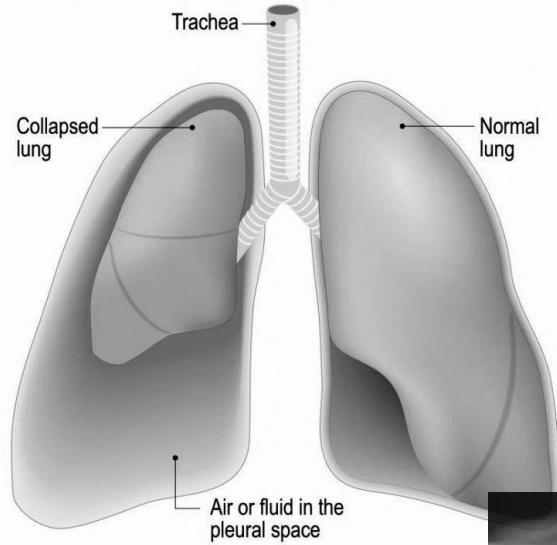


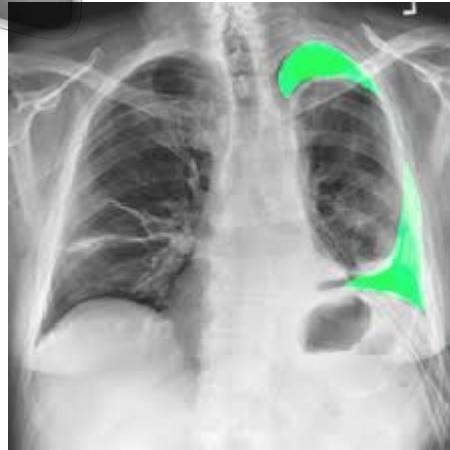
Chest X-Ray Pneumothorax images segmentation and classification

by Aleksandra Shchetinina (a.shchetinina@innopolis.ru)
& Anastasia Pichka (a.pichka@innopolis.ru)
BS17-RO

Intro

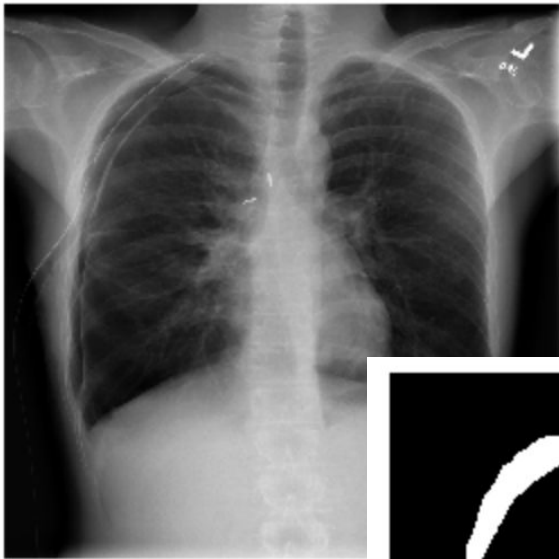


CHEST X-RAY



Pneumothorax

Collapse of the lung, occurs when the chest and lungs are injured, as well as certain lung conditions (eg, tuberculosis, pneumonia)



PNEUMOTHORAX



Dataset

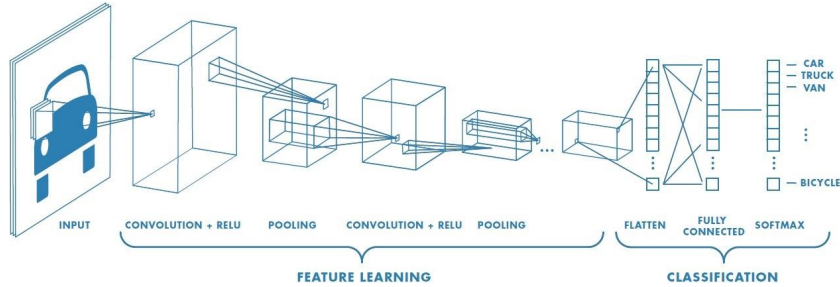
12,047 chest x-ray images
12,047 pneumothorax
masks

