



Intro of Image Segmentation

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Applications



Self- Driving Cars



Medical Images





Different Image Segmentation Techniques

01

Semantic segmentation

02

Instance segmentation

03

Panoptic segmentation

Semantic Segmentation

Input



Ground truth



Prediction



Simon Jegou, Michal Drozdal, David Vazquez, Adriana Romero, Yoshua Bengio, Montreal Institute for Learning Algorithms, Ecole Polytechnique de Montreal, Imagia Inc, Montreal, Computer Vision Center, Barcelona. "The One Hundred Layers Tiramisu: Fully Convolutional DenseNets for Semantic Segmentation." Computer Vision and Pattern Recognition(CVPR), 2016.

How to evaluate the performance of semantic segmentation



Semantic Segmentation

Pixel Accuracy

Focus on TP(True Positive), TN(True Negative), FP(False Positive), FN(False Negative)

$$\text{Pixel Accuracy} = \frac{\#TP + \#TN}{\#TP + \#TN + \#FP + \#FN}$$

Semantic Segmentation

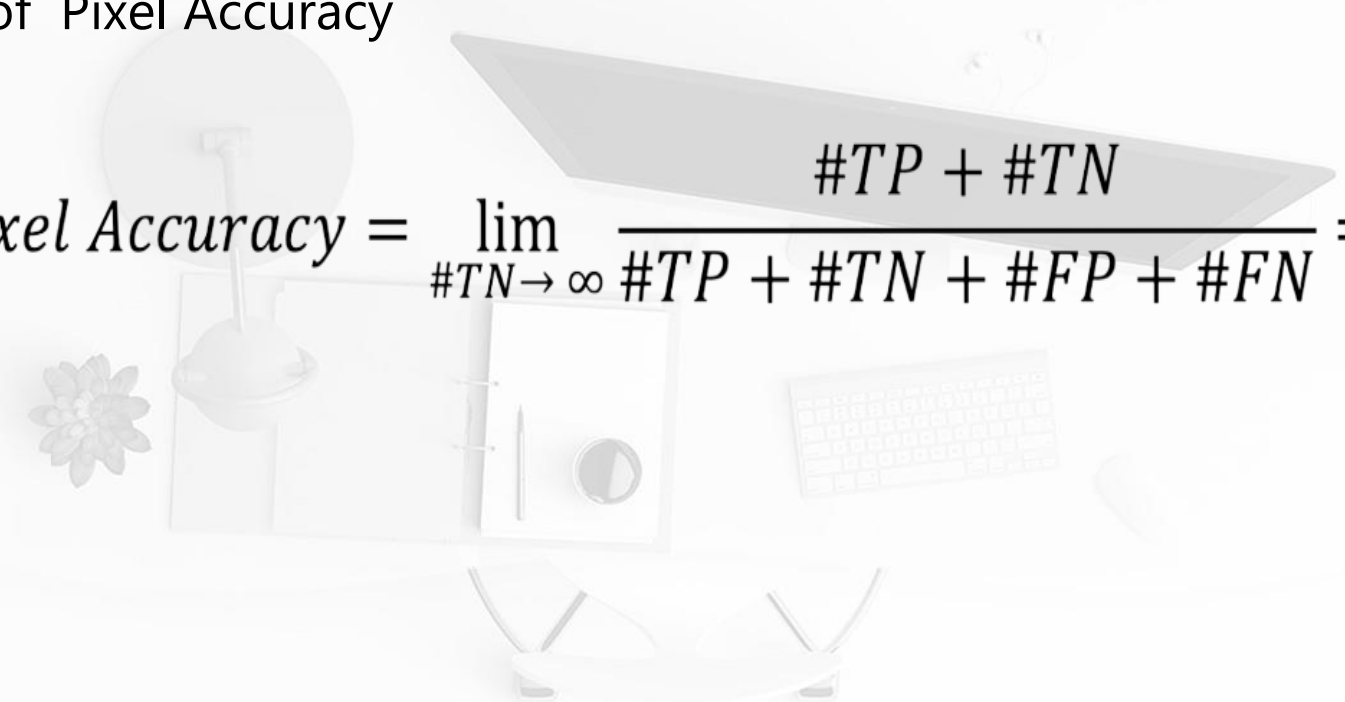
Problem of Pixel Accuracy



Photo by [Rowan Heuvel](#) on [Unsplash](#)

