Visum Competition 2020

Fish Detection in Underwater Images

Rocket Team

Osman Semih Kayhan, o.s.kayhan@tudelft.nl

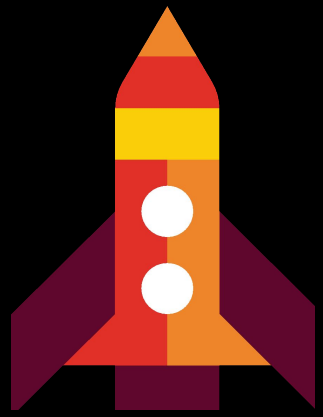
Luís Conde Bento, luis.conde@ipleiria.pt

Kristina Host, kristinahost@gmail.com

- Osman - TU Delft
- Luís - Politécnico de Leiria
- Kristina - University of Rijeka

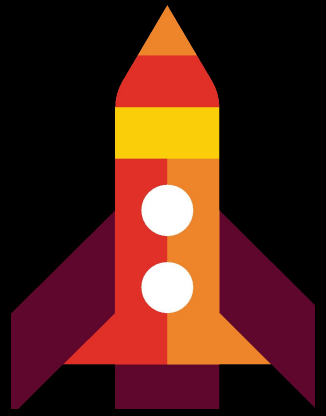
Rocket Team

- Osman - TU Delft
- Luís - Politécnico de Leiria
- Kristina - University of Rijeka



Rocket Team

- Osman - TU Delft
- Luis - Politécnico de Leiria
- Kristina - University of Rijeka

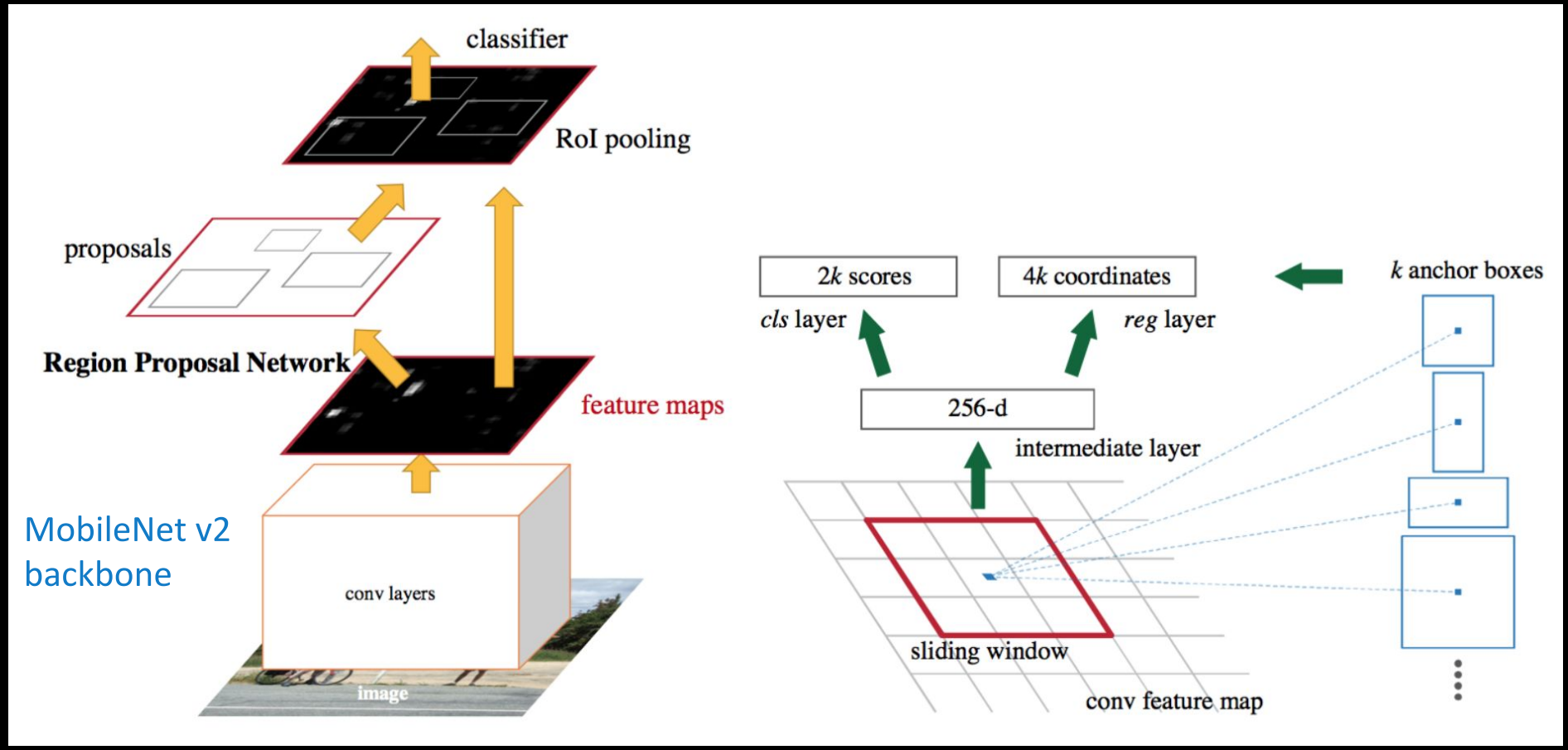


https://www.dexerto.com/pokemon/where-are-pokemon-team-rocket-going-this-summer-1361157

Q: Model vs Data?

