Université Paris-Est Créteil (UPEC)

International Master of Biometrics and Intelligent Vision

3D BRAIN MRI FEATURE EXTRACTION

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October 30, 2020

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OUTLINE

1. Introduction

2. Methods and materials

   - Image intensities exploration on 3D volume
   - Applying masks
   - Applying filters

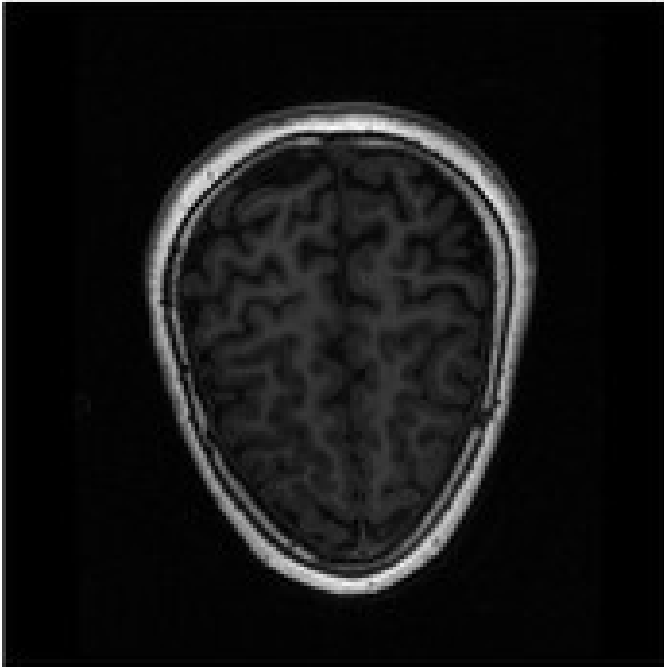3. Conclusion

INTRODUCTION

- **Feature extraction :** extract relevant information from an image for medical image analysis;

- 3D brain MRI absorption is highest in dense tissue;

OBJECTIVES

➔ Exploit intensity patterns to create a binary mask and apply it to a 3D brain MRI;

➔ Using convolutional filters to detect interesting features;

METHODS AND MATERIALS (1)

→ Loading the image using nibabel `get_fdata()` function;

```python
print('[INFOS] Data type              :', im.dtype)
print('[INFOS] Min. intensity value   :', im.min())
print('[INFOS] Mean intensity value   :', np.round(im.mean(),2))
print('[INFOS] Max. intensity value   :', im.max())
print('[INFOS] Size of data           :', im.size)
print('[INFOS] Image data shape       :', im.shape)
```

```
[INFOS] Data type              : int16
[INFOS] Min. intensity value   : 0
[INFOS] Mean intensity value   : 535.65
[INFOS] Max. intensity value   : 10106
[INFOS] Size of data           : 10878976
[INFOS] Image data shape       : (166, 256, 256)
```