Size - 1024x1024, in png
format

Segmentation

Process of partitioning a digital image into multiple segments (sets of pixels, also known as image objects)

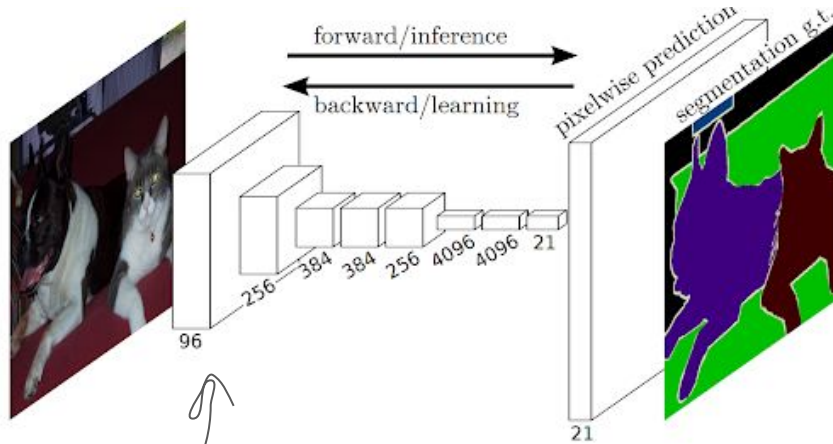




CNN

FCN - Fully Convolutional Network

Last fully connected layer of such network was replaced with a fully convolutional layer, produce a dense pixel-wise prediction



FCN

Related Work

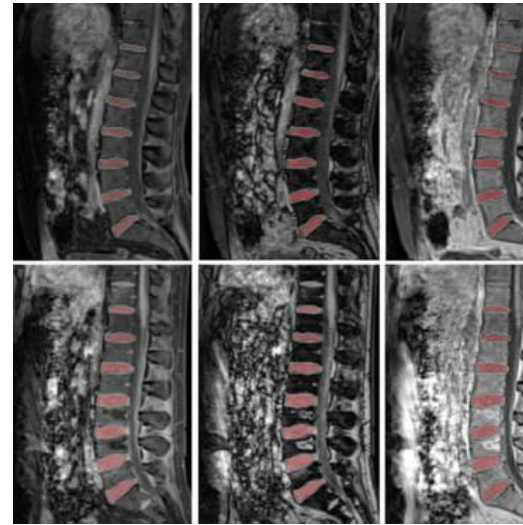
Deep Learning Techniques for Medical Image Segmentation: Achievements and Challenges

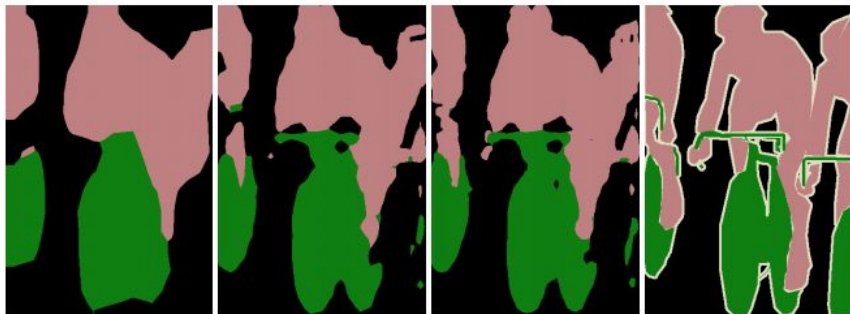
by Mohammad Hesam Hesamian, Wenjing Jia¹, Xiangjian He¹, Paul Kennedy,