Method

Method



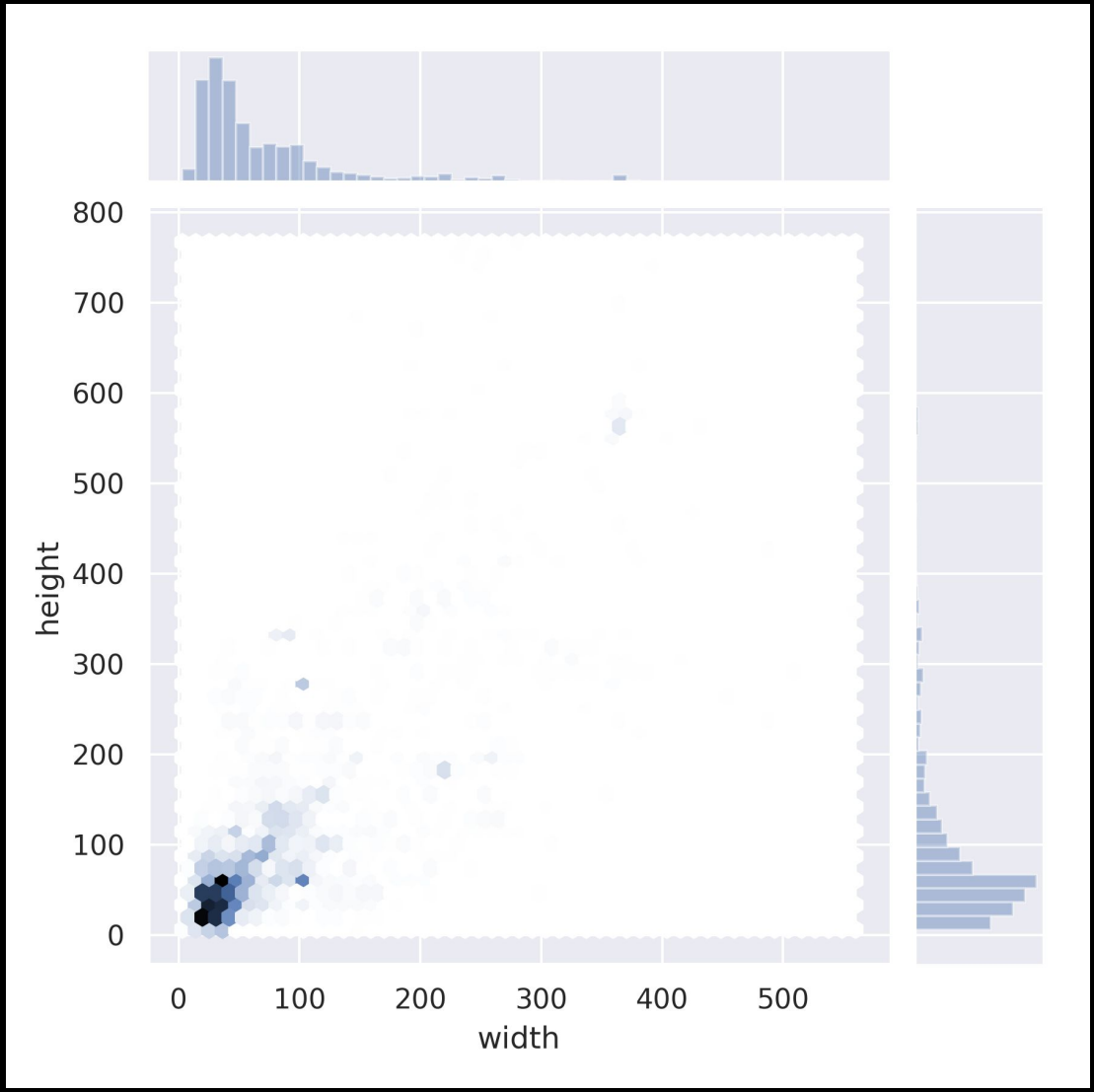
Faster RCNN: https://arxiv.org/abs/1506.01497

