IHCV Project Block 1

Team 2
Ana, Noa, Lorenzo, Raul

Task 1

Goal: Statistical analysis of the data provided

Approach: Read the images in the training dataset, their masks and their corresponding ground truth, then create histograms based on fill factor, form factor and size. Also keep count of number of appearances.

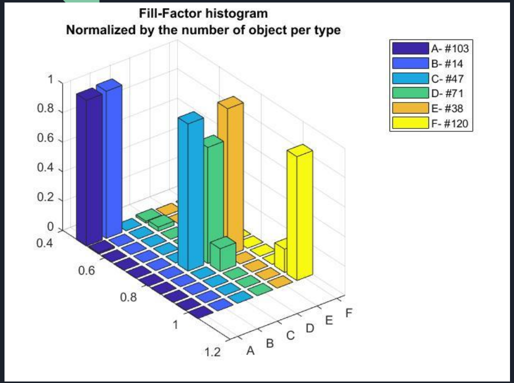
Results*: Frequency of appearance of each traffic sign type:

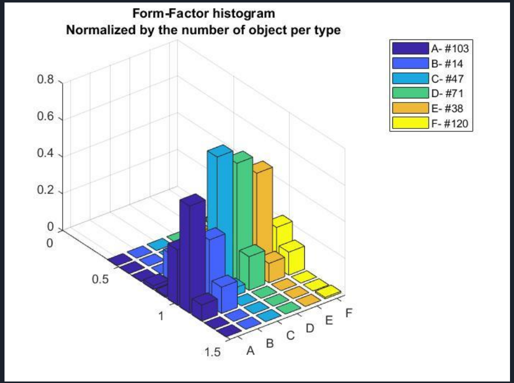
A: 103 B: 14 C: 47 D: 71 E: 38 F: 120

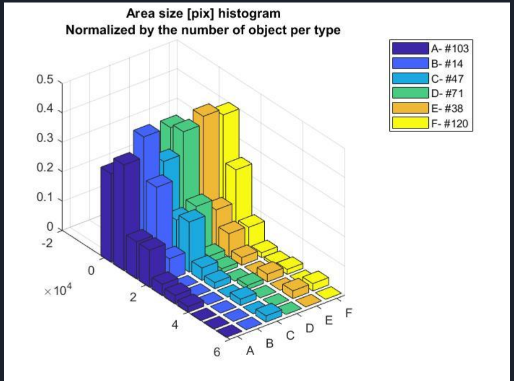
<u>Two most distinctive colours</u>: red (types A, B, C, E) and blue (types D and F).

* Histograms on the next slide

Task 1 - Results







Findings: Types A and B (triangles) cover more or less half the size of their masks, while types C, D and E (circular signs) range between 75% and 85%. Type F signs on the other hand cover between 95% and 100% of their masks. Geometrically speaking, these values make sense. The form-factor histogram shows how most of the signs have a 1:1 relation between height and width but the minimum and maximum values 0.7 and 1.3. Types A and B are on average slightly wider than the other types. The third histogram represents the size of the masks' bounding boxes. There is no correlation to the sign type as it only gives an idea of the distance between the camera and the sign when the picture was taken.

Task 2

Goal: Split the dataset into training data (70%) and evaluation data (30%)

Approach: The intention is to keep as much variety as possible in terms of:

1. Traffic sign type (which indirectly includes filling ratio)
2. Form factor
3. Size.

Results: The training data now contains 273 traffic signs and the evaluation data contains 120 traffic signs. Every type is represented in both datasets proportionally to the number of appearances in the original dataset.

Task 3

Goal: Colour segmentation to generate a mask.

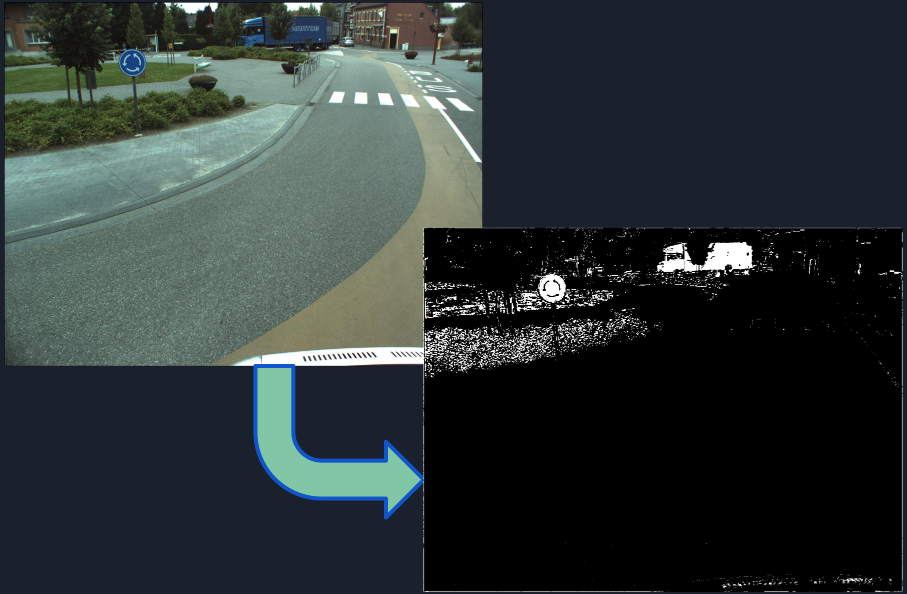
Approach: Red and blue are the most distinctive colours so they need to be detected in the image in order to detect traffic signs. Assumption: through some analysis of the training dataset and a few tests it would be possible to find the correct Hue, Saturation and Value ranges in order to detect red and blue separately.

