DEEP LEARNING BRASIL
SUMMER SCHOOL

U-Net: Segmentação Semântica para detecção de células

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Aula rápida....

- Olaf Ronneberger, 2015

U-Net: Convolutional Networks for Biomedical Image Segmentation

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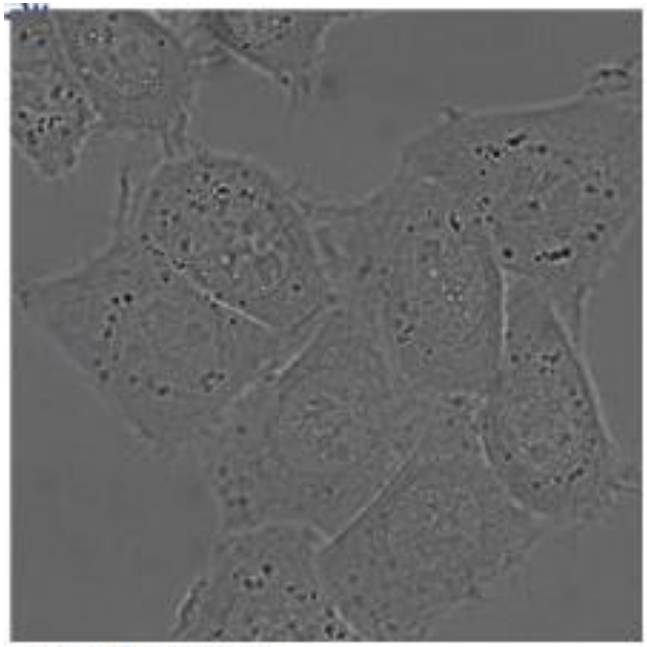
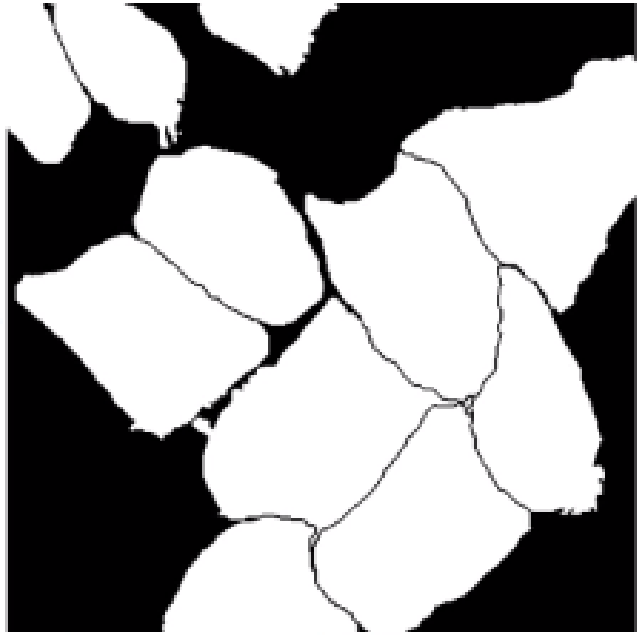
Abstract. There is large consent that successful training of deep networks requires many thousand annotated training samples. In this paper, we present a network and training strategy that relies on the strong use of data augmentation to use the available annotated samples more efficiently. The architecture consists of a contracting path to capture context and a symmetric expanding path that enables precise localization. We show that such a network can be trained end-to-end from very few images and outperforms the prior best method (a sliding-window convolutional network) on the ISBI challenge for segmentation of neuronal structures in electron microscopic stacks. Using the same network trained on transmitted light microscopy images (phase contrast and DIC) we won the ISBI cell tracking challenge 2015 in these categories by a large margin. Moreover, the network is fast. Segmentation of a 512x512 image takes less than a second on a recent GPU. The full implementation (based on Caffe) and the trained networks are available at http://lmb.informatik.uni-freiburg.de/people/ronneber/u-net.