Approaches

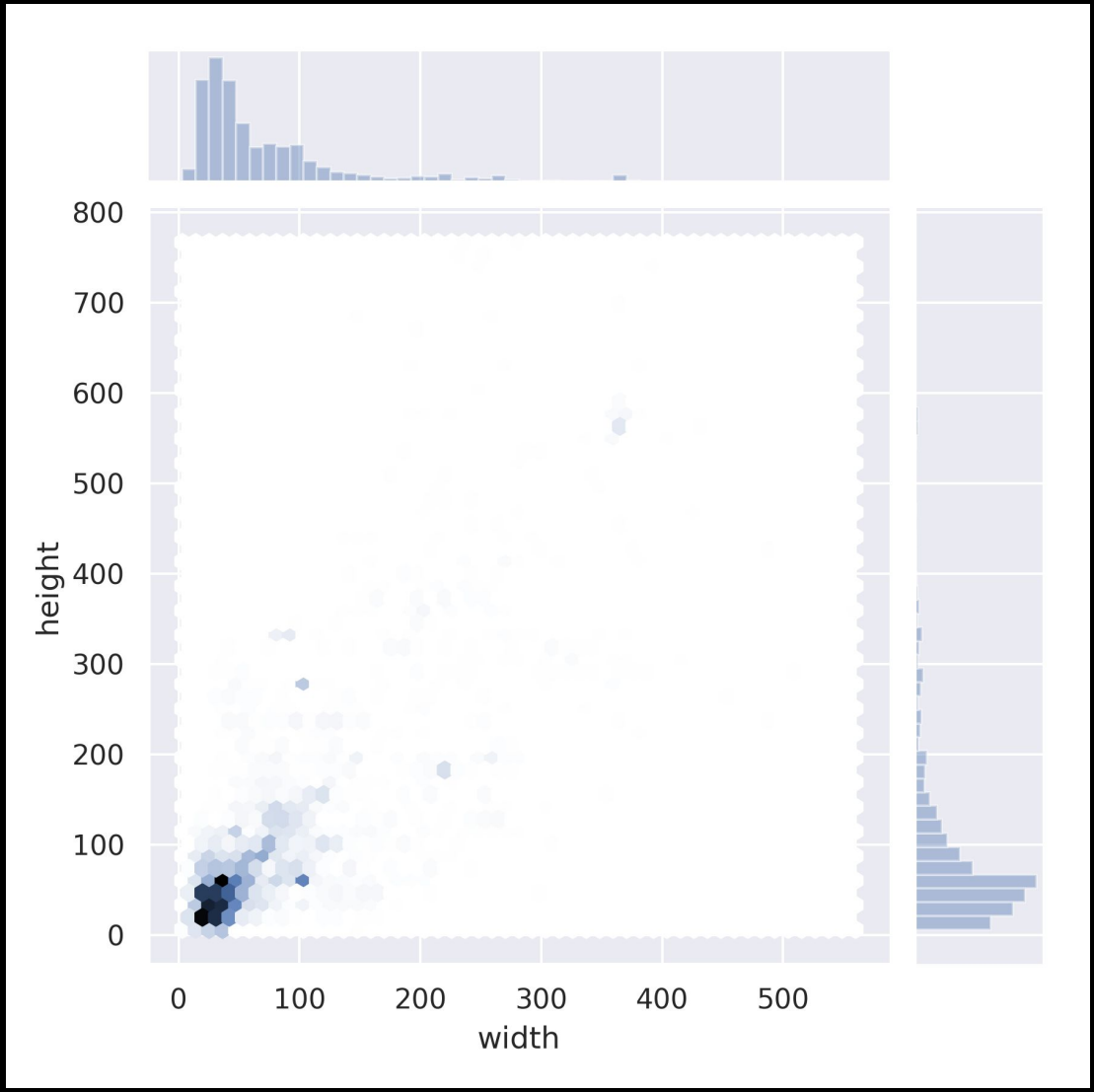
Approaches

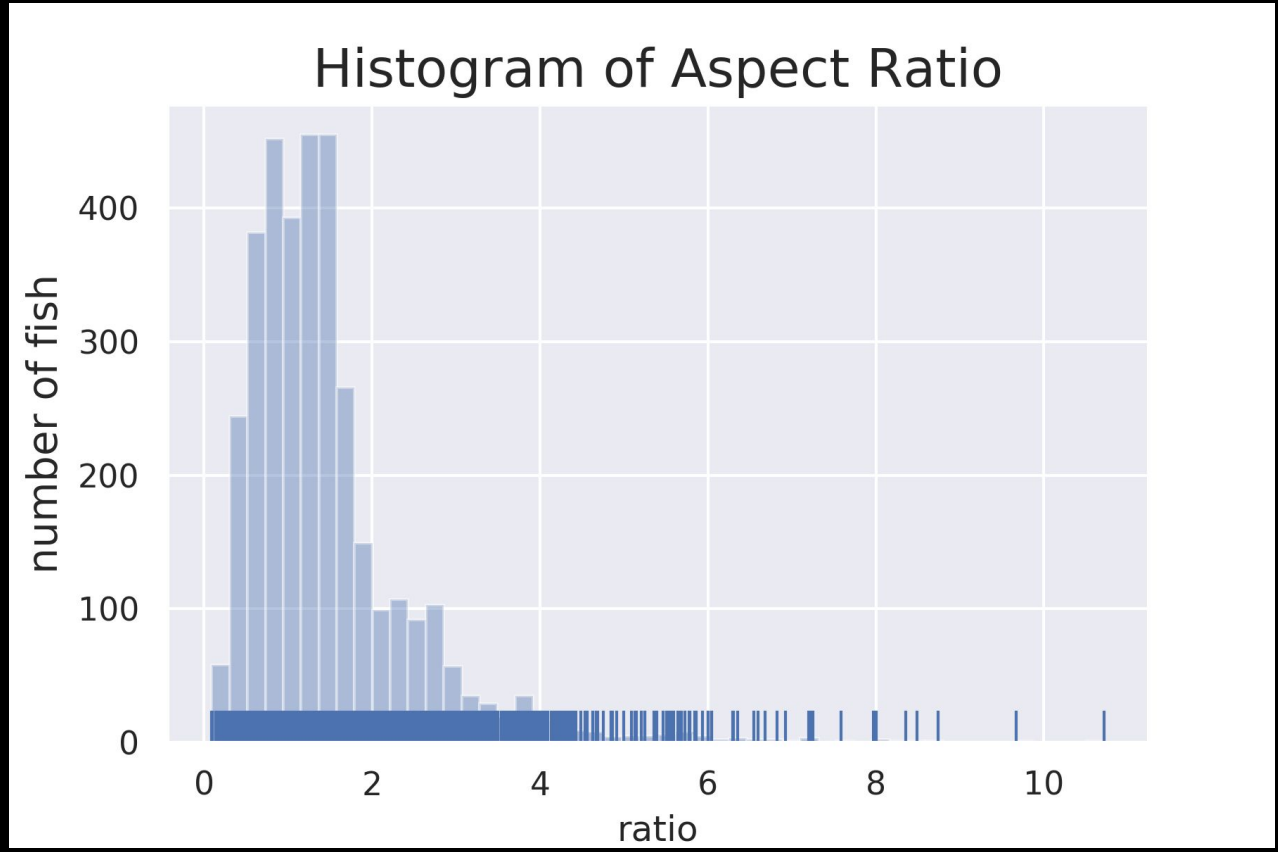
- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio