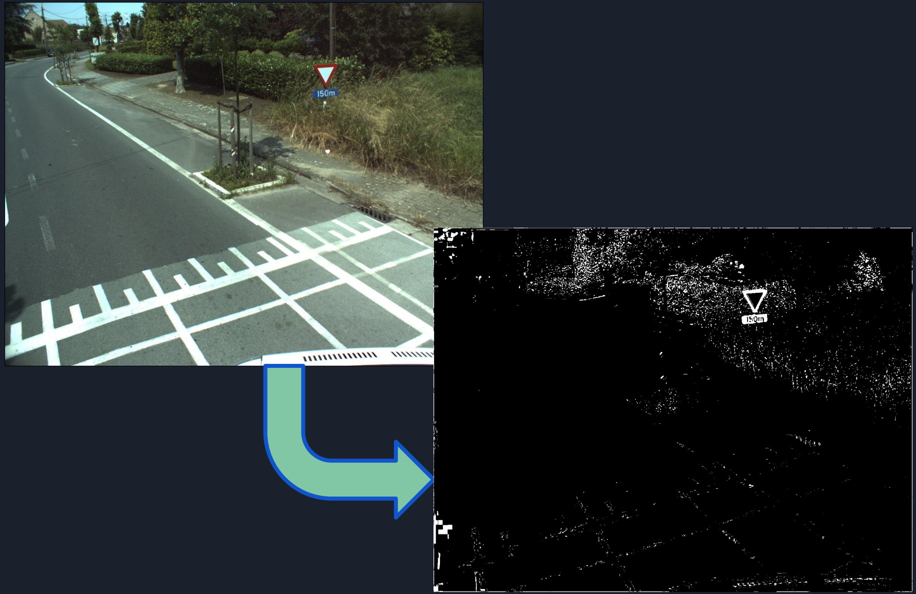
Results:

	BLUE	RED
Hue	0.55 - 0.65	0.5 - 0.9
Saturation	0 - 1	0.5 - 1
Value	0 - 1	0 - 1

Task 3

A couple of examples...





Task 4

Goal: Evaluate the segmentation using ground truth.

Approach: Use the provided script to evaluate the generated masks and analyse the results through a table showing the number of True Positives, False Positives, True Negatives and False Negatives.

Results:

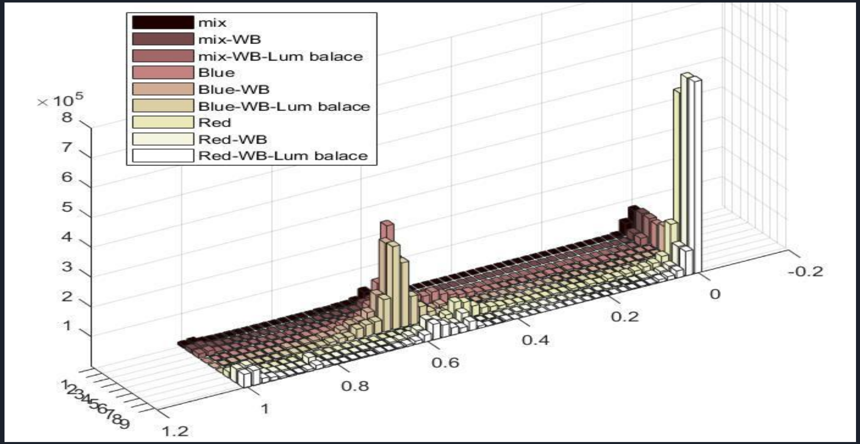
Precision	Accuracy	Recall	F1-Measure	TP	FP	FN	Time/Frame
0.0329	0.9323	0.5640	0.062	1633625	48039615	1262620	0.445

Task 5 (optional)

Goal: Study the influence of luminance normalization

Approach: Luminance normalization is used to help us to select exactly the color that we want, in this case the red and blue. It is used to see with approximately the same luminance all the images. White balance help us to see the colors as if they have the same light. For the normalization, we use the brightest part of the images (the 2% of the pixels of the image, the brighter ones).

Results: Applying the white-balance, the value ranges of the Hue has less variance, so the range is narrower than before. It normalized the colours in a useful way. In the other hand, the luminance doesn't depends on the Hue, so the luminance normalization didn't help us on that way. We observed that white-balance is more important to detect the signs in this project.



Conclusions

Achievements and findings:

- Blue and red are the most distinctive colours for these types of traffic sign.
- Three main shapes: triangle, circle and square.
- HSV colour space is better than RGB because it is more robust to lighting changes and noise.
- Training and validation datasets contain a proportional variety of signs.
- Colour segmentation works relatively well but it is not perfect (outliers are detected).

Problems

- Precision value needs to be bigger. A solution for this is to use a better range of the HSV values. The HSV value ranges that we chose are wide, so we can see outliers in the masks.
- Luminance normalization is not working as we expect. Once it’s well applied, it will help us to create a narrower range of the HSV, so the Precision will increase.