Descrição do problema

- ISBI Cell Tracking Challenge 2015



input image



output segmentation map

Desafios

- Poucos dados
- Objetos da mesma classe se encostando na imagem

Referência

- Long e Shelhamer, 2015

Fully Convolutional Networks for Semantic Segmentation

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Abstract

Convolutional networks are powerful visual models that yield hierarchies of features. We show that convolutional networks by themselves, trained end-to-end, pixels-to-pixels, exceed the state-of-the-art in semantic segmentation. Our key insight is to build "fully convolutional" networks that take input of arbitrary size and produce correspondingly-sized output with efficient inference and learning. We define and detail the space of fully convolutional networks, explain their application to spatially dense prediction tasks, and draw connections to prior models. We adapt contemporary classification networks (AlexNet [19], the VGG net [31], and GoogLeNet [32]) into fully convolutional networks and transfer their learned representations by fine-tuning [4] to the segmentation task. We then define a novel architecture that combines semantic informa-

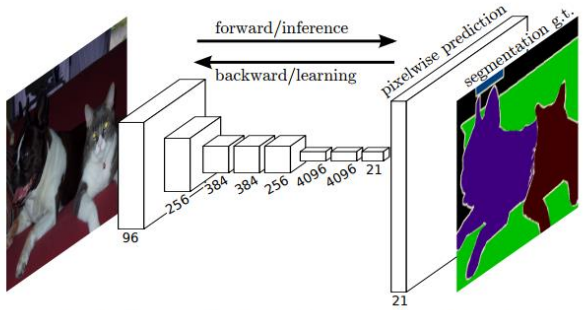
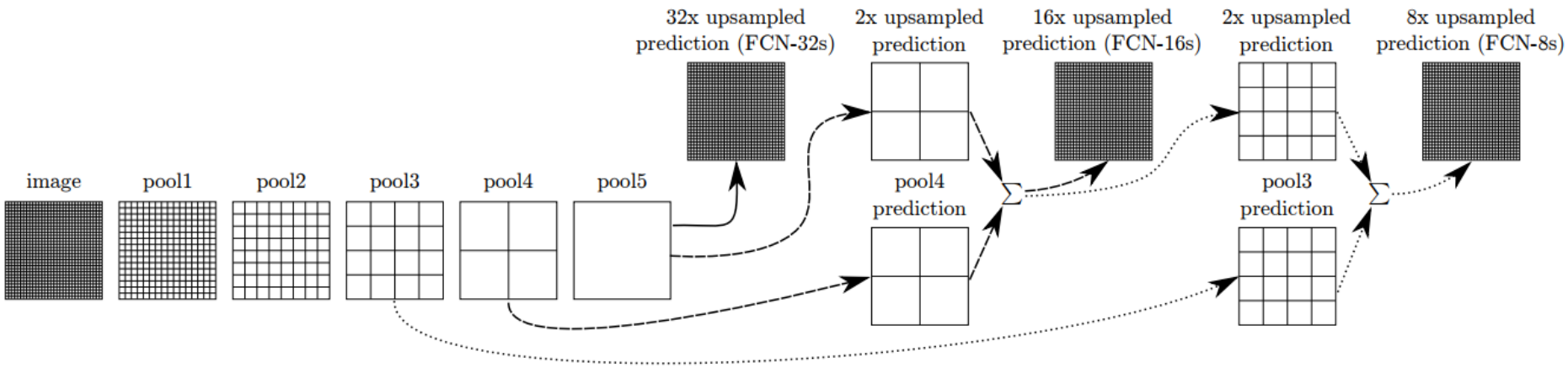


Figure 1. Fully convolutional networks can efficiently learn to make dense predictions for per-pixel tasks like semantic segmentation.

