

# Pixellevel Semantic Segmentation with PixelNet on CityScapes



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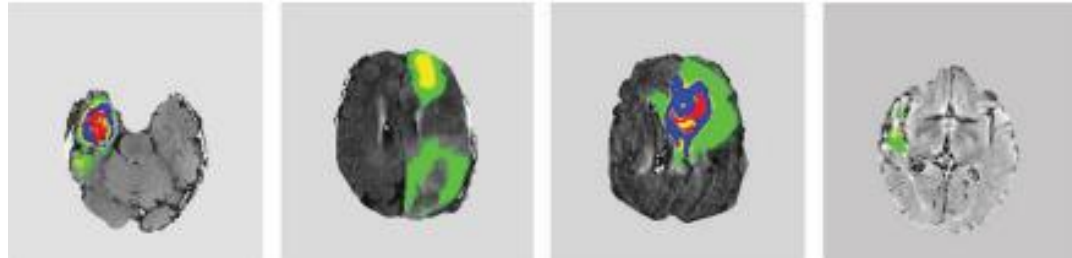
Marius Cordts et al., 2016

# The Importance of Semantic Segmentation

## Semantic Segmentation

Partition the image into semantically meaningful parts in order to classify each part

### Automatic Cancer Segmentation



Shaoguo Cui et al., 2018

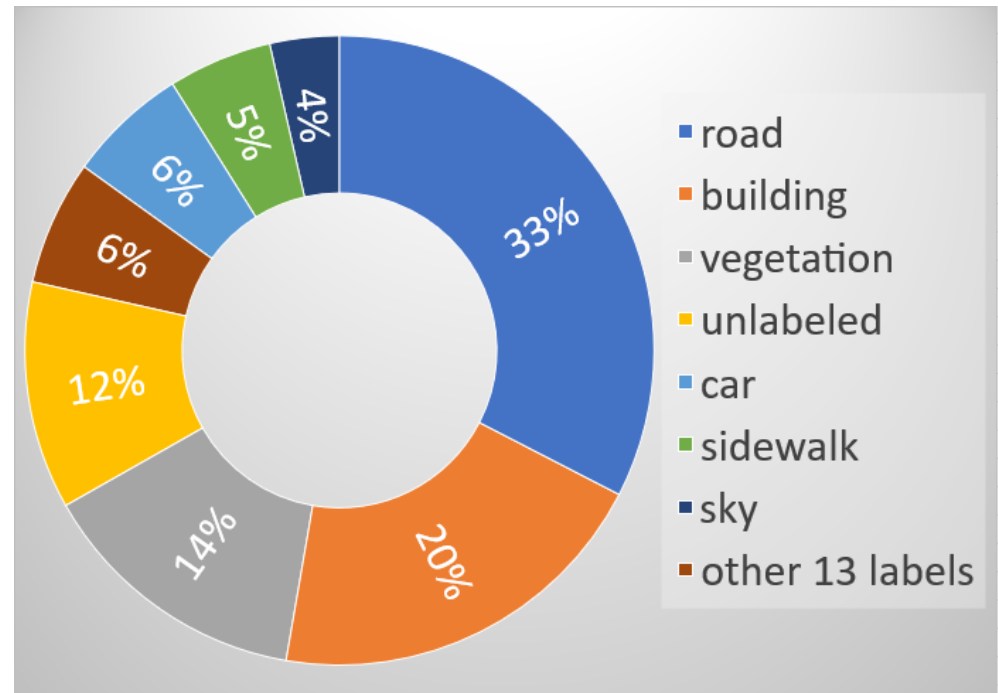
### Autonomous Driving



Marius Cordts et al.,  
2016

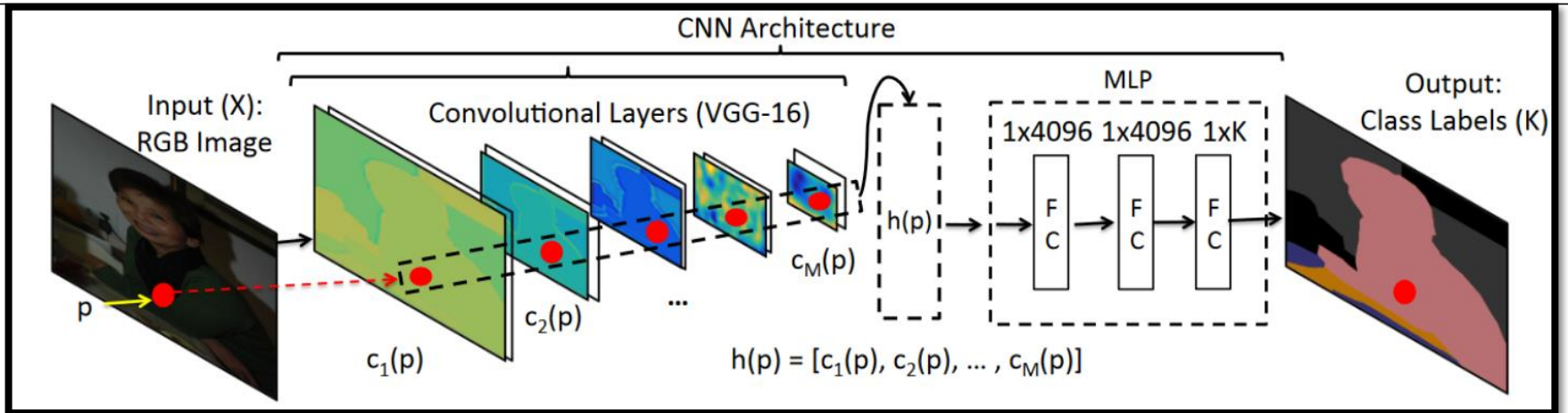
# CityScapes: Dataset Overview

- 5000 fine annotated images of street scenes (2950 for training)
