# Semantic Segmentation and Lane Detection

Visione Artificiale e Lab. – Project

Università di Modena e Reggio Emilia – 2017/2018

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# The problem

- Semantic Segmentation is one of the key problems in the field of computer vision.
- It is one of the high-level task that paves  the way towards  complete scene understanding.
- For this reason It has began a major problem in order to improve autonomous driving performances.

# Objectives

1. The aim of this project is to implement Semantic Segmentation on the well-known DR(eye)VE dataset composed by 74 video sequences of 5 min each, taken on Modena roads.

2. In addition to semantic segmentation the aim is also to perform lane detection that is a critical feature for self-driving cars.

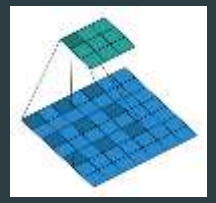
# Semantic Segmentation - Tool

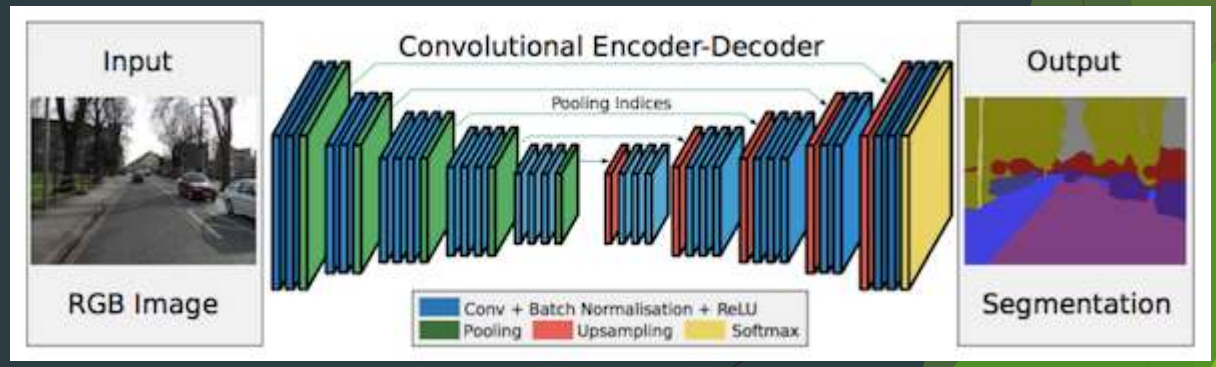
- Semantic Segmentation has been performed using WideResNet38 segmentation by DeepLab3.

- DeepLab is a state-of-art deep learning model (FCN) for semantic image segmentation, where the goal is to assign semantic labels (e.g., person, dog, cat and so on) to every pixel in the input image

Downsampling path : capture semantic/contextual information
Upsampling path : recover spatial information

Segnet + dilated convolutional layers

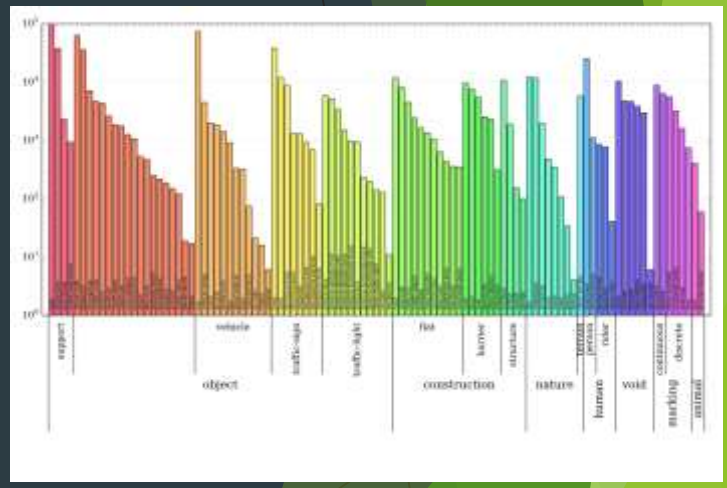





https://github.com/mapillary/inplace_abn
http://blog.qure.ai/notes/semantic-segmentation-deep-learning-review#segnet

# Semantic Segmentation -DeepLab training

- The WideResNet38 model has been trained on the Mapillary Vistas research set - 130 million images from places all around the globe.



