internship

Ollscoil na Gaillimhe
University of Galway

Department : the Faculty of Science

Field of study : computer science

université PARIS-SACLAY

Introductory internship presentation

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2024

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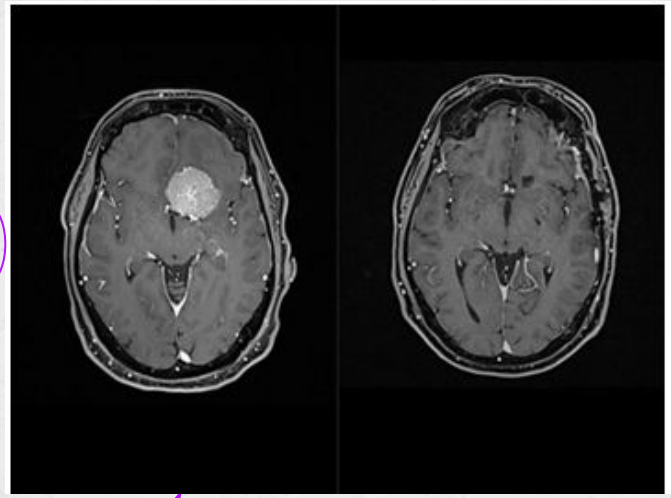
Introduction

Python Implementation Approach for Preparing Annotated Brats 2020 Dataset for YOLO Model Training

Brats2020



2024

Introduction

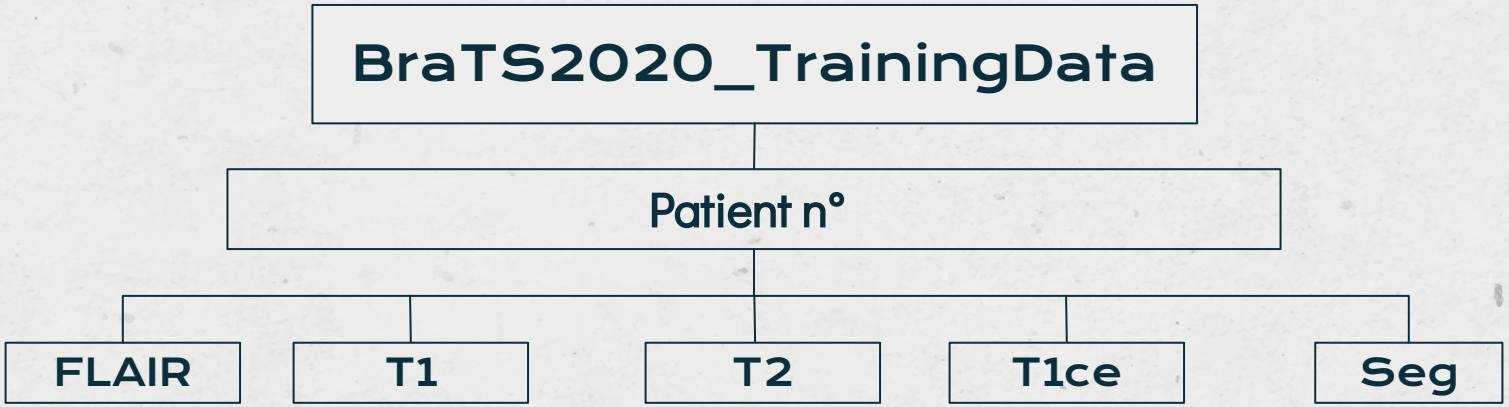
1. Brain Tumour Segmentation is an important challenge in biomedical image processing.
2. Early detection of brain tumours is vital for the successful treatment of patients.
3. One of the most prevalent types of primary brain tumours is Glioma, which comprises about 30 percent of brain tumours and 80 percent of all malignant brain Tumours.
4. Hence, there is a need for automated approaches to brain-tumour segmentation as it can help reduce/augment hospital workloads and save lives