Histograms


800
700
600
500
400
300
200
100
0
height
0
100
200
300
400
500
width

Histograms

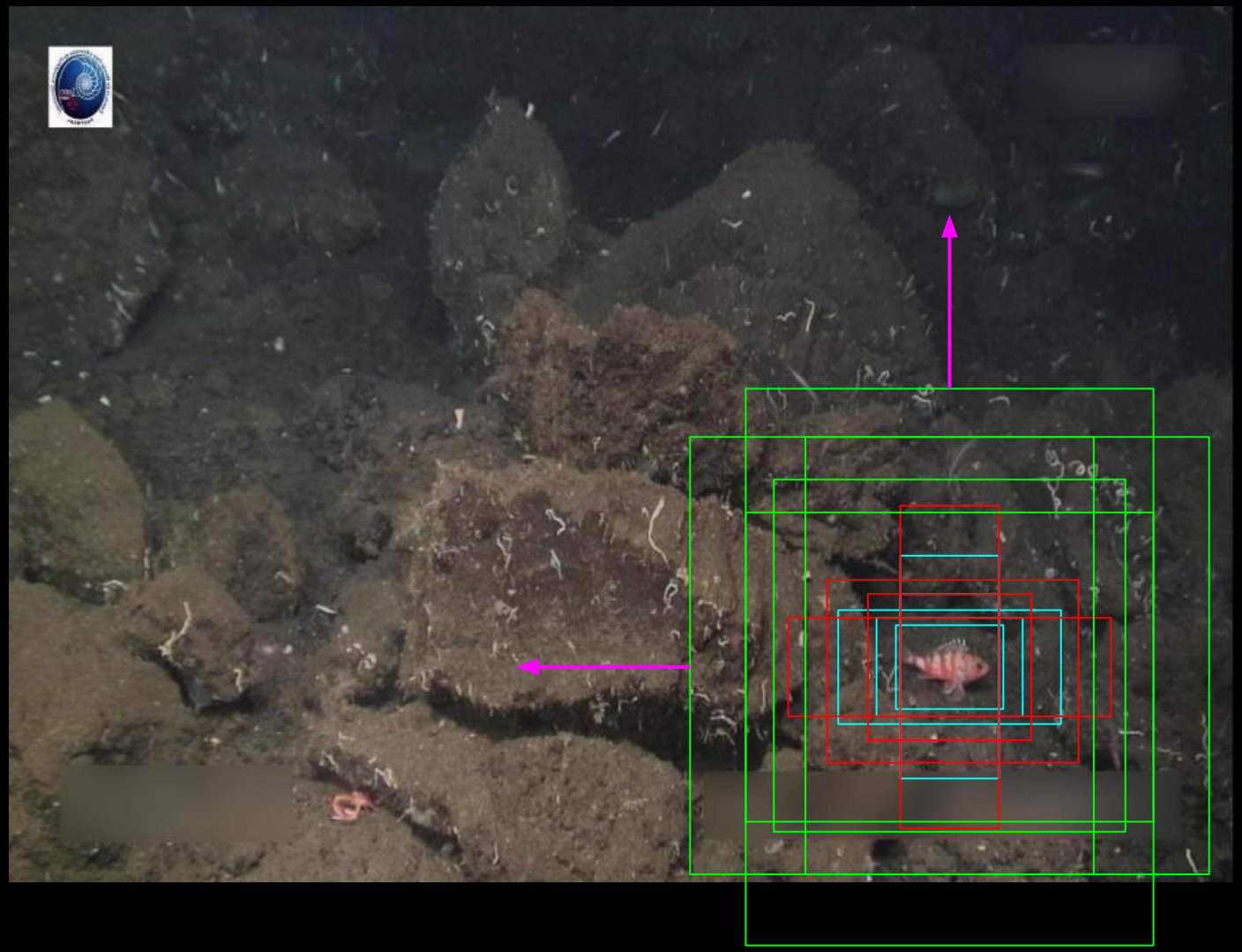

800
700
600
500
400
300
200
100
0
height
0
100
200
300
400
500
width


Histogram of Aspect Ratio
400
300
200
100
0
number of fish
0
2
4
6
8
10
ratio

Approaches

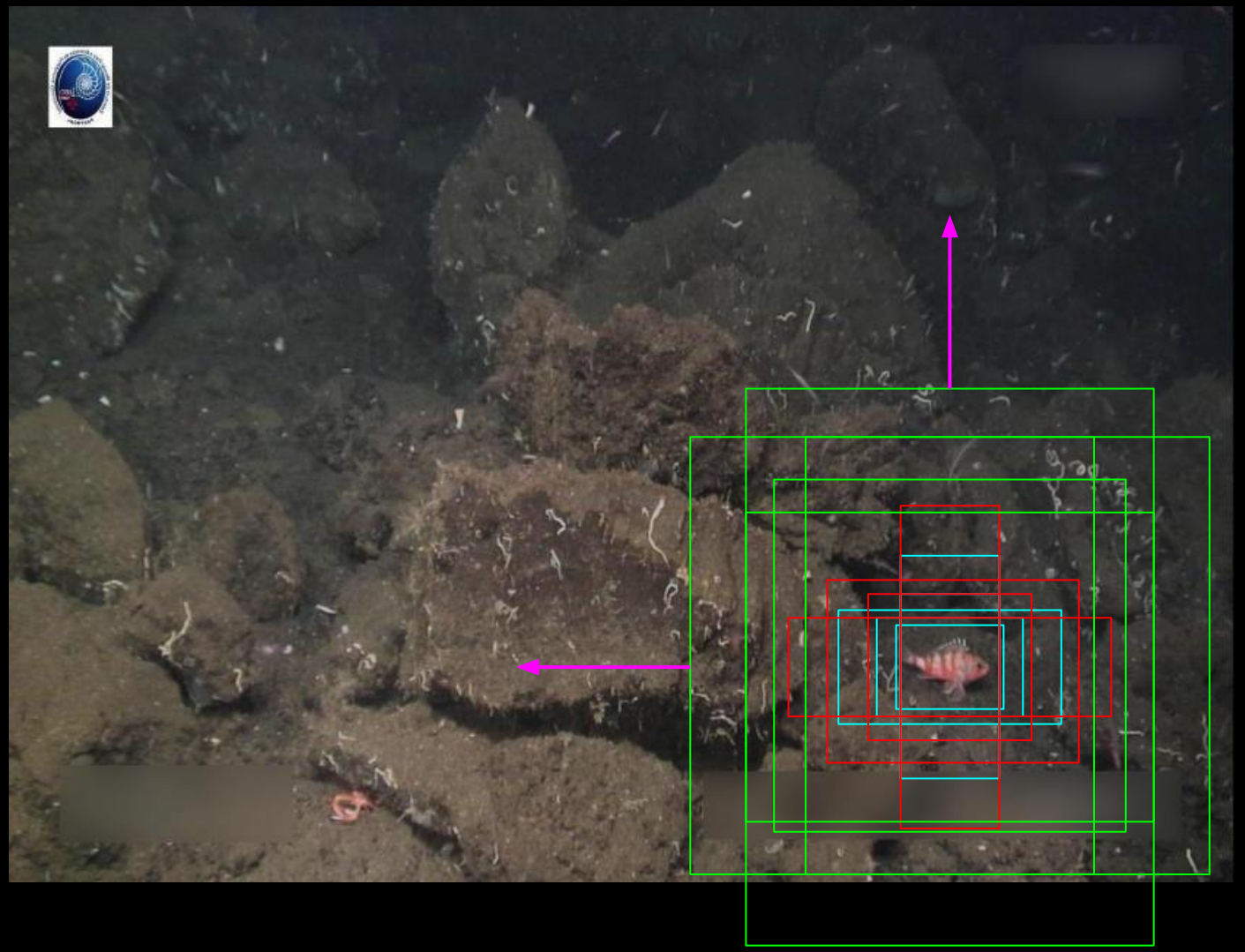
- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- **Design anchors**

