Université Paris-Est Créteil (UPEC)

International Master of Biometrics and Intelligent Vision

3D BRAIN MRI CLASSIFICATION : APPLICATION TO ALZHEIMER DIAGNOSIS

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OUTLINE

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4. Mesh generation from 3D imaging data
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INTRODUCTION

- **Image classification :** predicting a label given an input features;
- In medical field, several methods are proposed to identify patients with Alzheimer's disease;
- We propose a 3D brain MRI classification method using gray matter segmentation concept;

Objectives of the lab

- Loading 10 nifty files;
- Segment the gray matter of each file;
- Convert the results to meshes and compute some morphologic features;
- Run a binary classififer and conclude;

LOADING NIFTY FILES

- Loading NIFTI files format is done using ninabel library;
- OS module is used to list all the NIFTI files stored in the directory;
- Result is stored in a python list;

Code

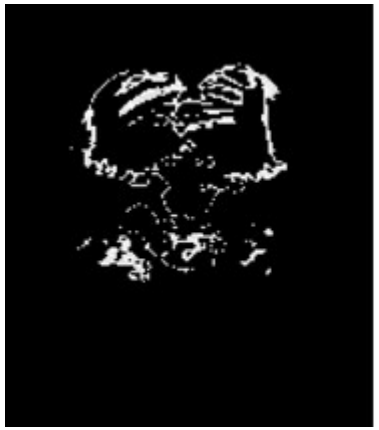
```
def getNiftiData(img_loc):
    im= nib.load(str(img_loc))
    data = im.get_fdata()
    return data
# Looping over the python list containing path of NIFTI files
data = [getNiftiData(path+"/"+s) for s in MRI_images]
```

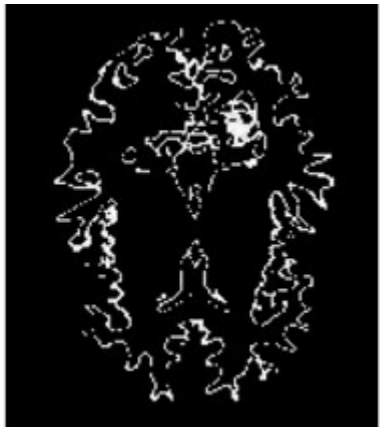
GRAY MATTER SEGMENTATION

Code

```
def getMask(imgData, pxlRanges):
    binaryMask=(imgData>=pxlRanges[0]) & (imgData<=pxlRanges[1])
    grayMatter=np.where(binaryMask, imgData, 0)
    return binaryMask, grayMatter
```

Results





- Gray matter pixels ranges : **[180 : 210]**
- Step is repeated for each image;
- Results are saved as .nii file

MESH GENERATION FROM 3D IMAGING DATA

- Mesh represent in more realistic and accurate geometrical description of 3D image data;
- VTK tool is used to create meshes;
- Morphologic features are : volume and surface;

Computing the mesh

```
def computeFeature(data):
    reader = vtk.vtkNIFTIImageReader()
    reader.SetFileName(data)
    reader.Update()
    contour = vtk.vtkContourFilter()
    contour.SetInputData(reader.GetOutput())yguf(jojçu
    contour.SetValue(0,0.1)
    contour.Update()
    polydata = contour.GetOutput()
    Mass = vtk.vtkMassProperties()
    Mass.SetInputConnection(reader.GetOutputPort())
    Mass.SetInputData(polydata)
    Mass.Update()
    print("Volume  = ", Mass.GetVolume())
    print("Surface = ", Mass.GetSurfaceArea())
```

- Process is repeated for each gray matter file;
- Results are saved as .csv file
- For 10 patients = 10 lines and 2 columns of data;

CLASSIFICATION

Steps

1. Load the dataset (csv file containing features);
2. Splitting the data (70% for training and 30% for testing);
3. Classification model : SVM with linear kernel;
4. Prediction and evaluation;

```
Traing set results
ACCURACY for train set 0.5714285714285714
F1 SCORE for train set 0.4155844155844156

Test set results
ACCURACY for test set 0.3333333333333333
F1 SCORE for test set 0.16666666666666666

Confusion matrix
[[1 0]
 [2 0]]
```

CONCLUSION

- We worked on 3D brain MRI classification;
- 10 NIFTI have been used (5 participants cognitively normal and 5 individuals at various stage of cognitive);
- Segmentation of the gray matter part of the brain is performed to compute morphologic features to be used as input for SVM classifier;
- Program could be improved for critical analysis;

THANKS
FOR YOUR ATTENTION

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