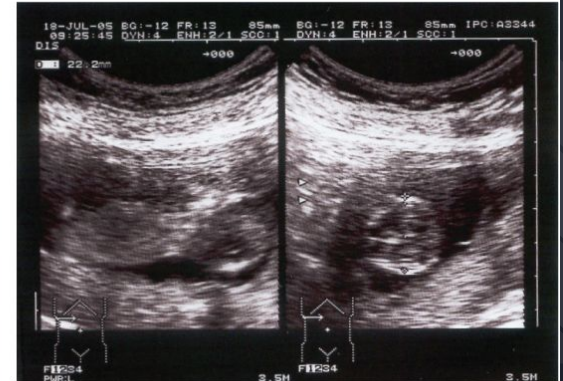
(a)



(b)



(c)



(d)



# Art restoration

This artificially restored Benin Bronze is part of the project, AI-Restored Benin Bronzes conceived by artist Minne Atairu. The project—a conceptual art restoration employs DALL·E 2 (Open AI's Text-to-Image algorithm) to generate visually plausible restorations of damages caused by colonial looting, natural weathering, and conservation practices.

In this case, DALL·E "restored" missing regions around the upper and lower periphery.

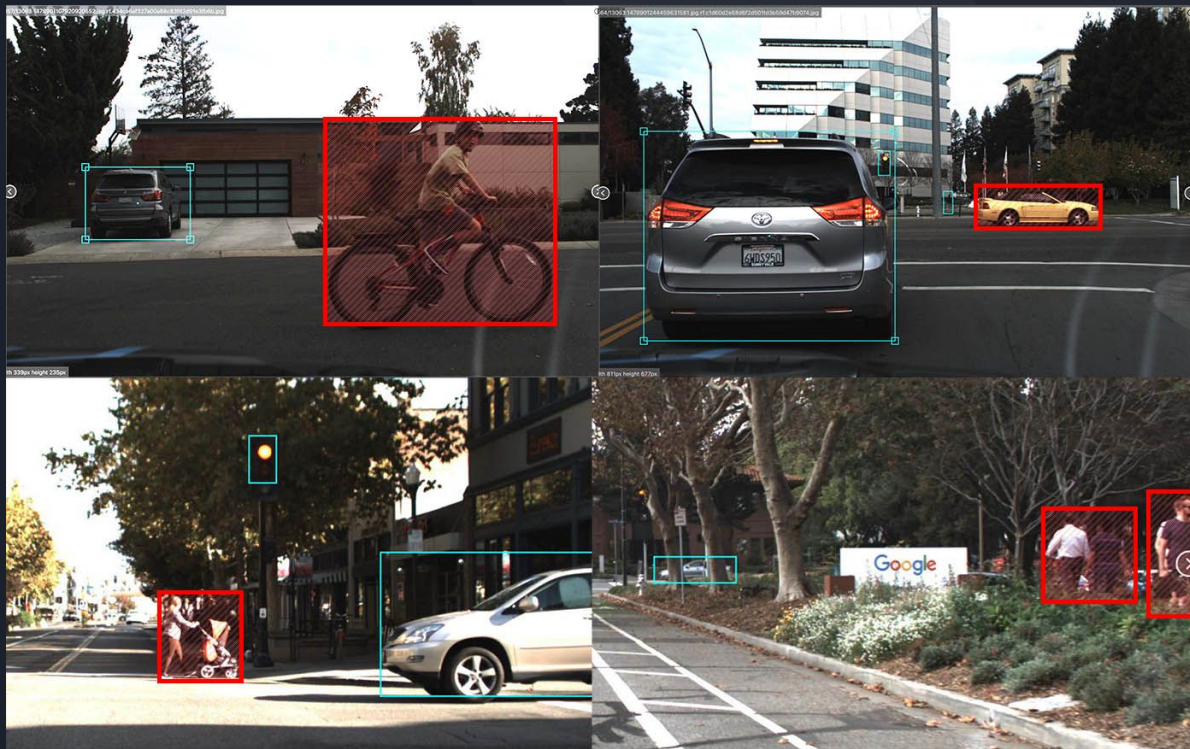
(Credit: Ethnologisches Museum der Staatlichen Museen zu Berlin. Stiftung Preußischer Kulturbesitz)



# Self-driving cars

Images from the Udacity dataset, containing images of common views in streets.