29 May 2019

One of network structures in this article - FCN (Fully Convolutional Network). Dice coefficient (statistic used to gauge the similarity of two samples) which can be obtained - of 0.885

$$Dice = \frac{2 \times TP}{(TP + FP) + (TP + FN)}$$





Fully Convolutional Networks for Semantic Segmentation

Jonathan Long, Evan Shelhamer, Trevor Darrell

8 Mar 2015

AlexNet, VGG, GoogLeNet can be adopted using transfer learning by fine-tuning and used for segmentation

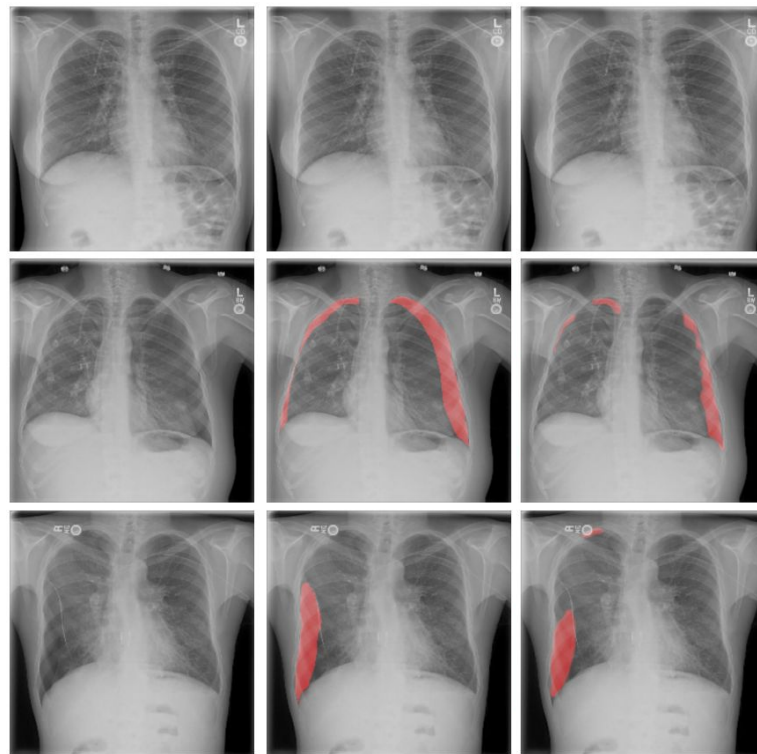
	FCN-AlexNet	FCN-VGG16	FCN-GoogLeNet ⁴
mean IU	39.8	56.0	42.5
forward time	50 ms	210 ms	59 ms
conv. layers	8	16	22
parameters	57M	134M	6M
rf size	355	404	907
max stride	32	32	32

Pneumothorax Segmentation: Deep Learning Image Segmentation to predict Pneumothorax

Karan Jakhar, Rohit Bajaj, Ruchika Gupta

16 Dec 2019

U-Net, which is built upon FCN. The problem domain of the article - pneumothorax X-Ray images segmentation. Transfer learning with ResNet is used, high results were achieved: IoU - 82.6%, Dice Coefficient - 84.3%



(a) input image

(b) ground truth

(d) FCN

Idea Explanation (partially Implemented)

