

Deep learning e segmentazione per la biologia cellulare

Utilizzo del transfer learning per l'identificazione di cellule in
microscopia

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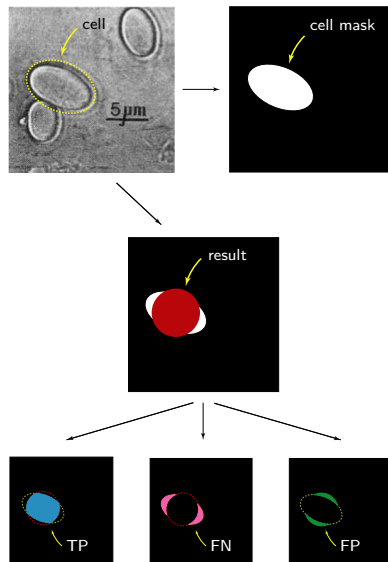
Image segmentation

- Pixel-based
- Edge-based
- Region-based
- Model-based
- **Supervised methods**

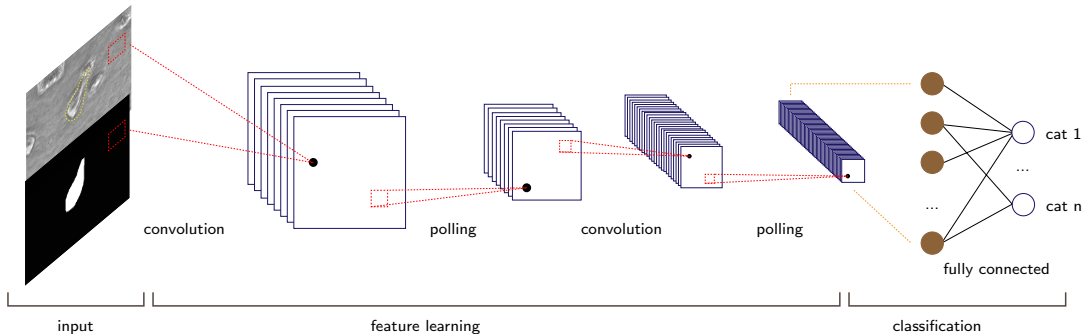
$$CM = \frac{TP}{TP+FN} = \frac{TP}{\text{Total area in GT}}$$