(Credit: Roboflow for the Udacity self-driving car dataset, URL: <https://github.com/udacity/self-driving-car/tree/master/annotations>)



# On images: How can computers see?

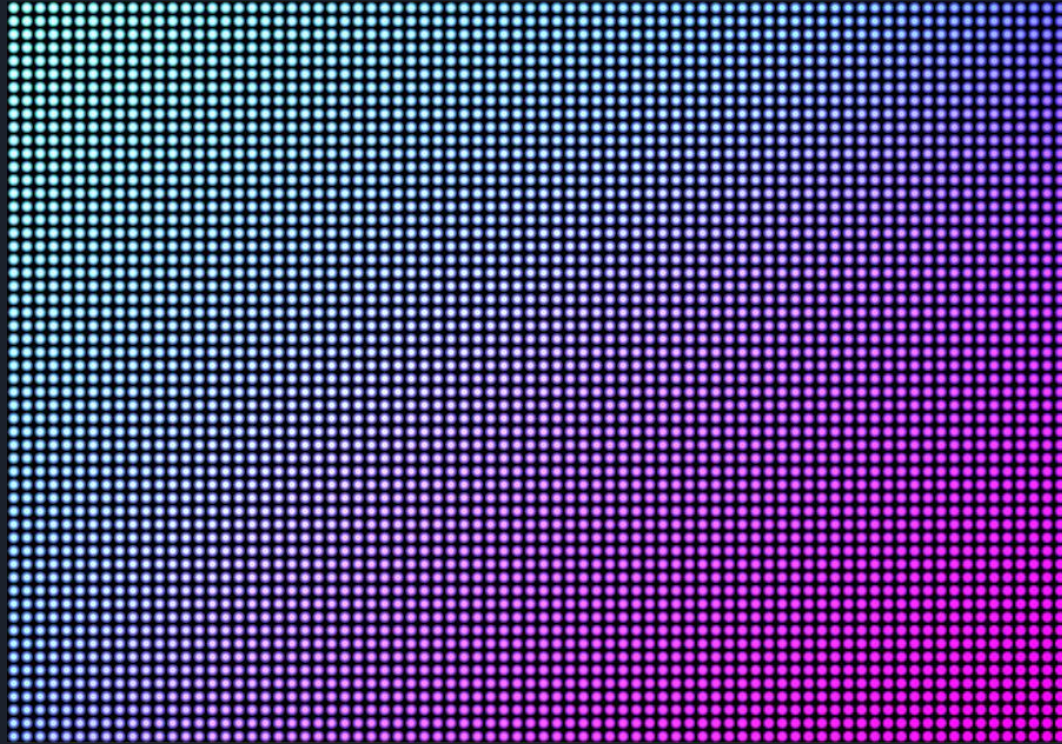
- Computers don't understand the world around us as we do.
- They use a more mathematical way of understanding (ever heard of pixels?).
- So, computers aren't really thinking or reasoning as we do, they are given a (numerical) input and then perform some dark magic spells (a.k.a. maths) to give as a result (the result of the problem).
- Based on the detections an object detection model gives, it will be rewarded or not. This "motivates" it to keep performing better and better.