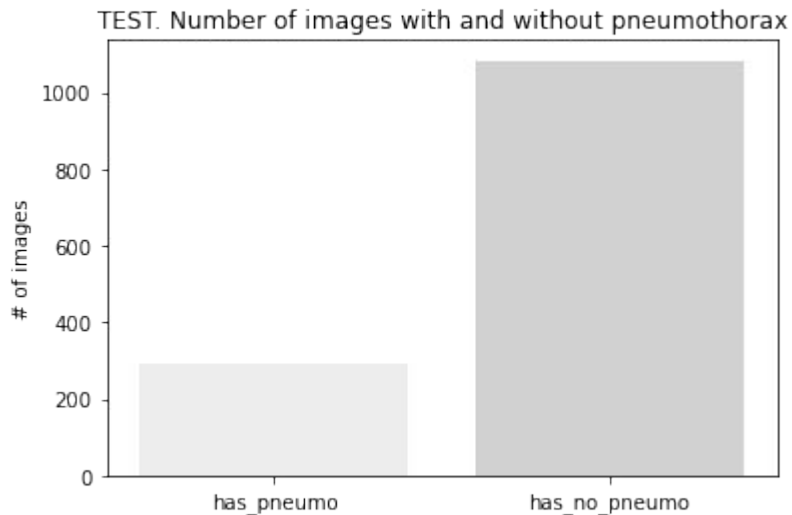
	new_filename	ImageId	has_pneumo
0	0_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.5597.151787518...	0
1	1_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.12515.15178752...	0
2	2_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.4904.151787518...	1
3	3_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.32579.15178751...	1
4	4_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.1314.151787516...	1
5	5_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.11364.15178752...	0
6	6_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.4541.151787518...	0
7	7_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.4440.151787518...	1
8	8_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.4982.151787518...	1
9	9_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.31759.15178751...	0
10	10_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.12743.15178752...	1
11	11_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.11633.15178752...	1
12	12_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.11512.15178752...	0
13	13_train_1_.png	1.2.276.0.7230010.3.1.4.8323329.2663.151787517...	1
14	14_train_0_.png	1.2.276.0.7230010.3.1.4.8323329.10206.15178752...	0

Data Preparation

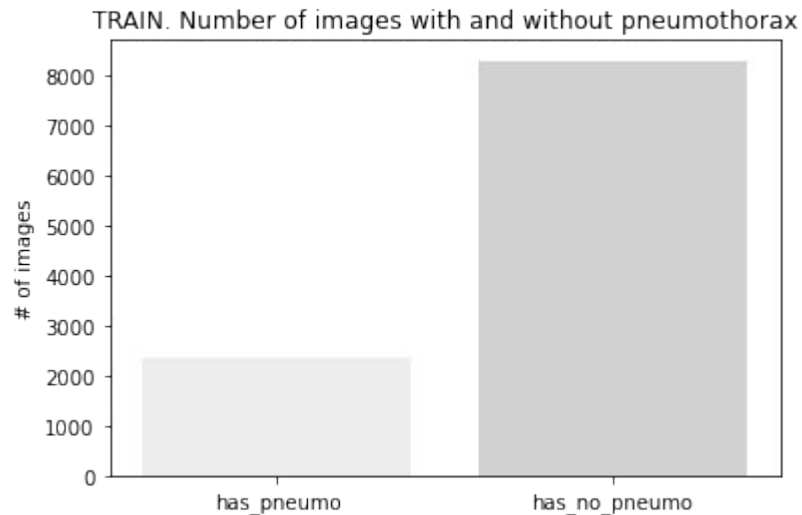
The data is taken from the dataset and prepared (normalized, resized, divided into test and train, etc). Masks (segmented image) is also prepared