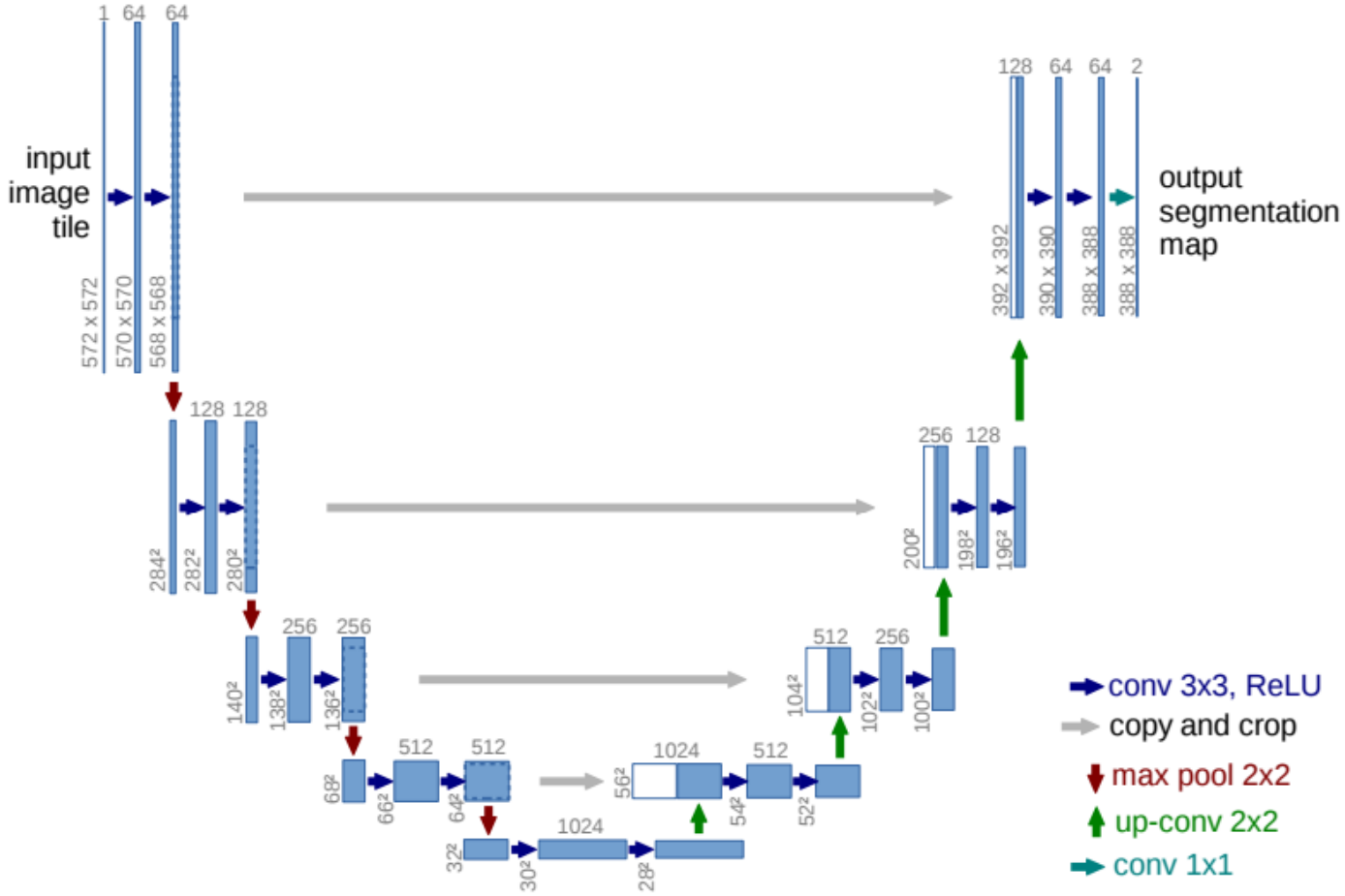
We show that a fully convolutional network (FCN), trained end-to-end, pixels-to-pixels on semantic segmentation exceeds the state-of-the-art without further machin

