

# cnr-04-cc3

December 2, 2021

## 1 TUMOR - CNR - TOWARD HISTOGRAM ANALYSIS - CC3 SUBJECT

Created: 2021.11.10 / Updated: 2021.12.02

ver: 0.02

- standarize ROI colors in images and histograms

```
[1]: %load_ext autoreload
      %autoreload 2
```

```
[2]: %matplotlib inline

import os
import pathlib
import glob

import numpy as np
import pandas as pd
import nibabel as nib
import matplotlib.pyplot as plt
```

```
[3]: import utils
      import functions1 as f1
```

## 2 GLOBAL VARIABLES

```
[4]: HOME_DIR = pathlib.Path(os.getcwd()).parent
      DATA_DIR = HOME_DIR / 'data'
      RESULTS_DIR = DATA_DIR / 'results'
      PLOT_DIR = DATA_DIR / 'plots'
      TABLE_DIR = DATA_DIR / 'tables'

      CURRENT_NOTEBOOK_NAME = 'cnr-04-cc3'
      CURRENT_NOTEBOOK_NUMBER = CURRENT_NOTEBOOK_NAME.split('-')[1]
```

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### 3 GET LIST ALL CC3 IMAGES

```
[5]: SUB = 'CC3'
```

```
[6]: files = list(RESULTS_DIR.glob(f"*{SUB}*.nii.gz"))
files
```

```
[6]: [PosixPath('/home/marek/Dropbox/plext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC3_t2_bladder.nii.gz'),
PosixPath('/home/marek/Dropbox/plext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC3_t2.nii.gz'),
PosixPath('/home/marek/Dropbox/plext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC3_t2_roi_dilated2.nii.gz'),
PosixPath('/home/marek/Dropbox/plext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC3_t2_roi.nii.gz'),
PosixPath('/home/marek/Dropbox/plext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC3_t2_roi_cm.nii.gz'),
PosixPath('/home/marek/Dropbox/plext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC3_t2_roi_dilated_ball3.nii.gz')]
```

```
[7]: # print only names
_ = [print(f'{k+1}) {f.name}') for k, f in enumerate(sorted(files))]
```

```
1) CC3_t2.nii.gz
2) CC3_t2_bladder.nii.gz
3) CC3_t2_roi.nii.gz
4) CC3_t2_roi_cm.nii.gz
5) CC3_t2_roi_dilated2.nii.gz
6) CC3_t2_roi_dilated_ball3.nii.gz
```

#### 3.1 LOAD ALL IMAGES

```
[8]: # image
img = nib.load(RESULTS_DIR / f'{SUB}_t2.nii.gz').get_fdata()
# roi
roi = nib.load(RESULTS_DIR / f'{SUB}_t2_roi.nii.gz').get_fdata()
# dilated 2
dil2 = nib.load(RESULTS_DIR / f'{SUB}_t2_roi_dilated2.nii.gz').get_fdata()
# ball3
bal3 = nib.load(RESULTS_DIR / f'{SUB}_t2_roi_dilated_ball3.nii.gz').get_fdata()
# bladder
bla = nib.load(RESULTS_DIR / f'{SUB}_t2_bladder.nii.gz').get_fdata()
```

### 3.1.1 CREATE LIST OF LOADED IMAGES AND LIST OF THEIR NAMES

```
[9]: masks = [dil2, bal3]
names = ['dil2', 'bal3']

# only dil and bal images; neither img nor roi
MASKS_CNT = len(masks)
```

### 3.1.2 BASIC INFO ABOUT IMAGES

```
[10]: f1.im_info(img, 'img')
f1.im_info(roi, 'roi')
f1.im_info(bla, 'bladder')
print()
for i,n in zip(masks, names):
    f1.im_info(i,name=n)
```

```
*** IMG ***,      max=1640.0, min=0.0, mean=443.37, shape=(320, 320, 28),
#voxels=2867200
*** ROI ***,      max=1.0, min=0.0, mean=0.01, shape=(320, 320, 28),
#voxels=2867200
*** BLADDER ***,      max=1.0, min=0.0, mean=0.00, shape=(320, 320, 28),
#voxels=2867200
```

```
*** DIL2 ***,      max=1.0, min=0.0, mean=0.01, shape=(320, 320, 28),
#voxels=2867200
*** BAL3 ***,      max=1.0, min=0.0, mean=0.02, shape=(320, 320, 28),
#voxels=2867200
```