$$CR = \frac{TP}{TP+FP} = \frac{TP}{\text{Total area in BW}}$$

$$FM = \frac{2 \cdot CM \cdot CR}{CM + CR} \in [0; 1]$$



Transfer learning

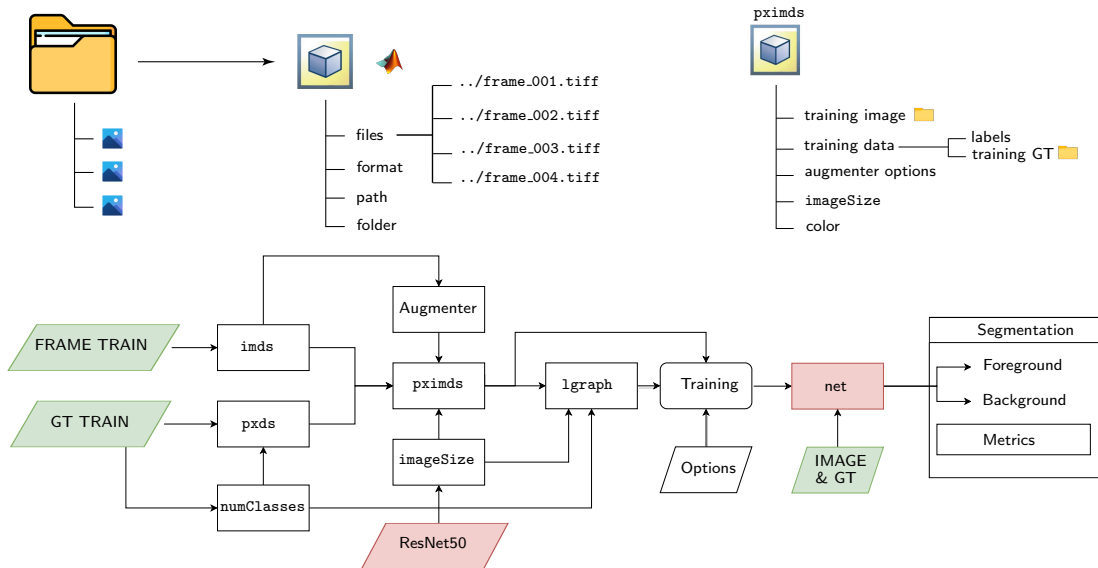


$\{B\}==1$
 $\{N\}==0$

```
1 pxds=pixelLabelDatastore(...  
2   strcat(newPath, 'dataset\GT-TRAIN') ,...  
3   ["N", "B"], [0 1]);
```

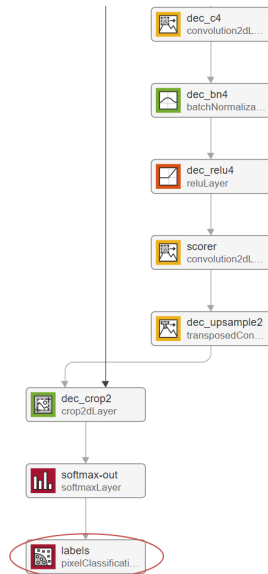
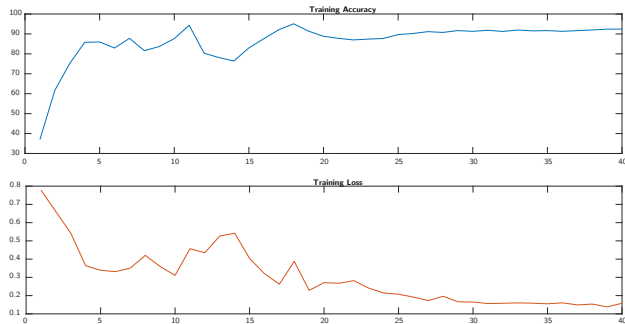
```
1 pxLayer = pixelClassificationLayer(...  
2   'Name', 'labels', 'Classes', tbl.Name, ...  
3   'ClassWeights', classWeights);
```

Training dataset



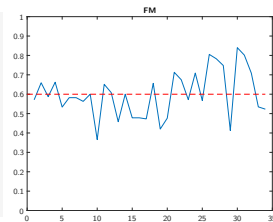
Classification layer and training

```
1 lgraph = deeplabv3plusLayers(imageSize,numClasses,"resnet50");
2 % balance predominance of 0
3 tbl = countEachLabel(pximds);
4 totalNumberOfPixels = sum(tbl.PixelCount);
5 frequency = tbl.PixelCount / totalNumberOfPixels;
6 classWeights = 1./frequency;
7 pxLayer = pixelClassificationLayer('Name','labels','Classes',...
8 tbl.Name,'ClassWeights',classWeights);
9 lgraph = replaceLayer(lgraph,"classification",pxLayer);
10 options = trainingOptions('sgdm','MaxEpochs',30,...
11 'MiniBatchSize',8,'Plots','training-progress');
12 [net,info]= trainNetwork(pximds,lgraph,options);
```

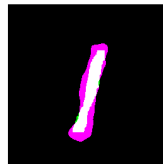
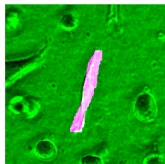
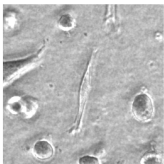