METHODS AND MATERIALS (2)
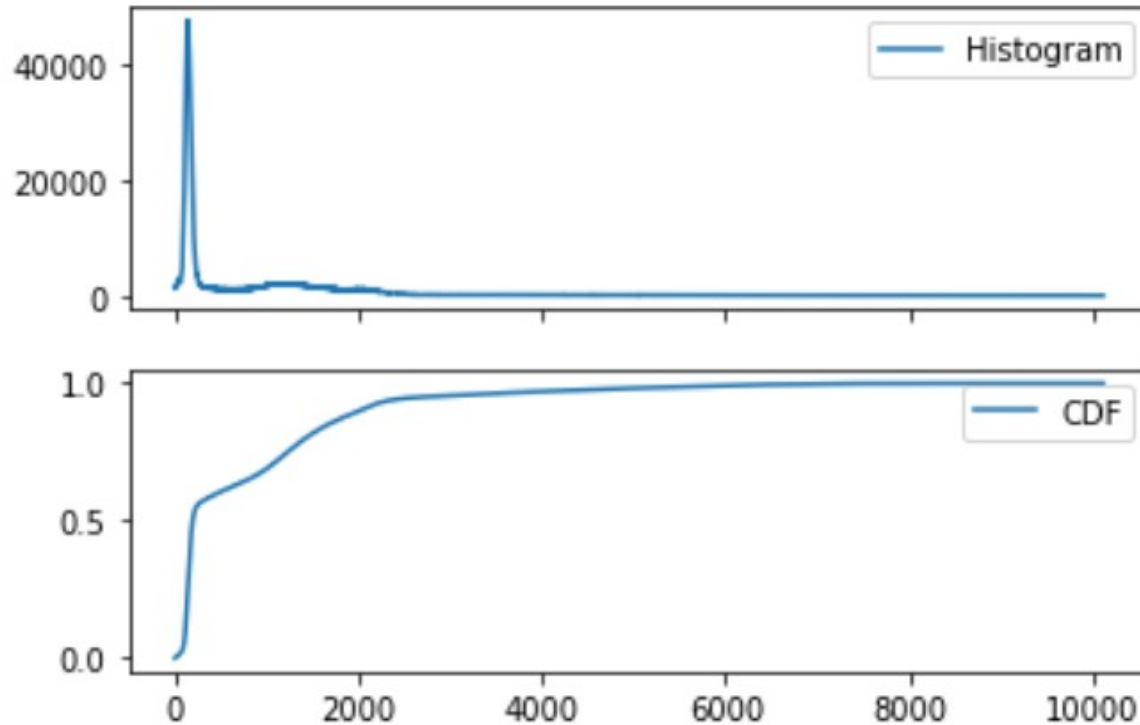
➜ Histogram count the number of pixels at each intensity values;

➜ Distribution is skewed toward low intensities;

➜ Cumulative distribution function (CDF) shows proportion of pixels in range;