- 50 different cities, primarily in Germany
- 34 labels (19 considered while training/ evaluation)
- Aspect ratio 2:1 (2048x1024)



→ uneven class distribution

# PixelNet: Architecture



Aayush Bansal et al., 2016

- 1 Input image fed into pretrained VGG16
- 2 Extraction of hypercolumn features for each Pixel (during training a small subset of pixels is randomly sampled)
- 3 MLP predicts label for each particular hypercolumn feature
- 4 Output: class label for each input pixel of MLP

**Implementing PixelNet with Tensorflow from scratch**

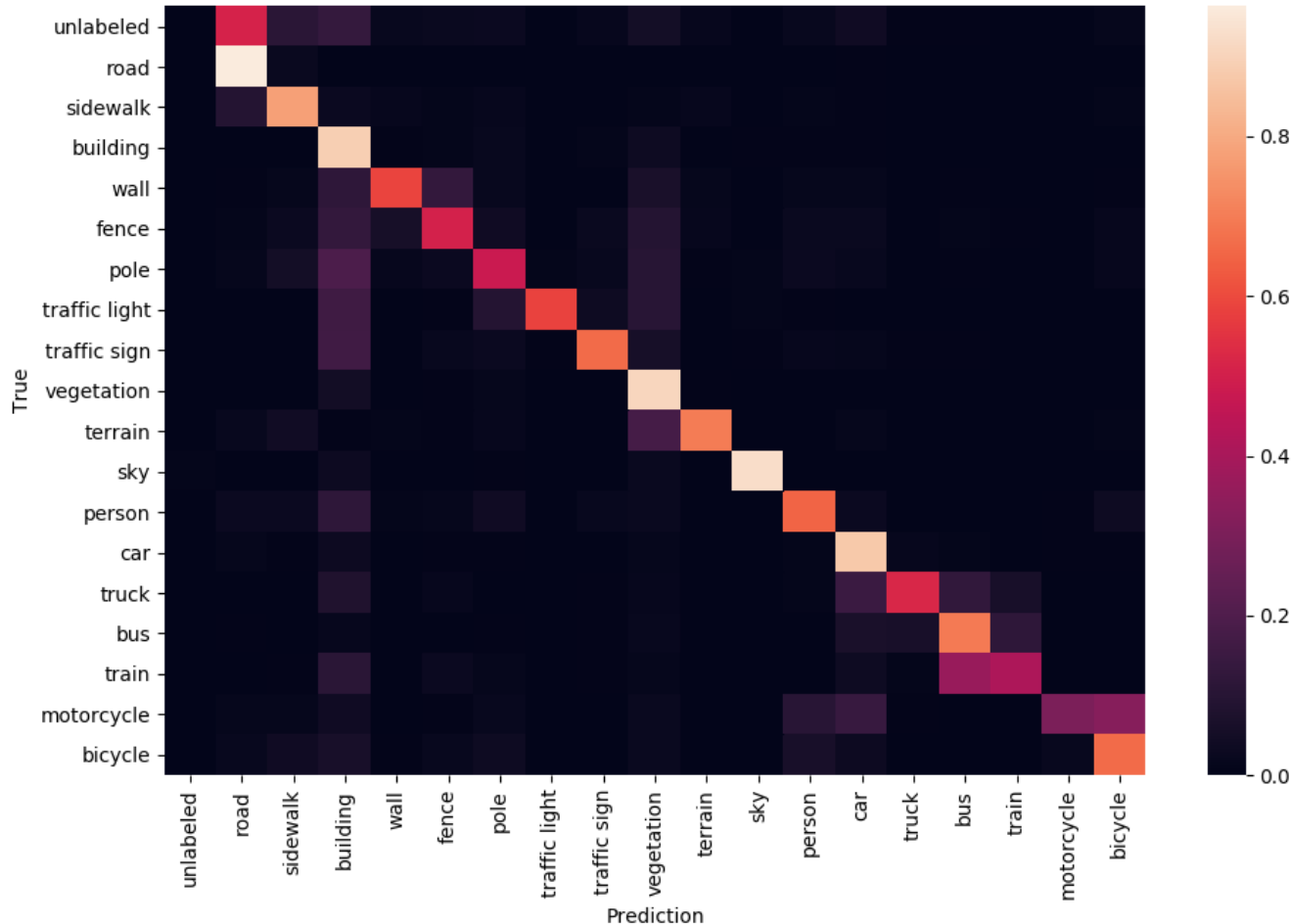
**Implementing training and evaluation environment**