Referência

- FCN

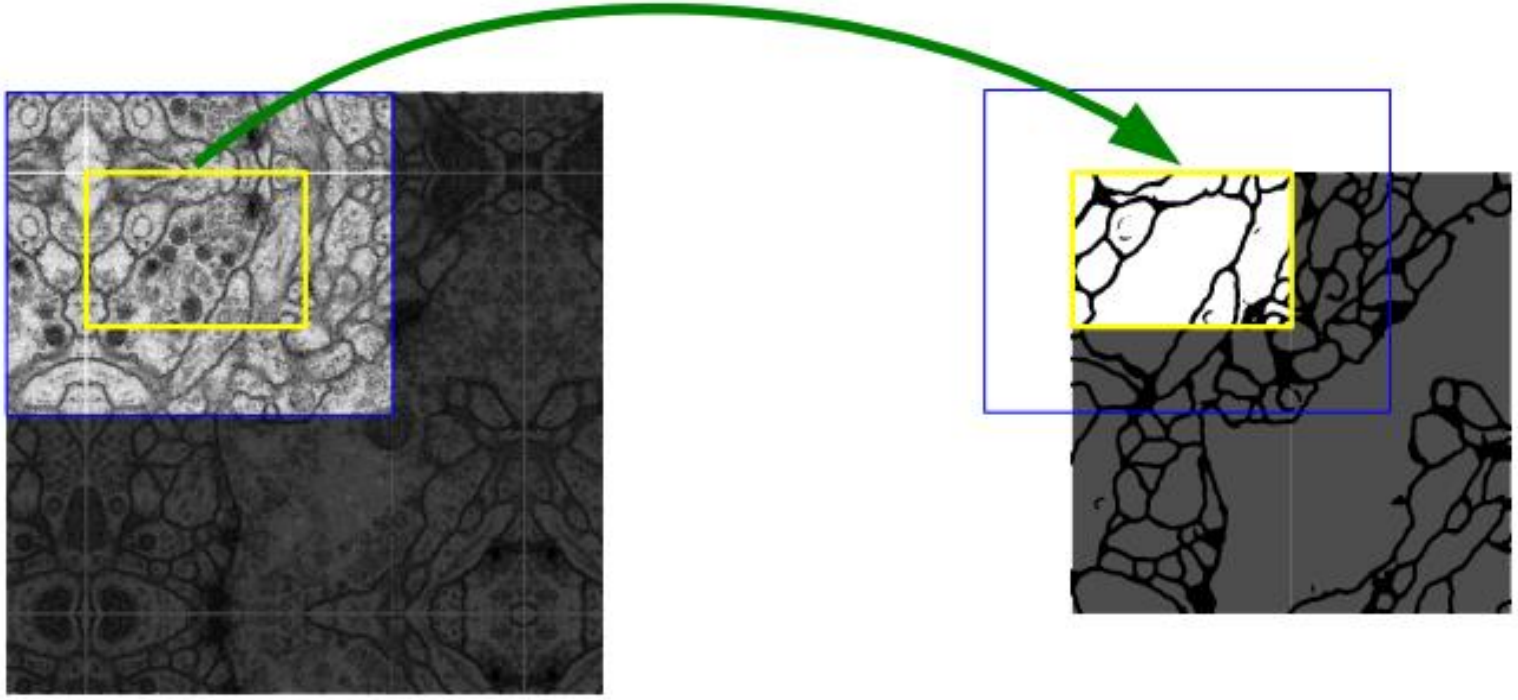


U-Net


input image tile
output segmentation map
conv 3x3, ReLU
copy and crop
max pool 2x2
up-conv 2x2
conv 1x1

Bordas?