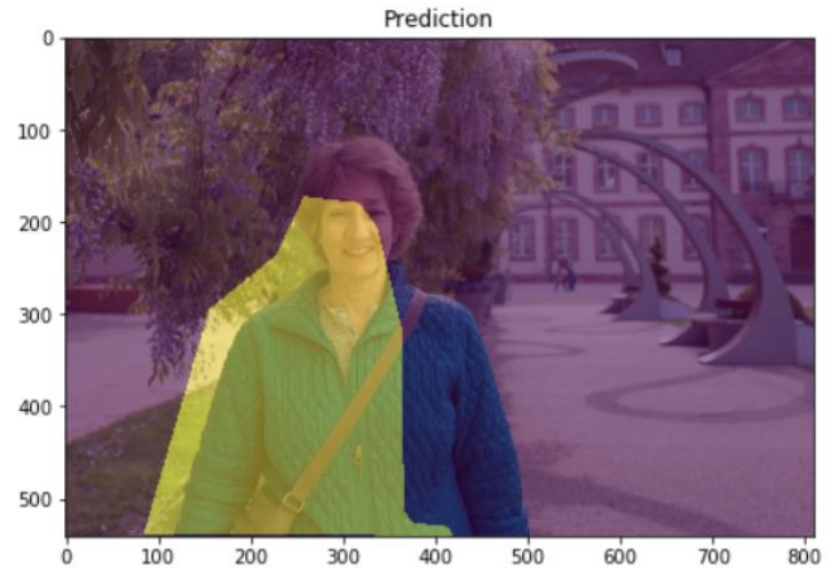
Semantic Segmentation

Problem of Pixel Accuracy


$$\text{Pixel Accuracy} = \lim_{\#TN \rightarrow \infty} \frac{\#TP + \#TN}{\#TP + \#TN + \#FP + \#FN} = 1$$

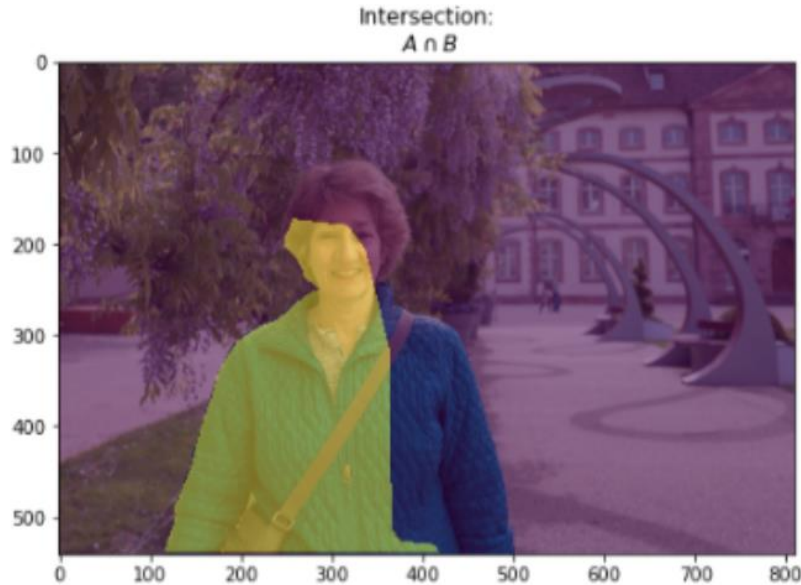
Semantic Segmentation

IOU (intersection-over-union)



Semantic Segmentation

IOU (intersection-over-union)