➜ 1200 in x-axis could separate distribution;
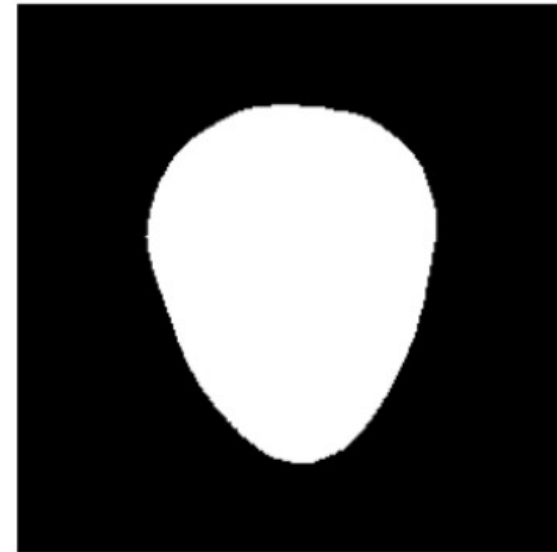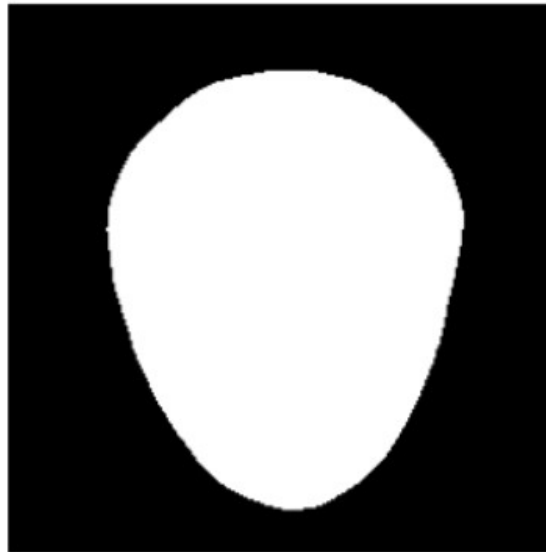
➜ **maskHead = im>1200**

```
# Create a histogram, binned at each possible value
hist = ndi.measurements.histogram(im, min=0, max=10106, bins=10107)

# Create a cumulative distribution function
cdf = hist.cumsum()/hist.sum()
```
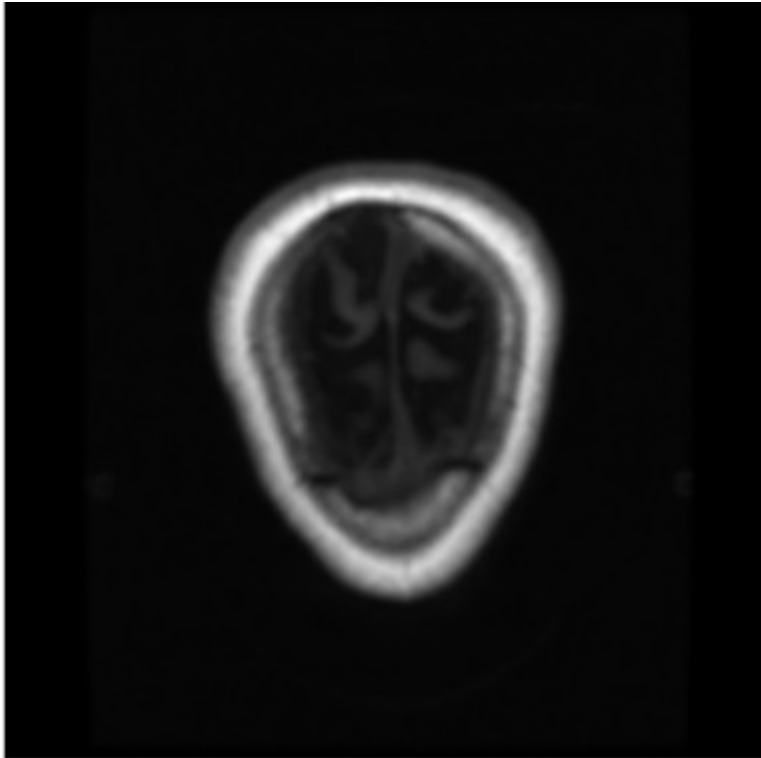
METHODS AND MATERIALS (3)

```
imHead = np.where(maskHead, im, 0)
imHead = ndi.binary_dilation(imHead, iterations=8)
imHead = ndi.binary_closing(imHead, iterations=8)
viewPlot(imHead)
```
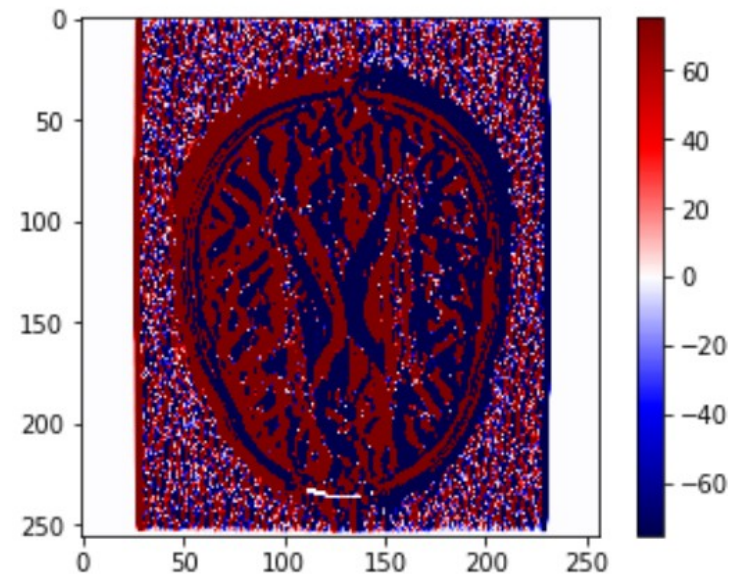
METHODS AND MATERIALS (4)

```
w = 0.11 * np.ones([3,3,3])
imFilt = ndi.convolve(im, w)
```

```
k = np.zeros([3, 3, 3])
k[0] = np.array([[1, 0, -1], [1, 0, -1], [1, 0, -1]])
k[1] = np.array([[1, 0, -1], [1, 0, -1], [1, 0, -1]])
k[2] = np.array([[1, 0, -1], [1, 0, -1], [1, 0, -1]])

imEdge = ndi.convolve(im, k)
```

CONCLUSION

➔ Exploiting intensities patterns helps us selecting sub-region of an array for feature extraction;

➔ Using convolutional filter enabled the detection of interesting feature such as edges;

➔ Scipy's ndimage module has been the main package used for this lab;

THANKS
FOR YOUR ATTENTION

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METHODS AND MATERIALS (1)

IMAGE INTENSITIES EXPLORATION ON 3D VOLUME