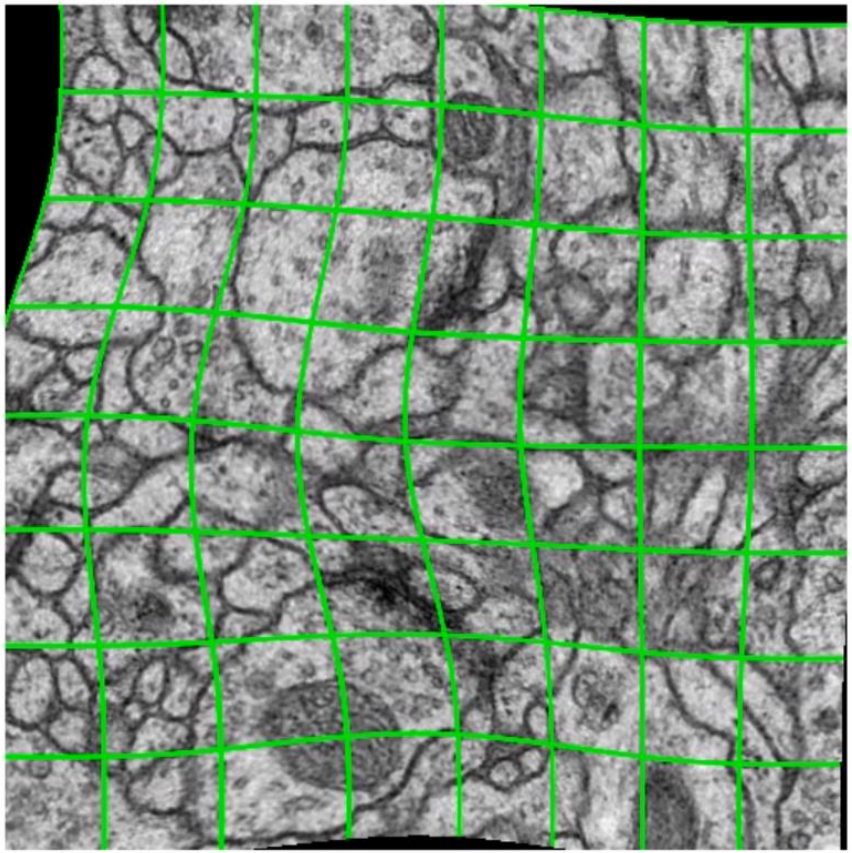
Bordas?