Semantic Segmentation

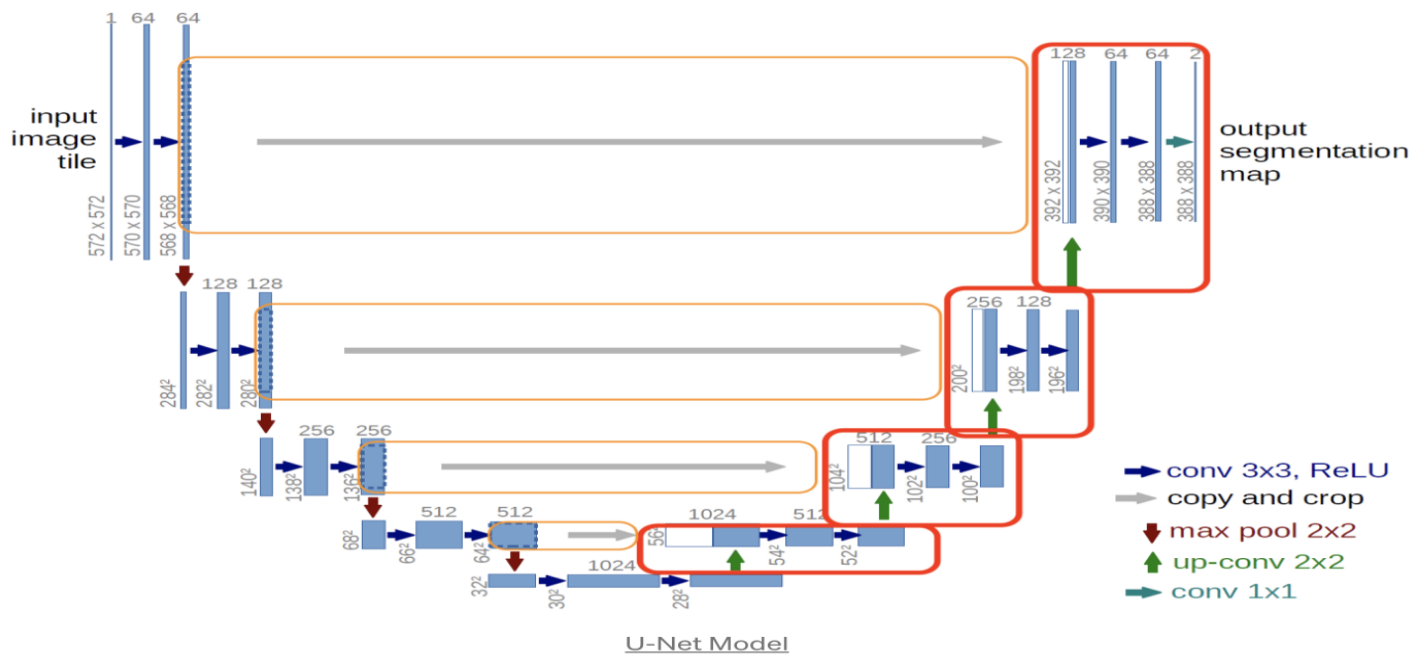
IOU (intersection-over-union)

Focus on TP(True Positive), FP(False Positive), FN(False Negative)

$$IoU = \frac{\text{Intersection}}{\text{Union}} = \frac{\#TP}{\#TP + \#FP + \#FN}$$