Imbalanced data

TEST



TRAIN



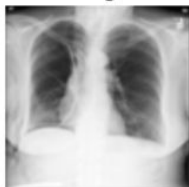
Image



Mask
Label: 1



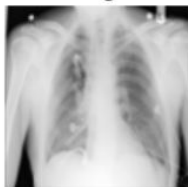
Image



Mask
Label: 1



Image



Mask
Label: 1



Image



Mask
Label: 1



Image



Mask
Label: 1



Image



Mask
Label: 1



Image



Mask
Label: 1



Image



Mask
Label: 1



Image



Mask
Label: 1



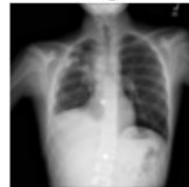
Image



Mask
Label: 1



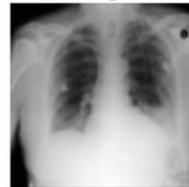
Image



Mask
Label: 1



Image

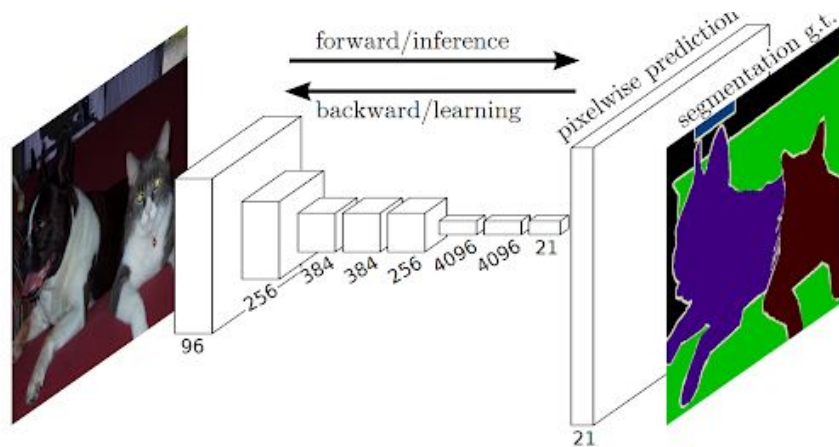


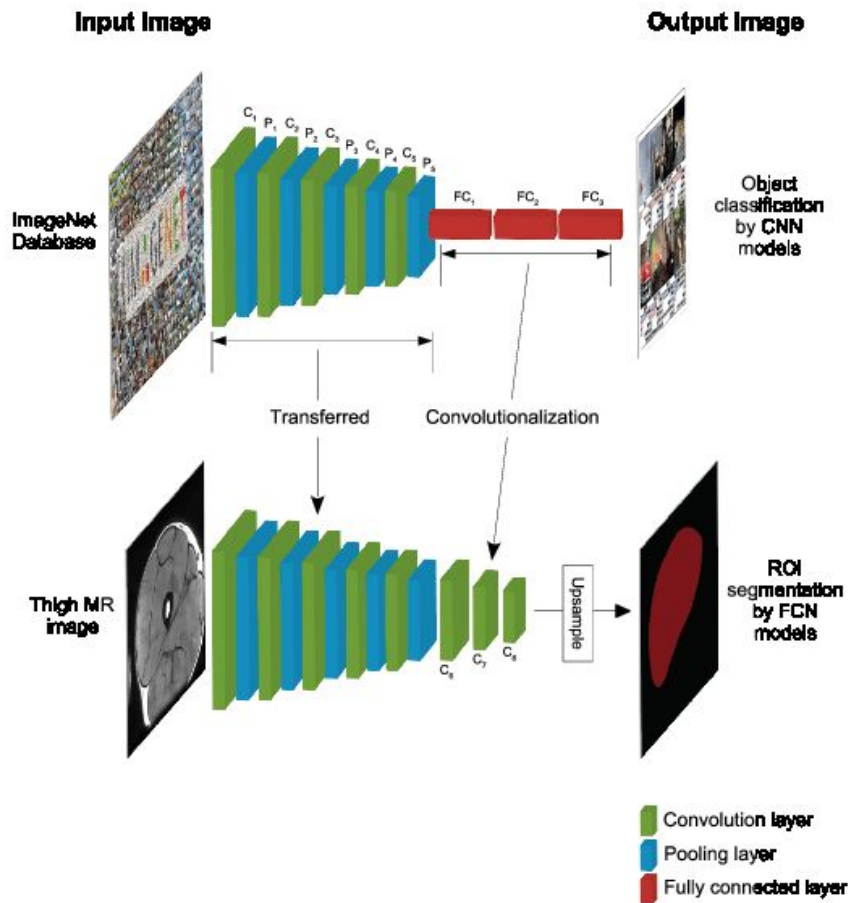
Mask
Label: 1



Model

The basic idea behind a fully convolutional network is that it is “fully convolutional”, so all of its layers are convolutional layers. FCNs don’t have any of the fully-connected layers at the end, which are typically used for classification. Instead, FCNs use convolutional layers to classify each pixel in the image.