### 3.1.3 DISPLAY ALL MASKS OVERLAYED ON IMAGE AND ROI FOR SELECTED SLICE

```
[11]: f,ax = plt.subplots(nrows=1, ncols=2, sharex=True, sharey=True, figsize=(24,12))

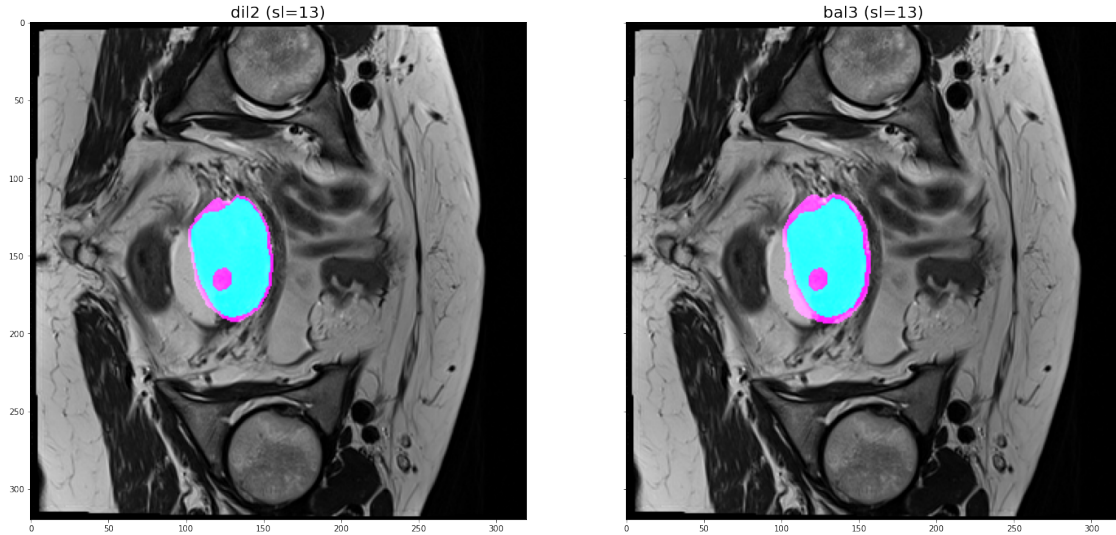
title = 'Images with overlaid ROIs (in yellow) and various MASKS (in red)'
f1.show_images_from_list2(ax, img, roi, masks_lst=masks, names_lst=names,
    ↪ slice_nr=13, title=title, fontsize=22)

f.tight_layout()

save_name = PLOT_DIR / f'{CURRENT_NOTEBOOK_NUMBER}-{SUB}-roi-and-dilated-masks.
    ↪ png'
print(f'Figure saved to:\n\t{save_name}')
plt.savefig(save_name)

plt.show()
```

Images with overlaid ROIs (in yellow) and various MASKS (in red)