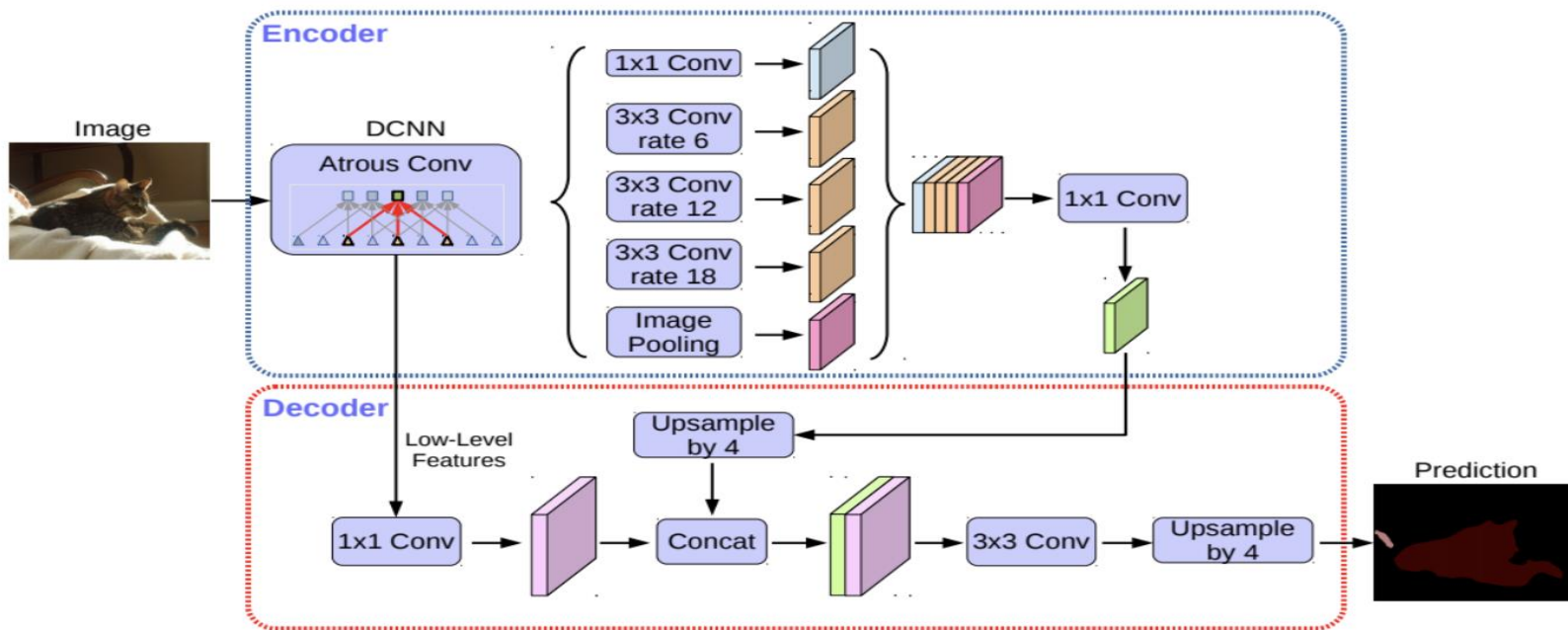
Model Introduction

U-Net



Model Introduction

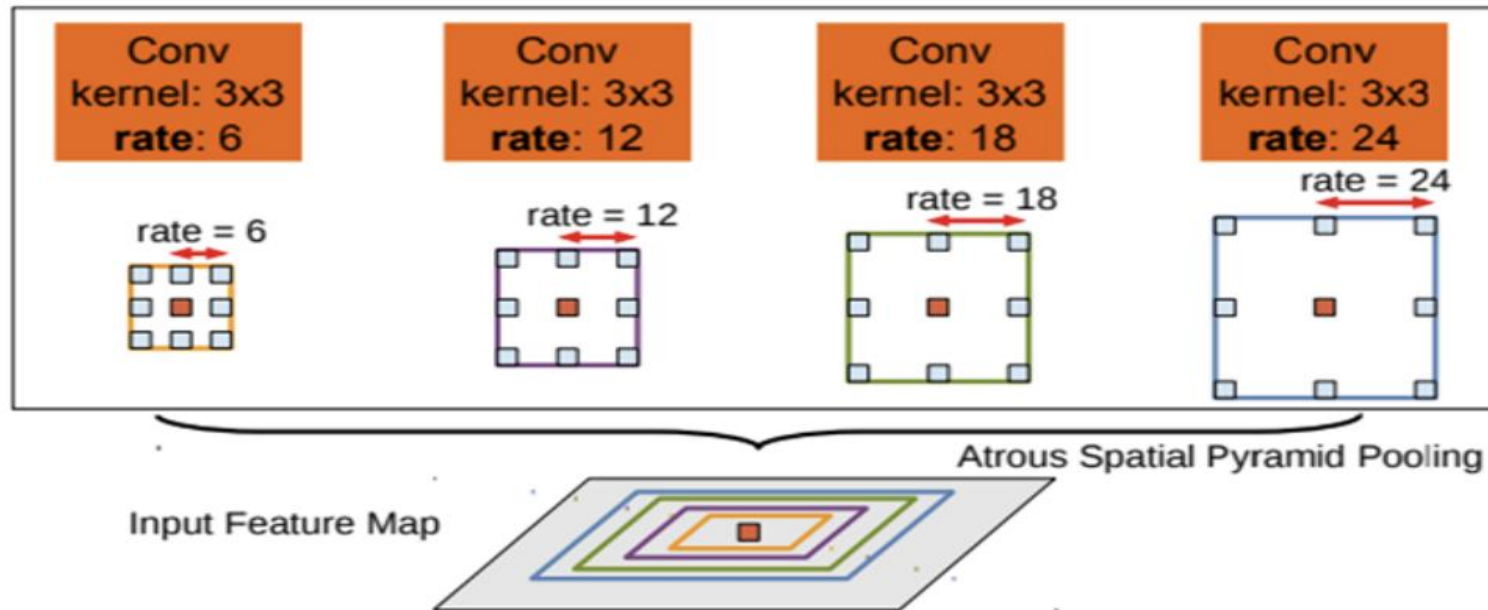
DeepLab v3+



Model Introduction

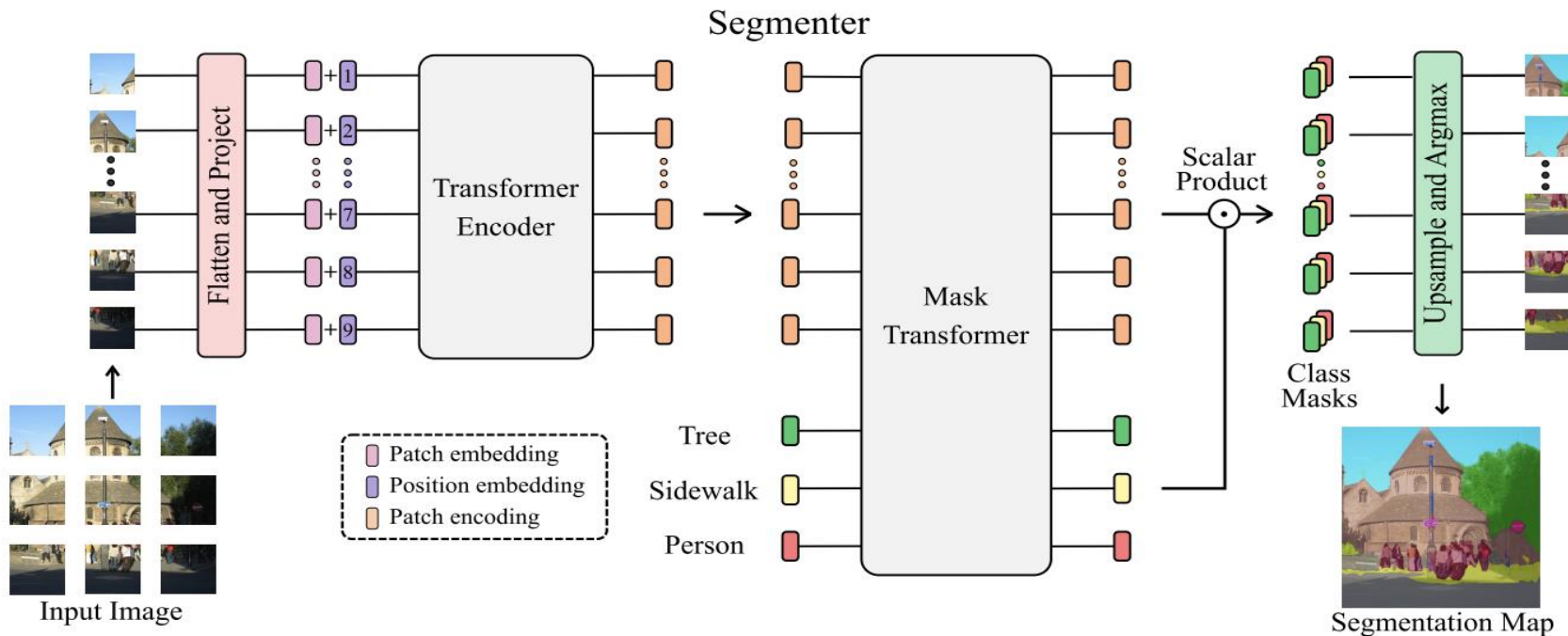
DeepLab v3+

Atrous Spatial Pyramid Pooling



Model Introduction

Segmenter



Reference

- [1] Dingfu Zhou, Jin Fang, Xibin Song, Chenye Guan, Junbo Yin, Yuchao Dai and Ruigang Yang. "IoU Loss for 2D/3D Object Detection." International Conference on 3D Vision, 2019.
- [2] Olaf Ronneberger, Philipp Fischer, and Thomas Brox. "U-Net: Convolutional Networks for Biomedical Image Segmentation." MICCAI, 2015.
- [3] Simon Jegou, Michal Drozdal, David Vazquez, Adriana Romero, Yoshua Bengio, Montreal Institute for Learning Algorithms, Ecole Polytechnique de Montreal, Imagia Inc, Montreal, Computer Vision Center, Barcelona. "The One Hundred Layers Tiramisu: Fully Convolutional DenseNets for Semantic Segmentation." Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops, 2017, pp. 11-19.
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- [5] Liang-Chieh Chen, George Papandreou, Senior Member, IEEE, Iasonas Kokkinos, Member, IEEE, Kevin Murphy, and Alan L. Yuille, Fellow, IEEE. "DeepLab: Semantic Image Segmentation with Deep Convolutional Nets, Atrous Convolution, and Fully Connected CRFs." TPAMI, 2016.

Reference

[6] Robin Strudel, Ricardo Garcia, Ivan Laptev, Cordelia Schmid. "Segmenter: Transformer for Semantic Segmentation." Proceedings of the IEEE/CVF International Conference on Computer Vision (ICCV), 2021, pp. 7262-7272.





**Thanks for
Listening**