Anchors



Anchors

sizes=(16, 32, 48, 64, 72, 96, 128, 256), aspect_ratios=(0.25, 0.5, 0.75, 1.0, 1.25, 1.5, 2.0, 4.0)



Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors
- **Checking the number of fishes**

Number of fishes

- Faster RCNN -> 100 objects per image (max)

Number of fishes

- Faster RCNN -> 100 objects per image (max)
- Fish detection -> 15 fishes

Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors
- Checking the number of fishes
- **Too many empty frames**

Empty frames

Problem:

- Too many negative

Empty frames

Problem:

- Too many negative

Solution:

- Remove empty frames
- Put flipped ones instead

Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors
- Checking the number of fishes
- Too many empty frames
- **Multi-scale**

Multi-scale

Problems:

- Mobilenet is limited
- Dataset includes fish with different sizes

Multi-scale

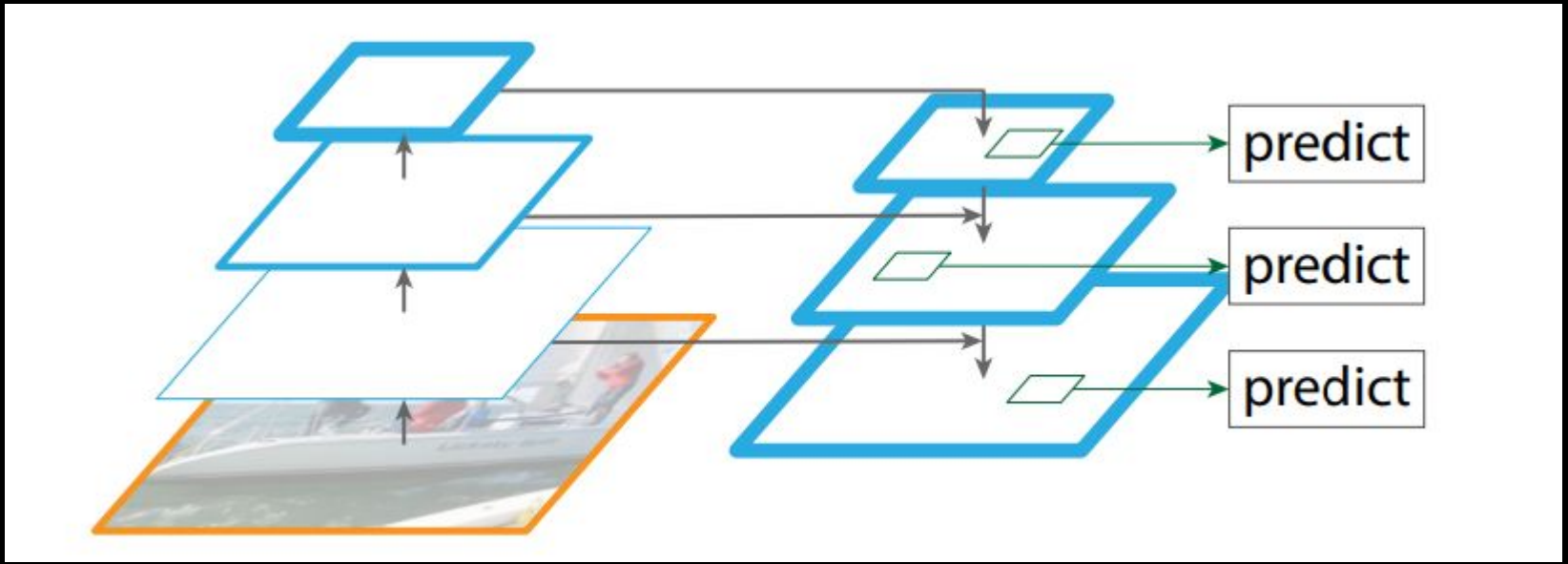
Problems:

- Mobilenet is limited
- Dataset includes fish with different sizes

Solution:

- Multi-scale backbone -> Feature Pyramid Network

Feature Pyramid Network



New backbone: Resnet-50 with FPN (COCO pretrained)

