cnr-04-cc2

December 2, 2021

1 TUMOR - CNR - TOWARD HISTOGRAM ANALYSIS - CC2 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-cc2'
CURRENT_NOTEBOOK_NUMBER = CURRENT_NOTEBOOK_NAME.split('-')[1]
```

3 GET LIST ALL CC2 IMAGES

[5]:
```
SUB = 'CC2'
```

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

[6]:
```
[PosixPath('/home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC2_t2_roi.nii.gz'),
 PosixPath('/home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC2_t2_bladder.nii.gz'),
 PosixPath('/home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC2_t2.nii.gz'),
 PosixPath('/home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC2_t2_roi_dilated_ball3.nii.gz'),
 PosixPath('/home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC2_t2_roi_cm.nii.gz'),
 PosixPath('/home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
git/data/results/CC2_t2_roi_dilated2.nii.gz')]
```

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

```
1) CC2_t2.nii.gz
2) CC2_t2_bladder.nii.gz
3) CC2_t2_roi.nii.gz
4) CC2_t2_roi_cm.nii.gz
5) CC2_t2_roi_dilated2.nii.gz
6) CC2_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 OFLOADED 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)
```

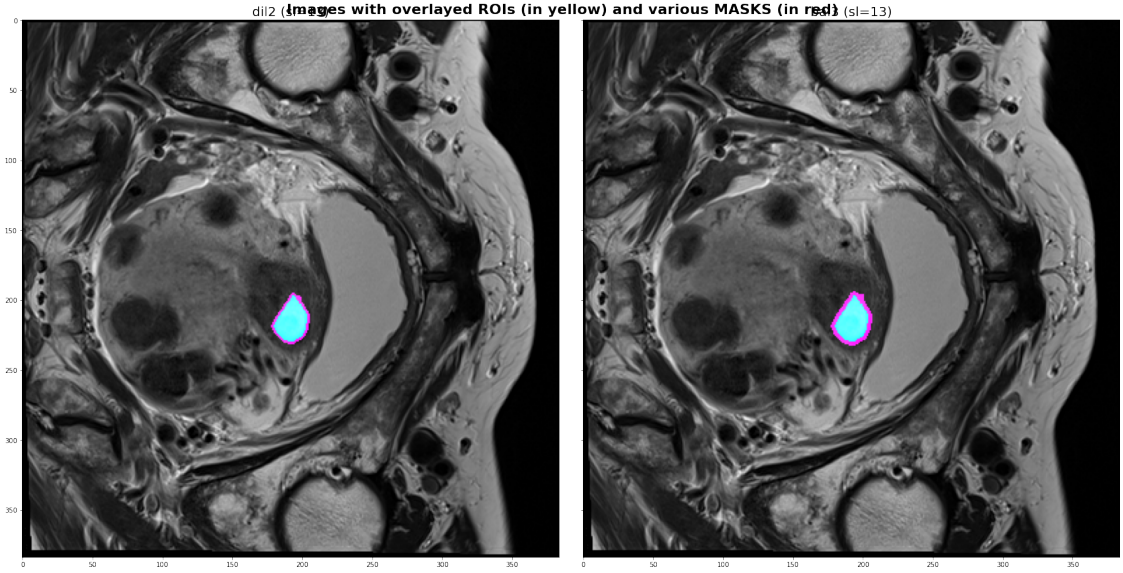
```
*** IMG ***,    max=1771.0, min=0.0, mean=336.25, shape=(384, 384, 28),
#voxels=4128768
*** ROI ***,    max=1.0, min=0.0, mean=0.00, shape=(384, 384, 28),
#voxels=4128768
*** BLADDER ***,        max=1.0, min=0.0, mean=0.00, shape=(384, 384, 28),
#voxels=4128768

*** DIL2 ***,   max=1.0, min=0.0, mean=0.00, shape=(384, 384, 28),
#voxels=4128768
*** BAL3 ***,   max=1.0, min=0.0, mean=0.00, shape=(384, 384, 28),
#voxels=4128768
```

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 overlayed 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()
```

```
Figure saved to:
        /home/marek/Dropbox/p1ext4_P/no_work/TUMOR-CNR/tumor-cnr-
```