## 4 PLOT HISTOGRAMS FOR ALL MASKS

```
[12]: # voxels inside ROI only (fullsize)
voxels_inside_roi = np.where(roi, img, 0)
voxels_inside_bla = np.where(bla, img, 0)

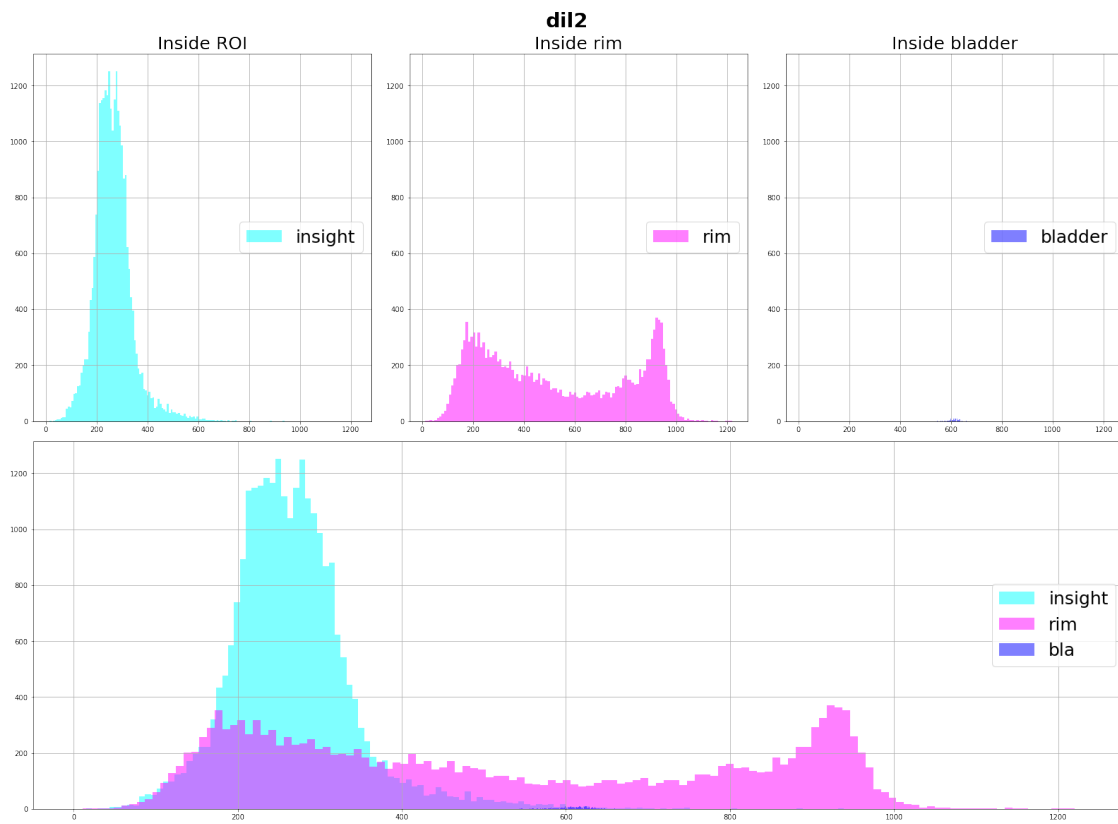
for mask, name in zip(masks, names):
    mask_of_rim = mask - roi
    voxels_inside_rim = np.where(mask_of_rim, img, 0)

    f1.plot_3_histograms_separately(voxels_inside_roi, voxels_inside_rim,
    →voxels_inside_bla, legendloc=7, title=name, sub=SUB, save=True,
                                notebook_nr=CURRENT_NOTEBOOK_NUMBER)

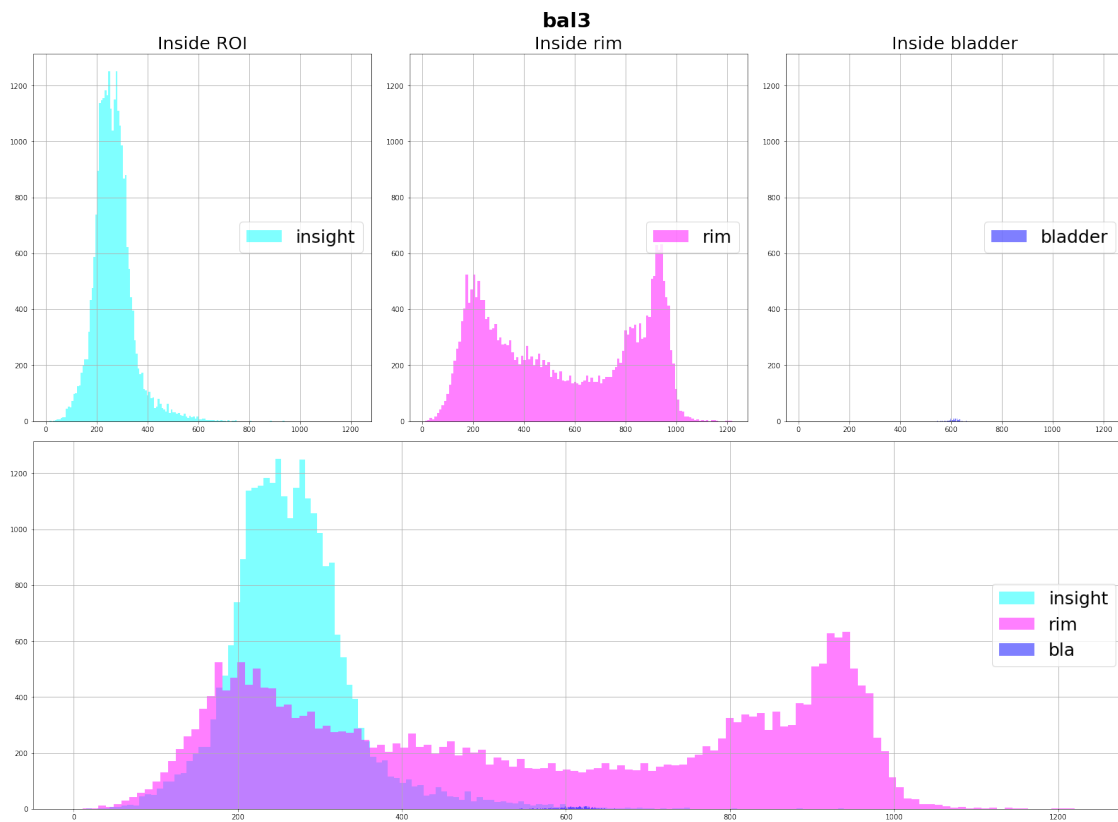
    print(80*' '*')
```

Saved figure:

../data/plots/04-CC3-dil2.png



\*\*\*\*\*  
 Saved figure:  
 ../data/plots/04-CC3-bal3.png



\*\*\*\*\*

```
[13]: utils.print_date(5)
```

02-Dec-2021 19:10:42

```
[14]: utils.save_notebook_as_html(file_name=CURRENT_NOTEBOOK_NAME, cleaning_delay=2)
```

```
[15]: utils.save_notebook_as_pdf(file_name=CURRENT_NOTEBOOK_NAME, cleaning_delay=2)
```