Feature Pyramid Networks for Object Detection: https://arxiv.org/abs/1612.03144

Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors
- Checking the number of fishes
- Too many empty frames
- Multi-scale
- **Limited data**

Limited data

- Data augmentation
  - Random flip
  - Rotation [-30,30]
  - Cutmix
  - Intensity

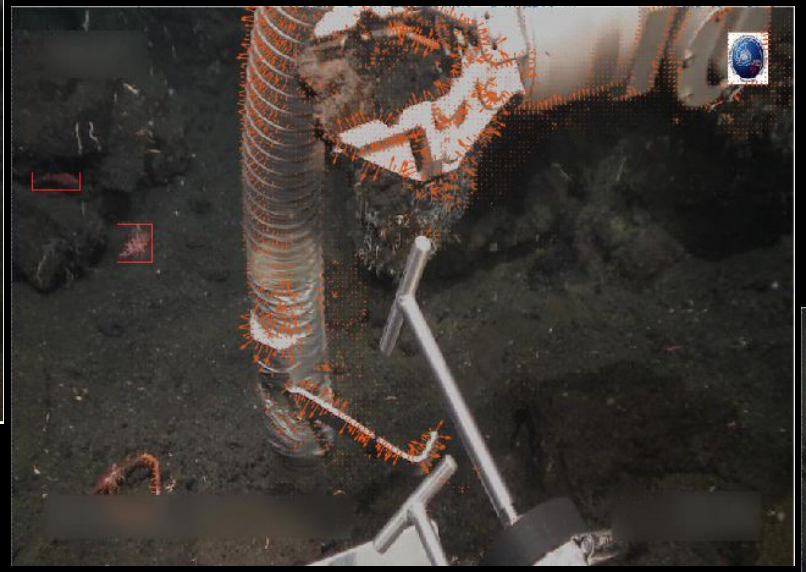
Failing Attempts

Failing Attempts

- Optical Flow

Optical Flow

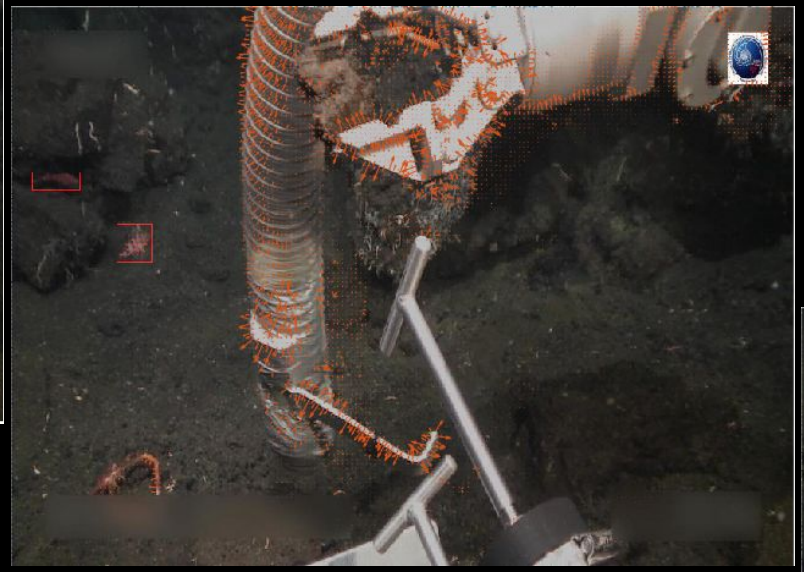
- Exploring the optical flow



Optical Flow

- Exploring the optical flow

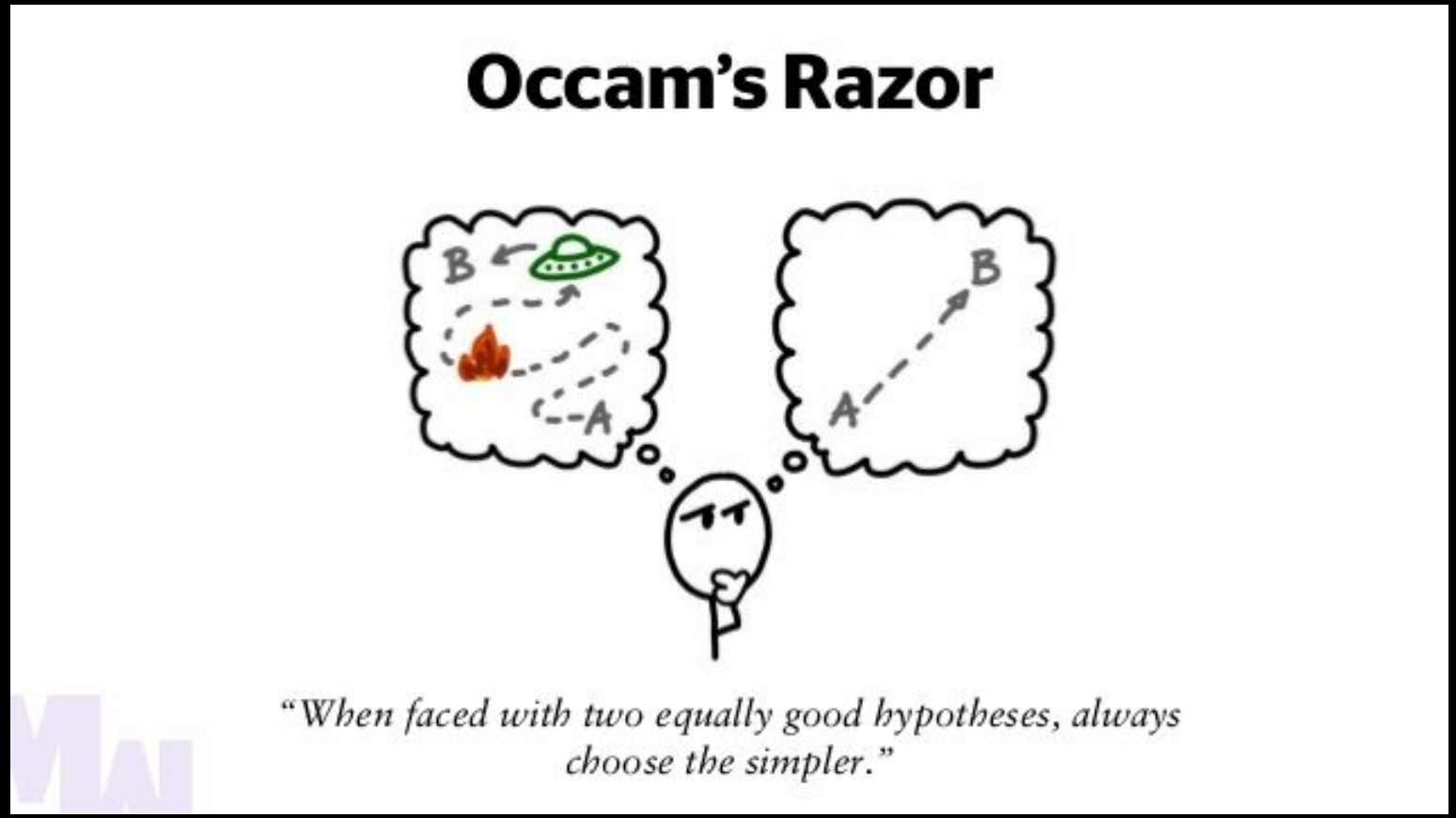
- fishes in subsea are ***lazy***



https://www.deviantart.com/t3h-lazy-fish/art/The-ORIGINAL-Lazy-Fish-38639595

Final Approaches

Simple is the best!



Source: https://automaticaddison.com/occams-razor-and-machine-learning/

Final Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors

Final Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors