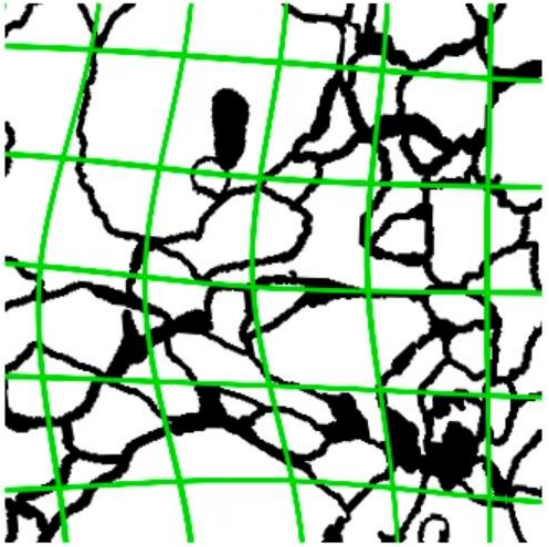
Desafios

- Poucos dados
- Objetos da mesma classe se encostando na imagem

Data augmentation



resulting deformed image

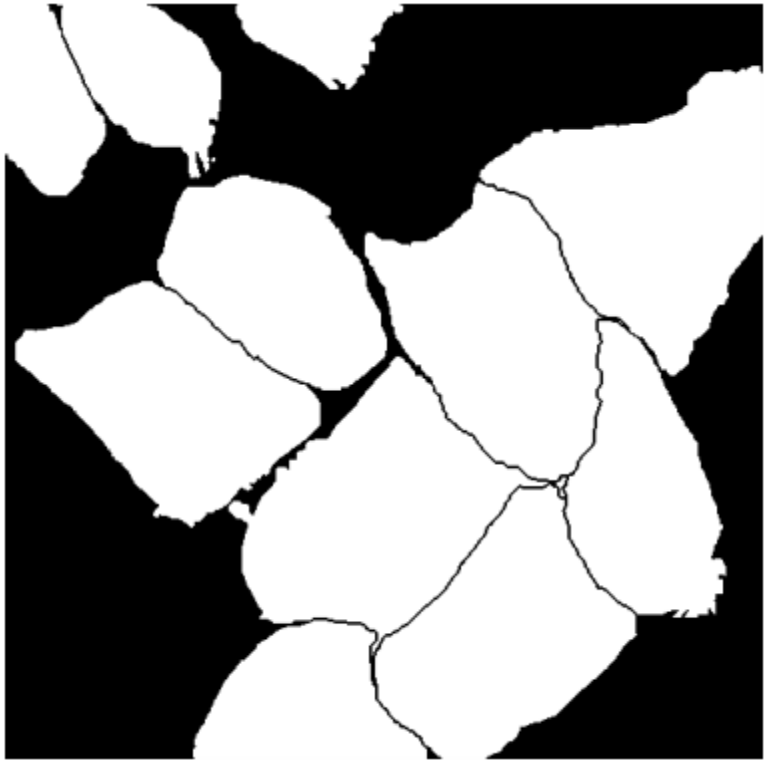


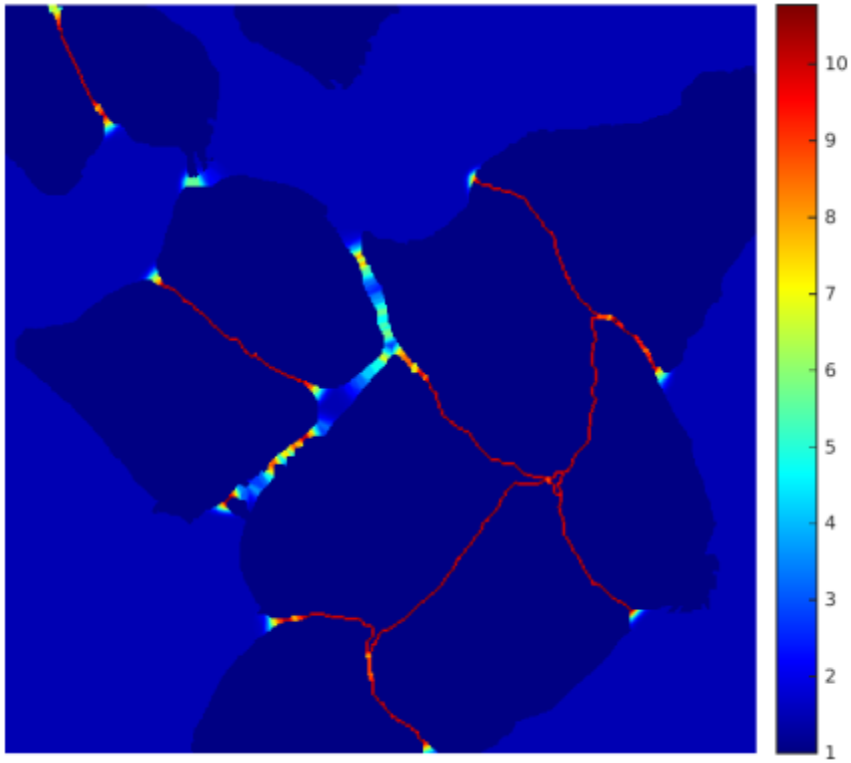
correspondingly deformed manual labels

Desafios

- Poucos dados
- Objetos da mesma classe se encostando na imagem

Custo ponderado





Resultados

- Link