Objective

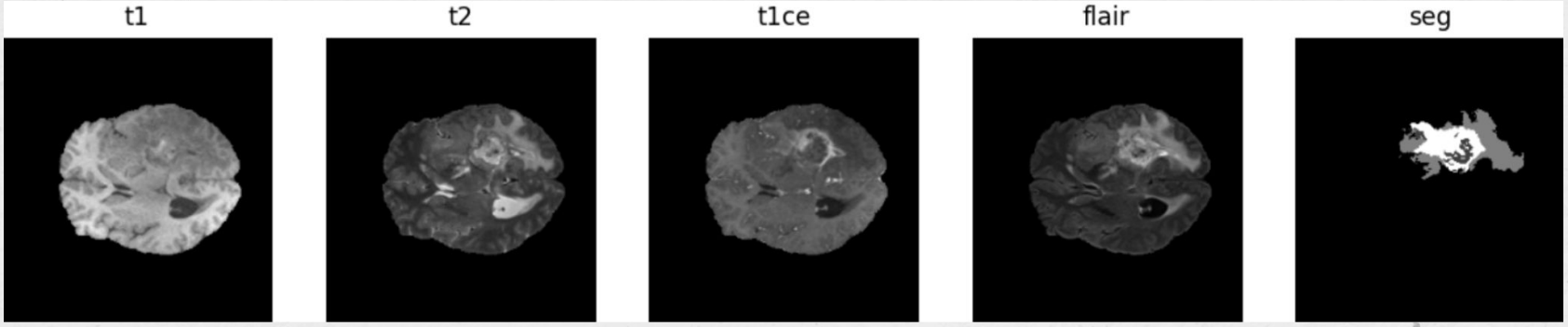
- The preparation of the Brats 2020 dataset for YOLO model training.
- The conversion of the segmentation masks in this dataset into annotations that YOLO models can use .
- The creation of a high-quality annotated dataset that could be used for object detection tasks.

Methodology and Approach

- **Understanding the BraTS 2020 Dataset :** 150 patients



Methodology and Approach



Eg. Patient n° 09

Methodology and Approach

Process steps :

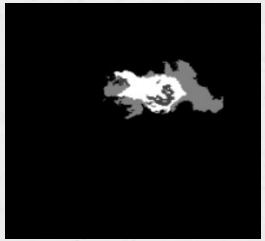
seg.nii

1

```
[[[0,  0,  0, ....., 0, 0,0],
 [0,  1,  0, 4,  ..., 4, 1,0],
 .....
 [0,  1,  4, 2,  ...2, 4, 1,0],
 [0,  0,  0, 2,  ...2, 4, 1,0],
 ......
 [0,  0,  0, ...,      0, 0,0],
 [0,  0,  0, ...,      0, 0,0],
 [0,  0,  0, ...,      0, 0,0]]]
```

Tab numpy

2



Seg patient n°09

3

(class , x , y , W , H)

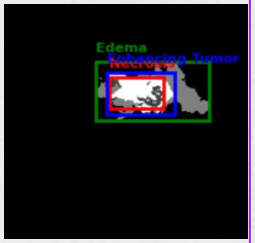
(0 , 0.529 , 0.372 , 0.0 , 0.004)

(1 , 0.541 , 0.397 , 0.433 , 0.312)

(2 , 0.539 , 0.379 ,0.129 , 0.091)