- Checking the number of fishes -> 15 fishes

Final Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors
- Checking the number of fishes -> 15 fishes
- Too many empty frames -> Remove + flipping

Final Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors
- Checking the number of fishes -> 15 fishes
- Too many empty frames -> Remove + flipping
- Multi-scale -> Resnet-50 FPN backbone

Final Approaches

- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors
- Checking the number of fishes -> 15 fishes
- Too many empty frames -> Remove + flipping
- Multi-scale -> Resnet-50 FPN backbone
- Limited data -> data augmentation

Final Approaches

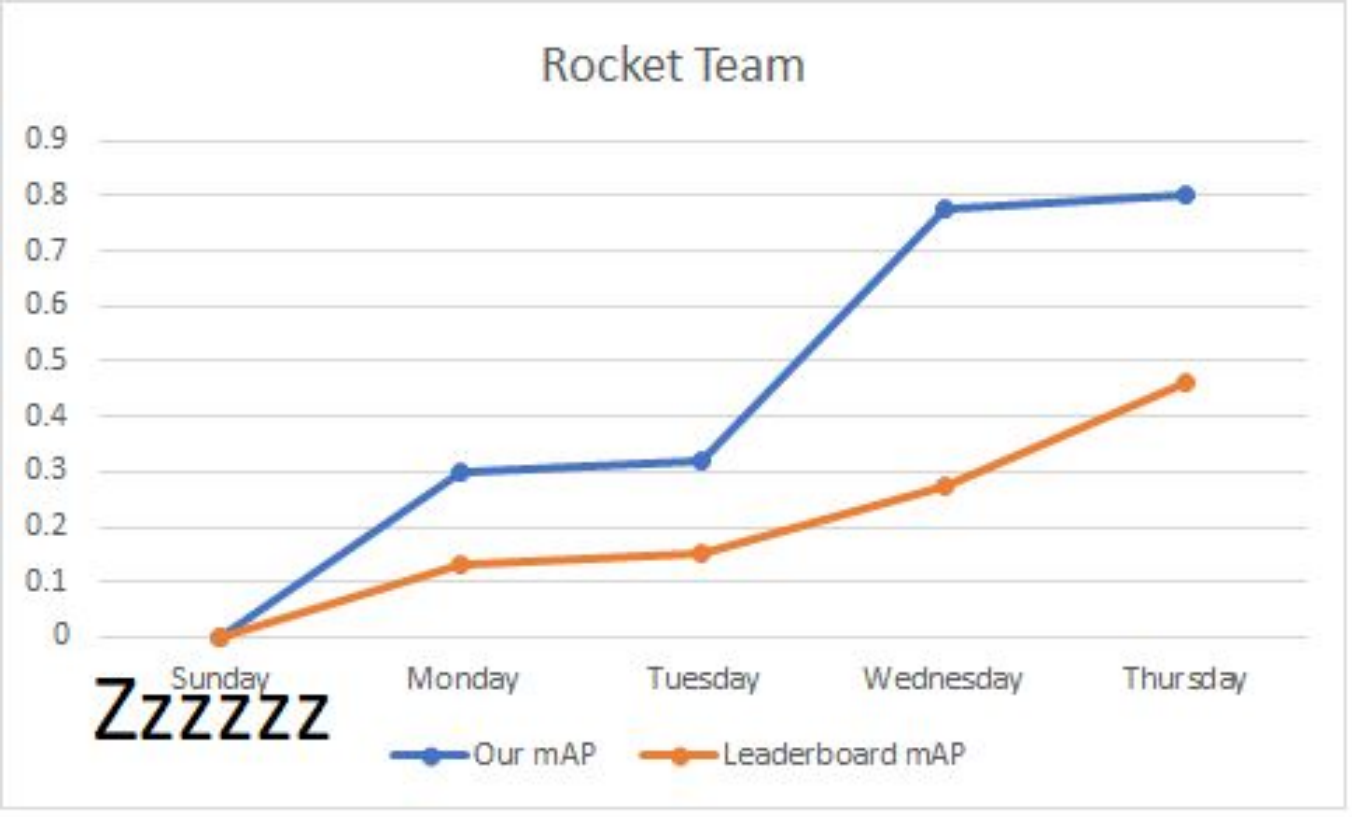
- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors
- Checking the number of fishes -> 15 fishes
- Too many empty frames -> Remove + flipping
- Multi-scale -> Resnet-50 FPN backbone
- Limited data -> data augmentation
- **Using validation set for training**