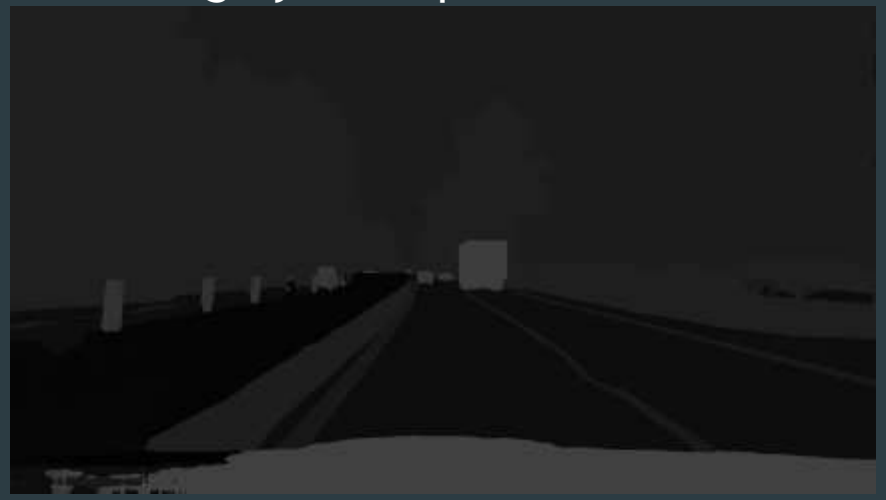

+100 object categories

https://research.mapillary.com/img/publications/ICCV17a.pdf
http://blog.qure.ai/notes/semantic-segmentation-deep-learning-review#segnet

# Semantic Segmentation - Results

original

gray-scale predictions



color coded predictions

# Semantic Segmentation – Results 2

After blending

Video Result

# Lane Detection - Approach

- A classic geometric approach has been taken to perform lane detection on the DR(eye)VE dataset.
- OpenCV libraries provide functions to perform Hough transform to detect lines.
- The implemented algorithm is based on the results provided by the performed semantic segmentation to improve reliability.

https://github.com/manganarofabio/hough_tesina_CV

# Lane Detection - Algorithm

- Input images:

Original

Segmented

# Lane Detection – Algorithm 2

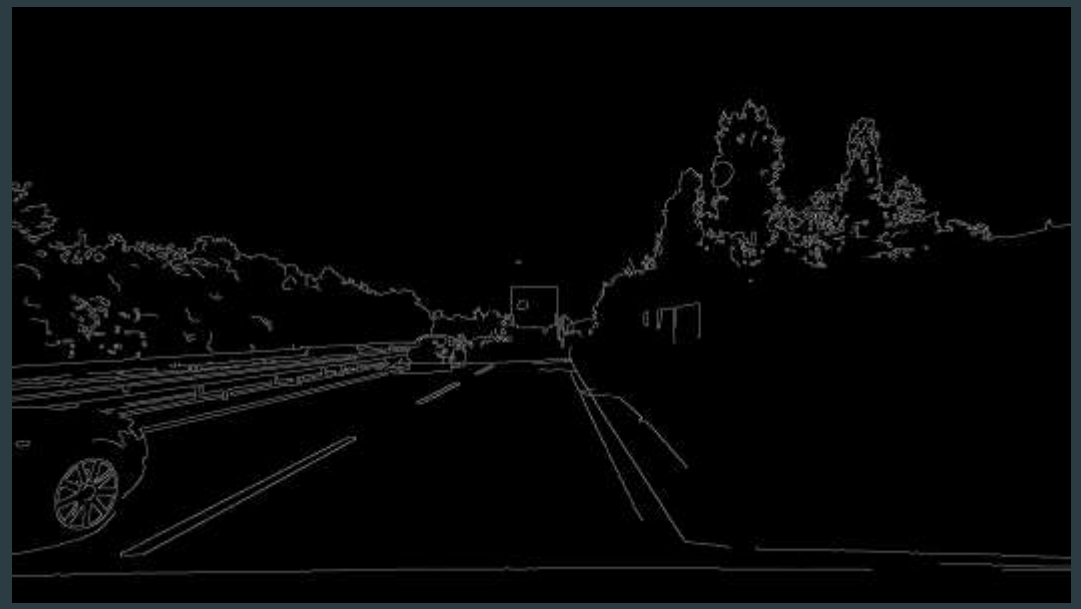
1. Getting segmented road mask from which obtain original road segmentation mask.