**Training and tuning PixelNet on CityScapes dataset**

**Evaluation of results**

# Results: Confusion matrix

Confusion Matrix



**Training:**

Mean IoU: 73.95%

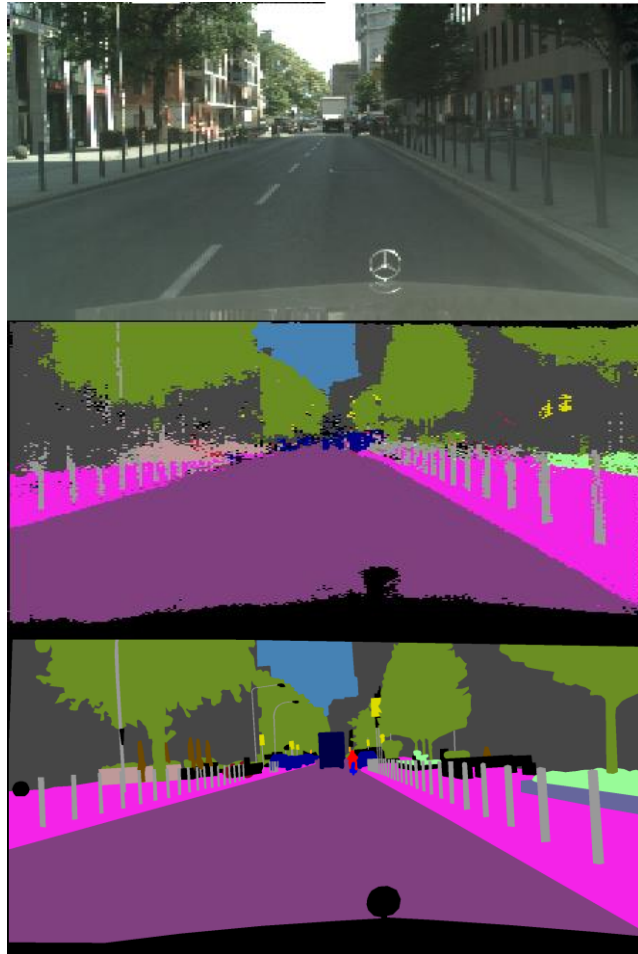
**Validation:**

Mean IoU: 43.2%

Weighted IoU: 59.2%

Category IoU: 69.9%

# Results: Examples

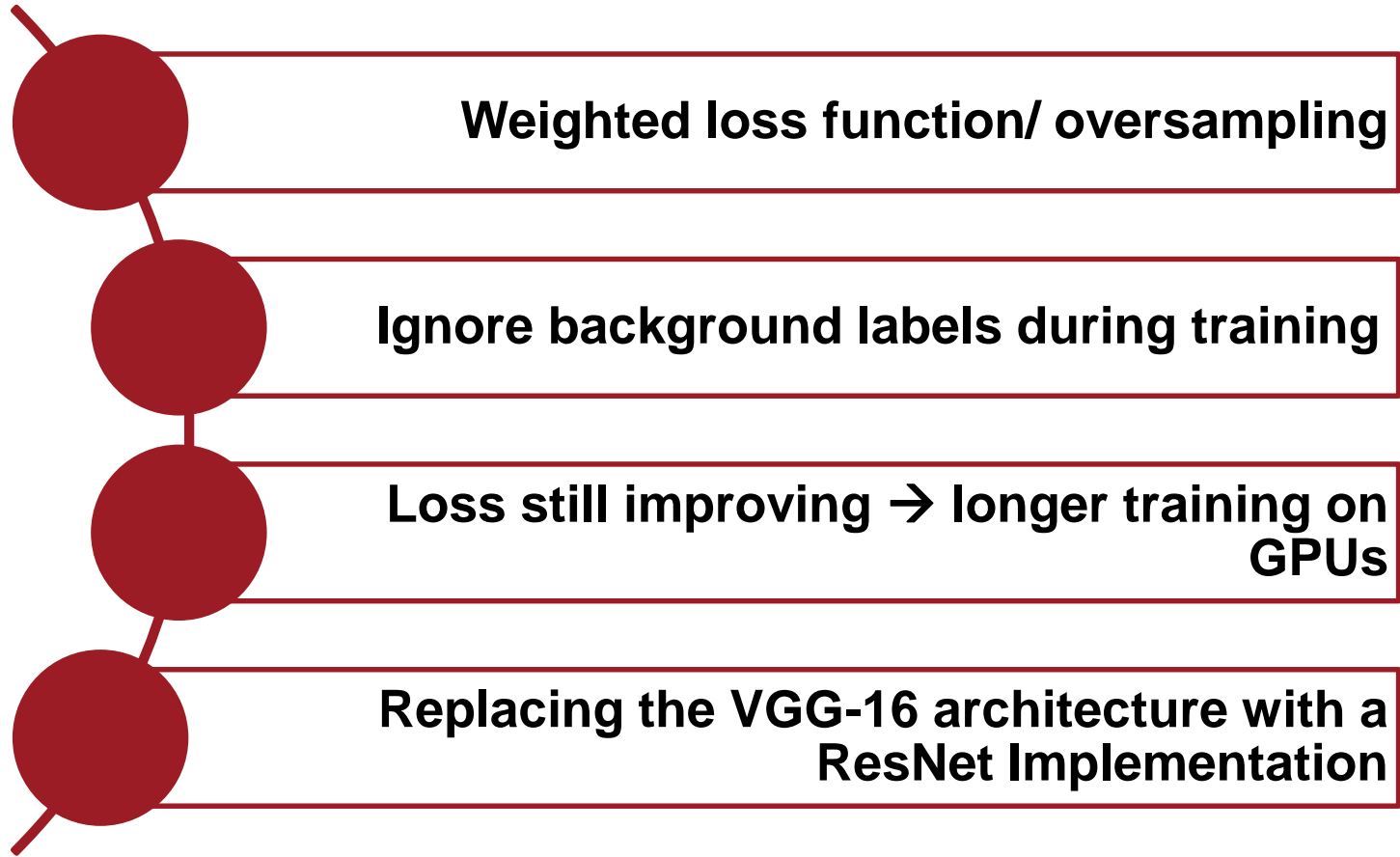


Input Image

Prediction

Ground Truth







# QUESTIONS?



Marius Cordts et al., 2016

- Cordts, Marius; Omran, Mohamed; Ramos, Sebastian; Rehfeld, Timo; Enzweiler, Markus; Benenson, Rodrigo et al.: The Cityscapes Dataset for Semantic Urban Scene Understanding. Available online at <http://arxiv.org/pdf/1604.01685v2>.
- Shaoguo Cui, Lei Mao, Jingfeng Jiang, Chang Liu, and Shuyu Xiong, “Automatic Semantic Segmentation of Brain Gliomas from MRI Images Using a Deep Cascaded Neural Network,” Journal of Healthcare Engineering, vol. 2018, Article ID 4940593, 14 pages, 2018. <https://doi.org/10.1155/2018/4940593>
- Bansal, Aayush; Chen, Xinlei; Russell, Bryan; Gupta, Abhinav; Ramanan, Deva: PixelNet. Towards a General Pixel-level Architecture. Available online at <http://arxiv.org/pdf/1609.06694v1>.