Transfer Learning

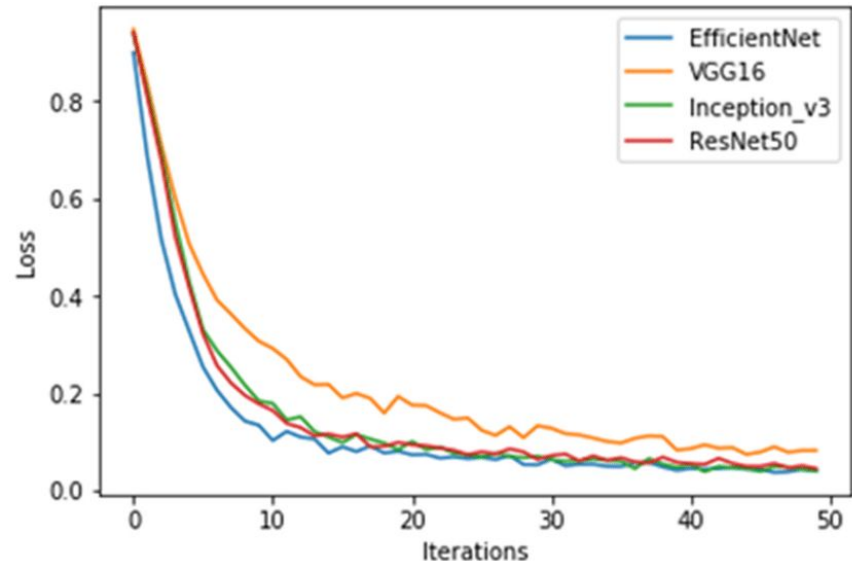
Research problem in machine learning (ML) that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem

Architecture

Architecture:

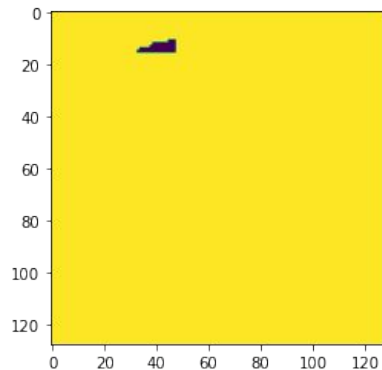
- Pre-trained classifier without fully-connected layers (transferred, frozen)
- Convolution layers
- Upsampling(Deconvolution)
- Softmax layer

→ VGG
→ RESNET
→ INCEPTIONV3

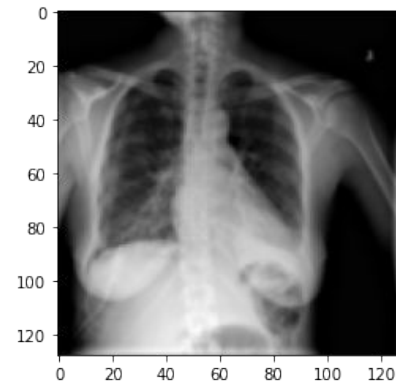


Results, we've got

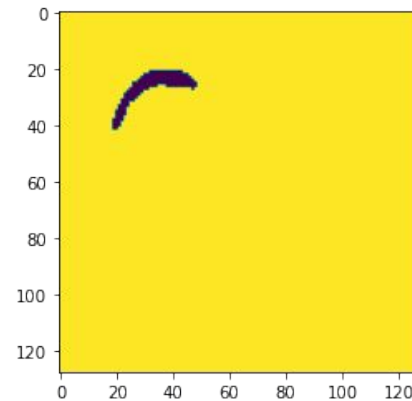
after some training



X_TEST



Y_TEST



Plans

- data augmentation
- train models
- choose metrics
- compare accuracy of the models