Final Approaches

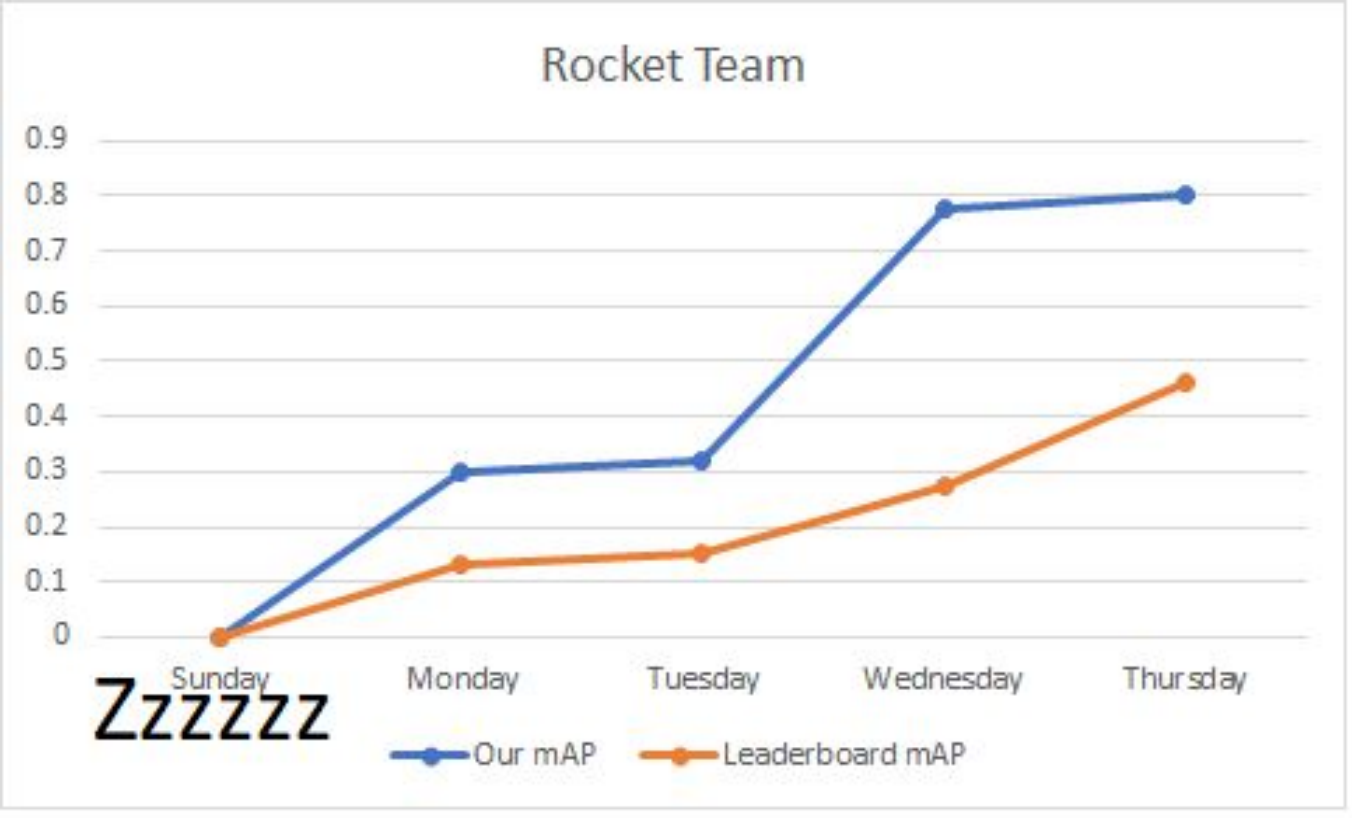
- Checking the dataset
- Getting statistics
- Plotting histograms
  - ➢ Width
  - ➢ Height
  - ➢ Aspect Ratio
- Design anchors -> More anchors
- Checking the number of fishes -> 15 fishes
- Too many empty frames -> Remove + flipping
- Multi-scale -> Resnet-50 FPN backbone
- Limited data -> data augmentation
- **Using validation set for training (only 9 epochs)**

Source:https://brazilianexperience.com/carbon-footprint-brazil-around-world/

Results


Rocket Team
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Sunday
Monday
Tuesday
Wednesday
Thursday
Zzzzzz
Our mAP
Leaderboard mAP

Results



with a given testset:
mAP: **0.8499**
AP at IoU level [0.50]: 0.9932
AP at IoU level [0.55]: 0.9932
AP at IoU level [0.60]: 0.9923
AP at IoU level [0.65]: 0.9912
AP at IoU level [0.70]: 0.9874
AP at IoU level [0.75]: 0.9789
AP at IoU level [0.80]: 0.9520
AP at IoU level [0.85]: 0.8641
AP at IoU level [0.90]: 0.6248
AP at IoU level [0.95]: 0.1218

Source:https://steamcommunity.com/sharedfiles/filedetails/?id=1241544856

Source:https://www.popularmechanics.com/space/rockets/g32758515/falcon-9-anniversary/

Source: https://www.space.com/42337-spacex-tesla-roadster-starman-beyond-mars.html

Thanks!