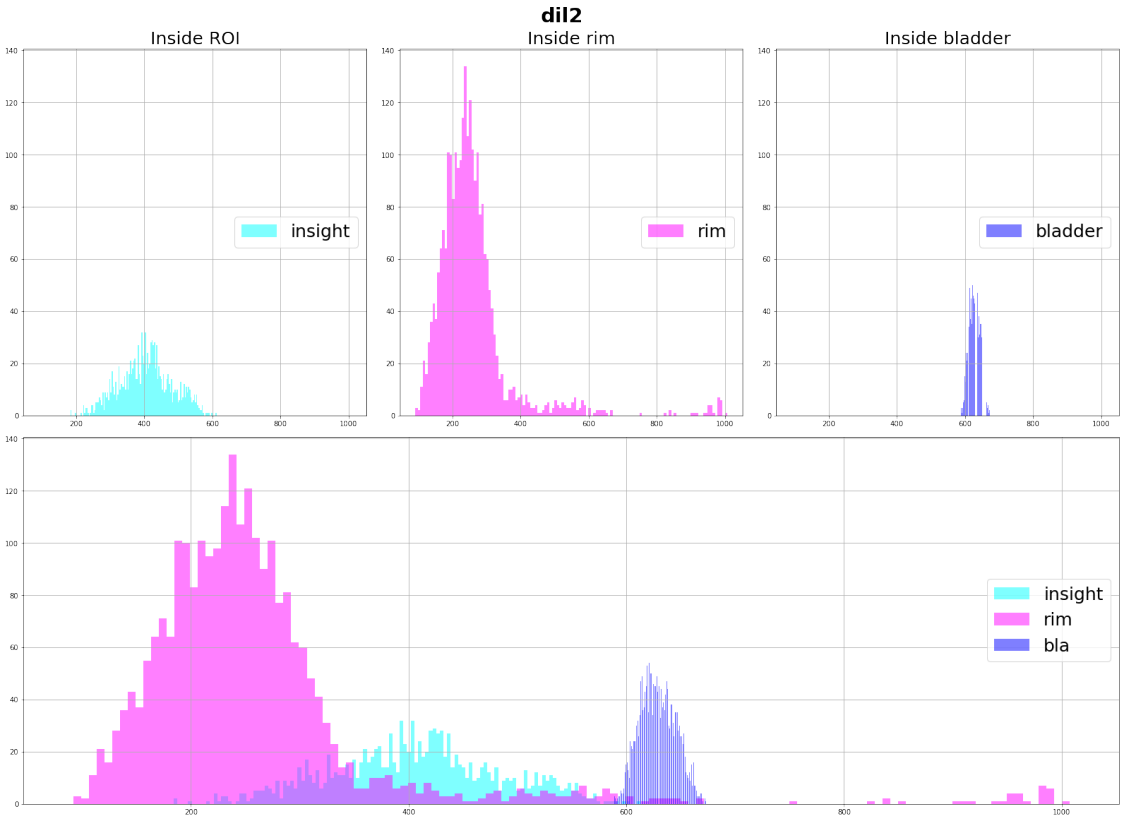
git/data/plots/04-all-roi-and-dilated-masks.png



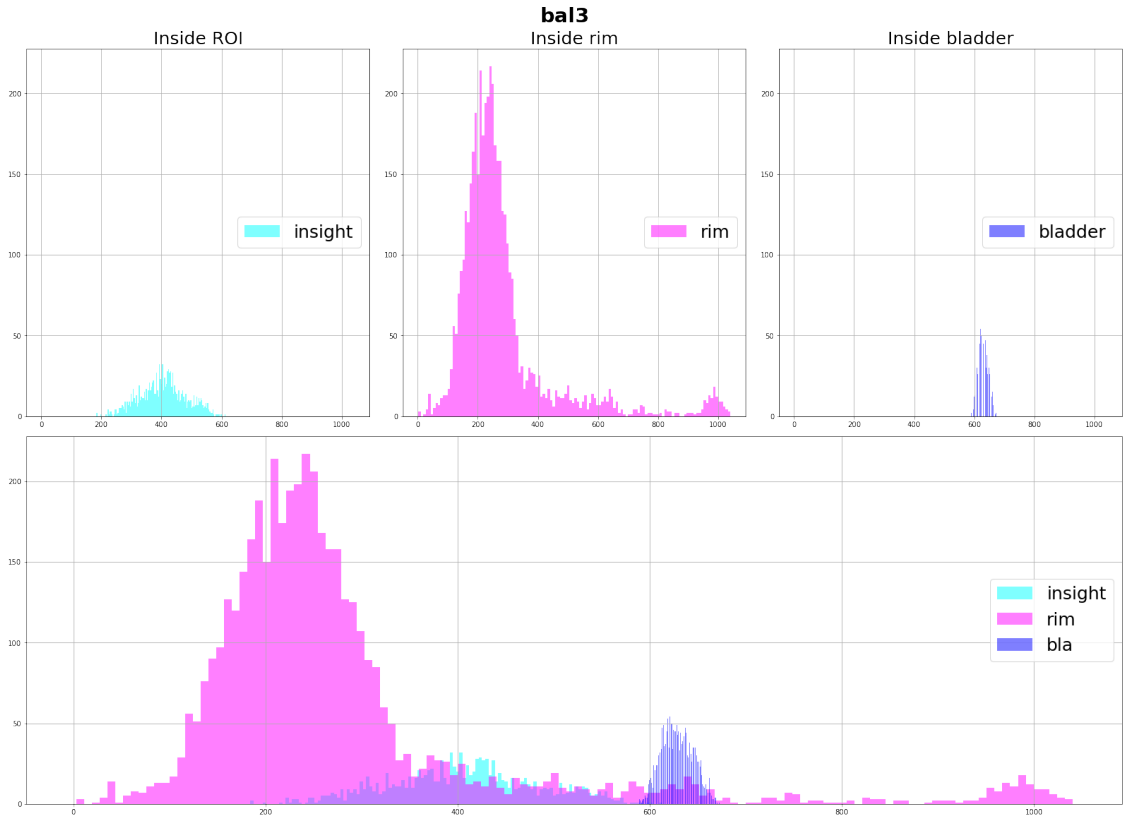
4 PLOT HISTOGRAMS FOR ALL MASKS

[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-CC2-dil2.png




```
**********************************************************************************
Saved figure:
        ../data/plots/04-CC2-bal3.png
```



****

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

```
02-Dec-2021 19:13:40
```

[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)
```