Application

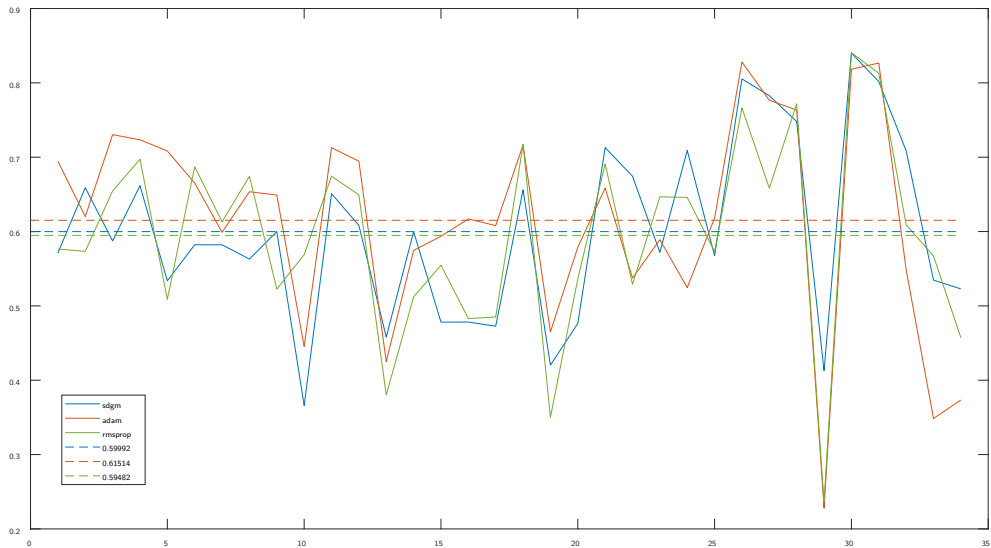
```
1 for l = 1:length(f_test)
2     testImage=imread([strcat(dataPath, '/FRAME_TEST_SEG/'), f_test(l).name]);
3     C_test = semanticseg(testImage, net);
4     D=C_test=='B';
5     GTImage=imread([strcat(dataPath, '/GT_TEST/'), gt_train(l).name]);
6     [TP, FP, FN, CR, CM, FM_test(l)]=evaluation_segmentation(...
7     bwareafilt(D,1), GTImage);
8     imshowpair(testImage, bwareafilt(D,1), 'montage');
9     pause(0.5); drawnow;
10    clear C_test D testImage;
11 end
```



n. 25:

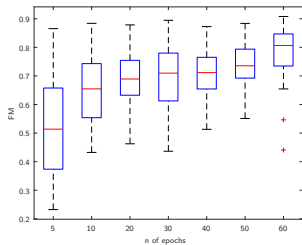
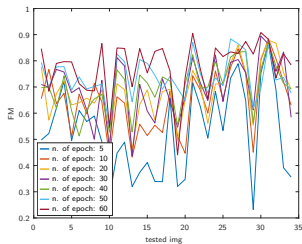


Solver

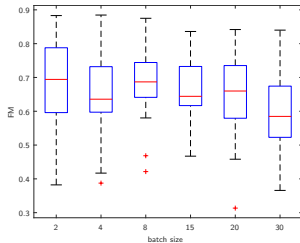
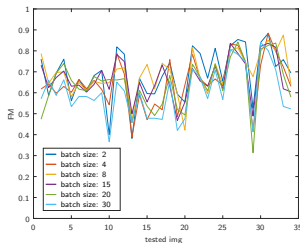


Training options

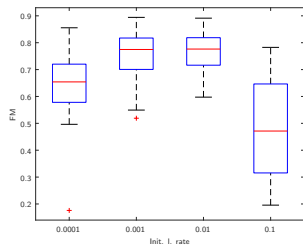
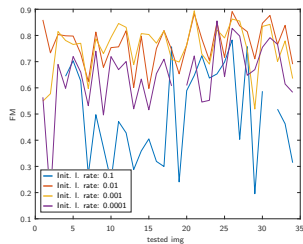
numbers of epochs



mini batch size



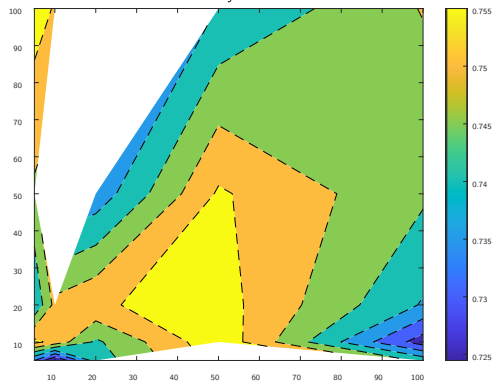
numbers of epochs



only rotation
mean: 0.4659

only reflection
mean: 0.7989

only traslation



all