Keep only road and lines segmentations

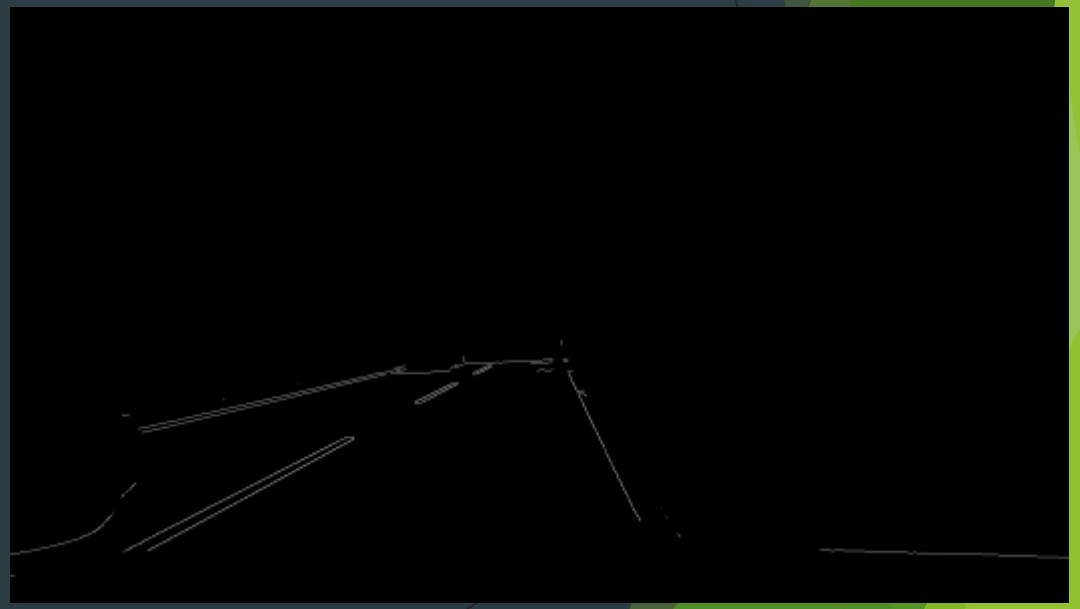
# Lane Detection – Algorithm 3

- After applying a bilateral filter to “clean” the image, Canny is implemented on grayscale image and post-processed to get only road mask.

  ⟶ cv2.**Canny**(image, threshold1, threshold2) → edges



Full image



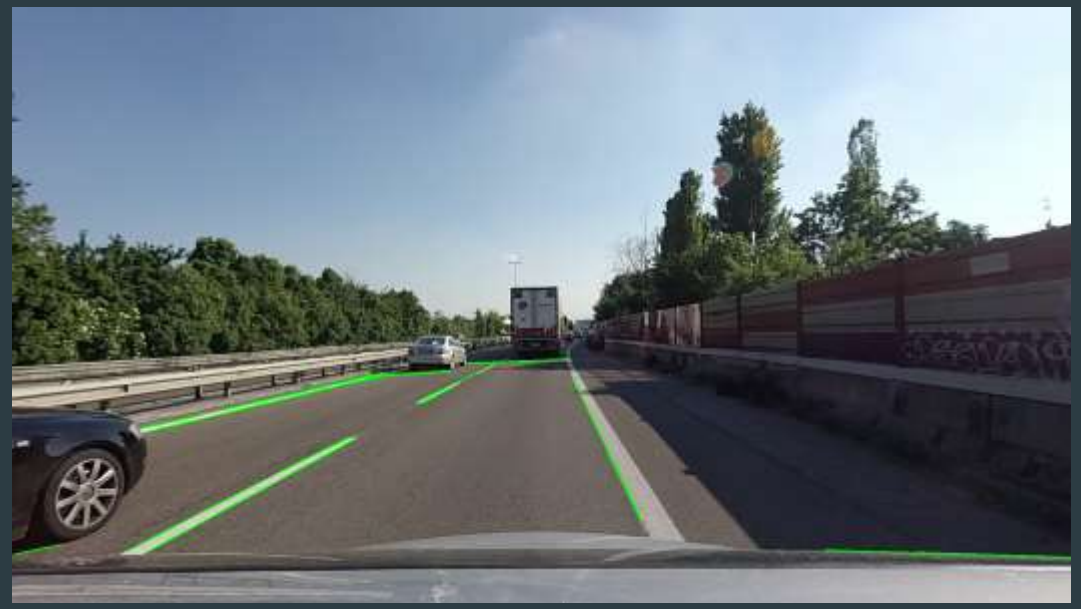
Road mask

# Lane Detection – Algorithm 4

- Getting Hough lines on canny road mask

  → *cv2.**HoughLines**(image, rho, theta, threshold[,minLineLength[, maxLineGap]]]) → lines*

- Performing average slope selection to create final lines mask.



Hough lines displayed on original image

Final lines mask

# Lane Detection – Algorithm 4

- Getting final visualization using original and segmented images

Only road, lines and lane are highlighted

# Final Result

# Skills achieved

- Implement what we learnt during computer vision labs in a real-life case.
- Combining different computer visions functions to perform tasks.
- Choice best solutions for specific study case.