Credits: Eka Panova through Shutterstock.  
Upload date: 16 October 2023

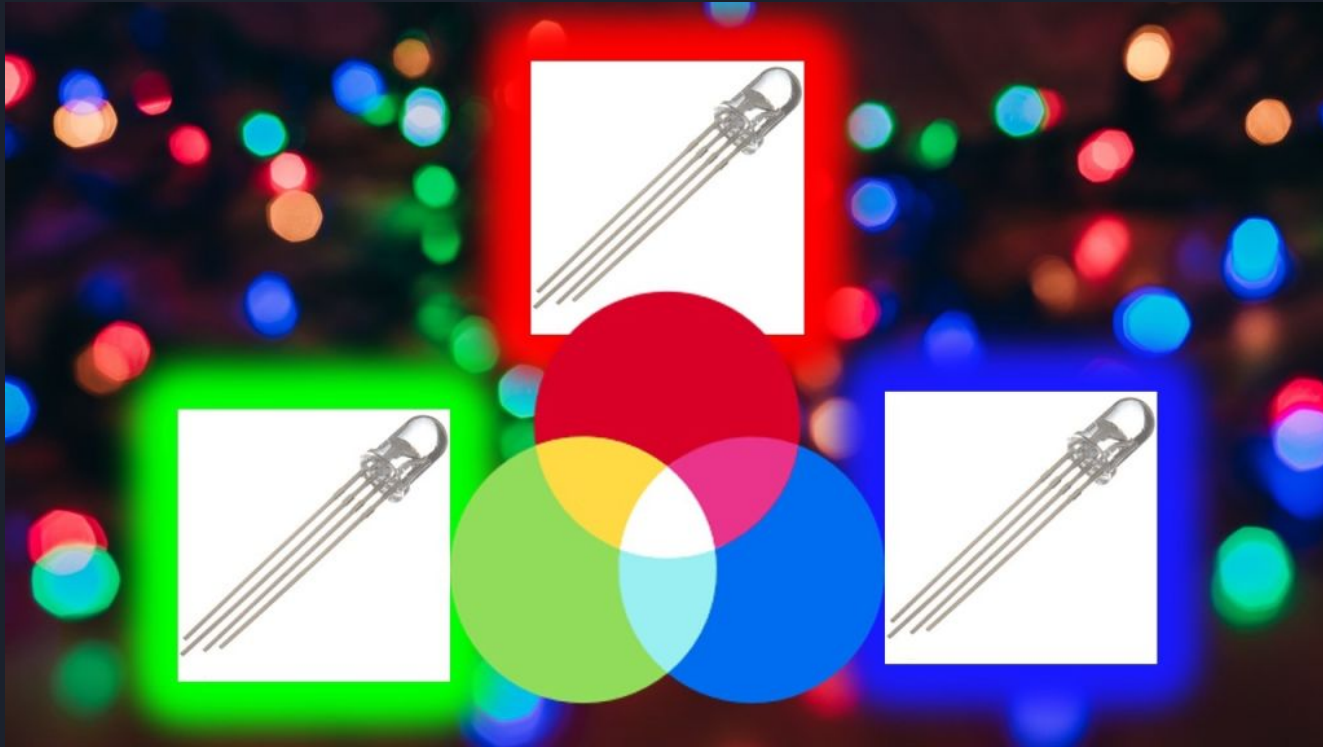


# Pixels and RGB values



Credits: Free license from FreePik

# Pixels and RGB values



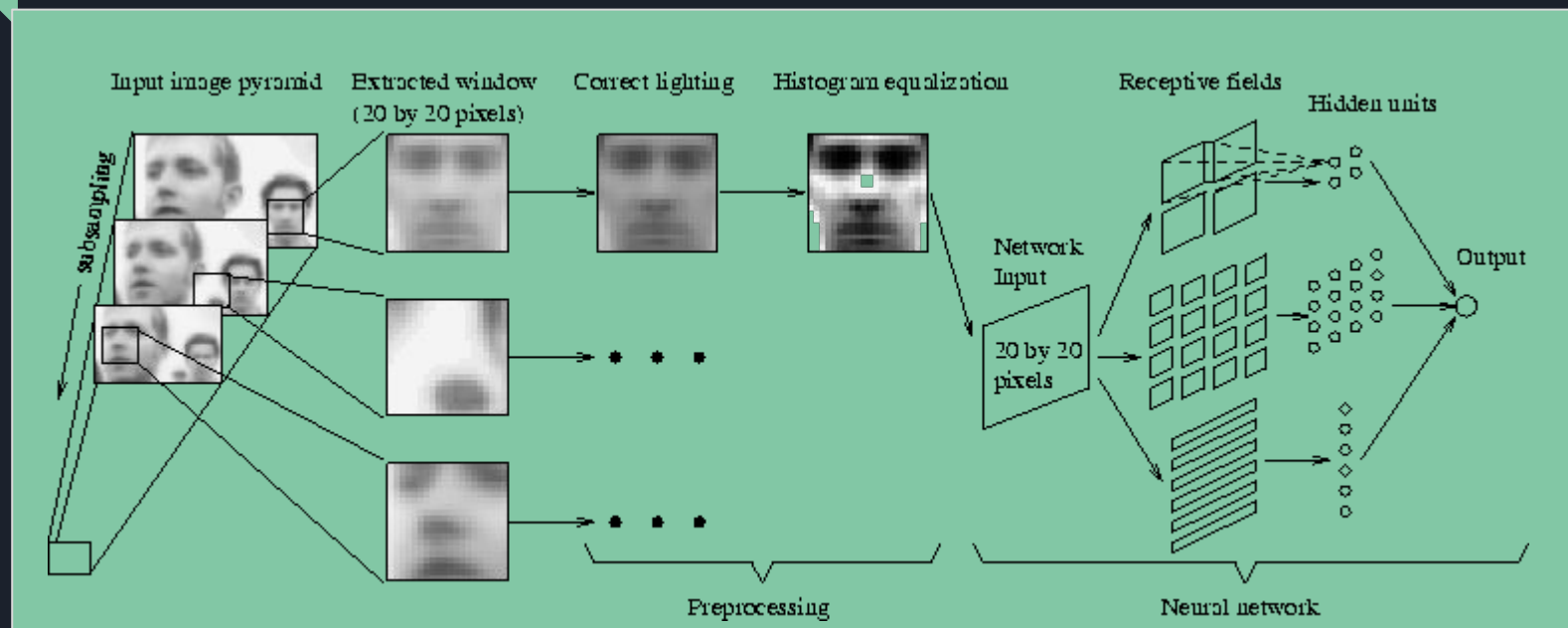
Credits: How do RGB LEDs work?, by Random Nerd Tutorials

# Convolution layers

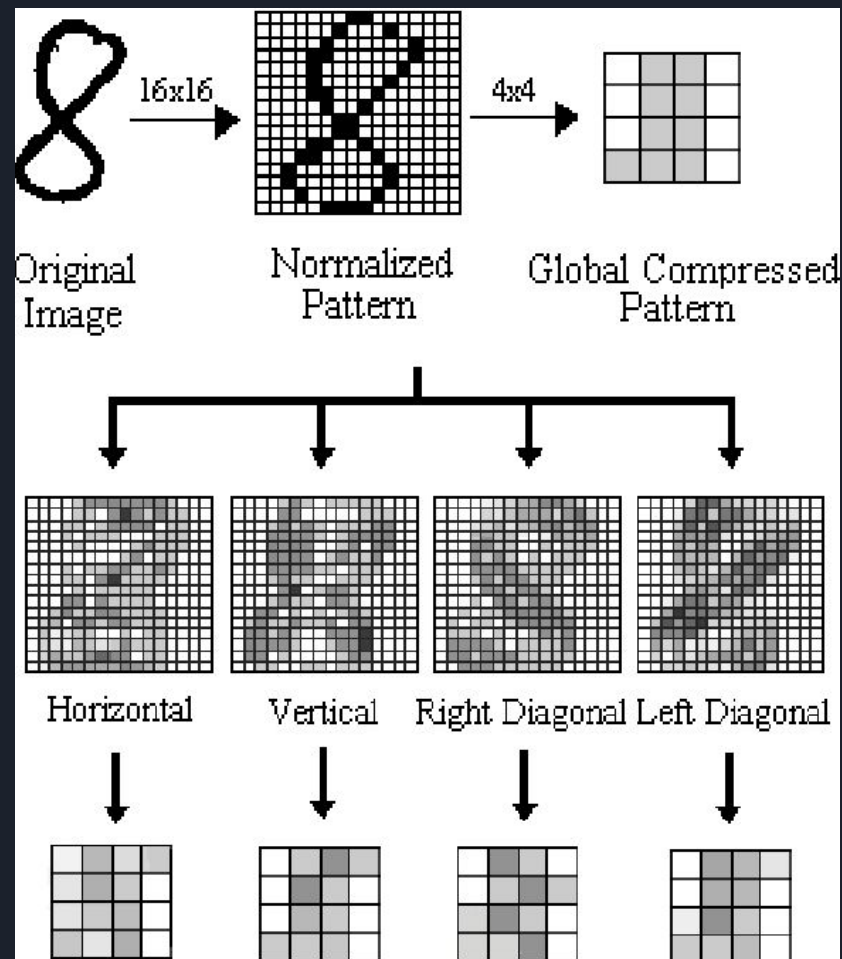
input

0.88	0.44	0.14	0.16	0.37	0.77	0.96	0.27
0.19	0.45	0.57	0.16	0.63	0.29	0.71	0.70
0.66	0.26	0.82	0.64	0.54	0.73	0.59	0.26
0.85	0.34	0.76	0.84	0.29	0.75	0.62	0.25
0.32	0.74	0.21	0.39	0.34	0.03	0.33	0.48
0.20	0.14	0.16	0.13	0.73	0.65	0.96	0.32
0.19	0.69	0.09	0.86	0.88	0.07	0.01	0.48
0.83	0.24	0.97	0.04	0.24	0.35	0.50	0.91

# Basic algorithm for face detection



Credits: Henry A Rowley, Sun Nov 26 00:21:42 EST 1995. Stage One: A Neural Network-Based Filter.

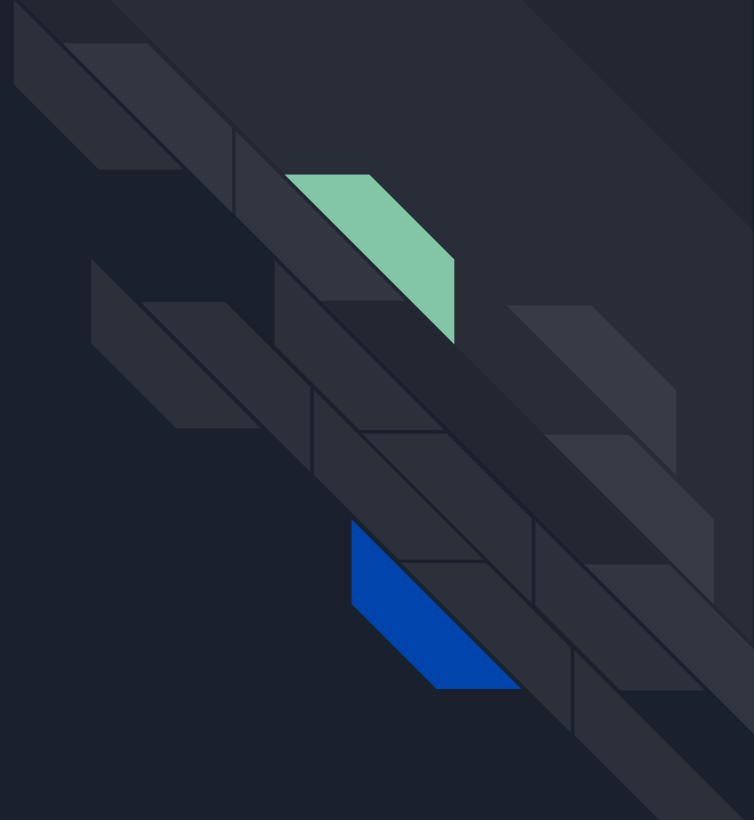


Credits: Álvarez, Daniel Cruces et al. "Printed and Handwritten Digits Recognition Using Neural Networks." (2003).





Time for some hands-on





# Metrics

Let's check out the Object Detection Metrics by Rafael Padilla:



# Questions?

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Thanks!