Annotations

4



Bounding Boxes

5

Methodology and Approach

1. Step 1 :

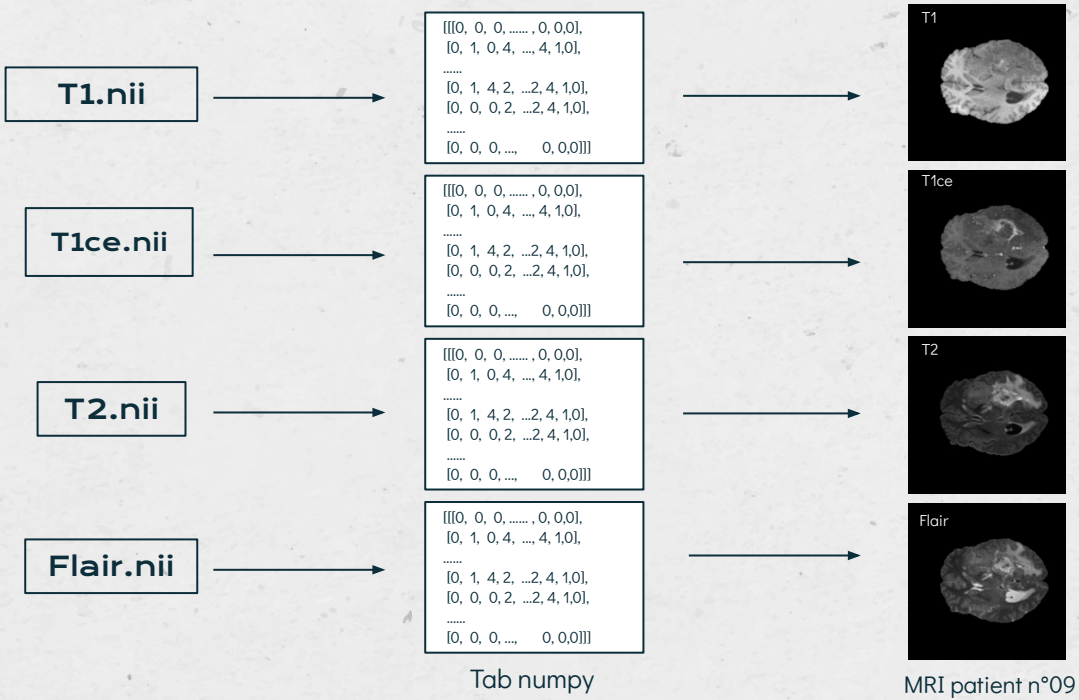
`seg.nii` File: Medical Image Segmentation

- **NIfTI Format** (`.nii`)
  - Used for storing 3D medical images, commonly in neuroimaging.
- **Segmentation**
  - **Necrosis**: Value **1**
  - **Edema**: Value **2**
  - **Enhancing Tumor**: Value **4**
  - Each voxel value represents a specific region (tumor or healthy tissue).
- **Alignment with Original Image**
  - Aligned with MRI/CT images to identify anatomical structures.
- **Applications**
  - Training AI models, statistical analysis, medical planning.

Methodology and Approach

2. Step 2 & 3 :

- **Data Preparation :** Preprocess the images and their segmentation masks.



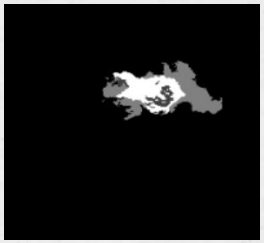
Methodology and Approach

The important part :

seg.nii →

```
[[[0,  0,  0, ....., 0, 0,0],
 [0,  1,  0, 4,  ..., 4, 1,0],
 .....
 [0,  1,  4, 2,  ...2, 4, 1,0],
 [0,  0,  0, 2,  ...2, 4, 1,0],
 .....
 [0,  0,  0, ...,      0, 0,0],
 [0,  0,  0, ...,      0, 0,0],
 [0,  0,  0, ...,      0, 0,0]]]
```

Tab numpy →



Seg patient n°09

Methodology and Approach

4. Step 4 :

- **Annotation Generation :** Create annotation files compatible with the YOLO format.

    1. Labeling Tumor Parts
    2. Binary Mask Creation
    3. Bounding Box Calculation : `masks_to_boxes`
    4. Annotation Storage

```
[[[0,  0,  0, ....., 0, 0,0],
  [0,  1,  0, 4,  ..., 4, 1,0],
 .....
  [0,  1,  4, 2,  ...2, 4, 1,0],
  [0,  0,  0, 2,  ...2, 4, 1,0],
 .....
  [0,  0,  0, ...,      0, 0,0],
  [0,  0,  0, ...,      0, 0,0],
  [0,  0,  0, ...,      0, 0,0]]]
```

Tab numpy

```
[ { 'part': 'Necrosis','color': 'red','x': 139.0,'y': 80.0,width': 10.0,'height':
13.0 } ,

 { 'part': 'Edema', 'color': 'green', 'x': 107.0,'y': 64.0, 'width':
72.0,'height':37.0 } ,

 { 'part': 'Enhancing Tumor','color': 'blue','x': 135.0,'y': 71.0,'width':
16.0,'height': 21.0 } ]
```

Dict of annotation of different Tumor

Methodology and Approach

- **Writing Annotations in TXT file:**

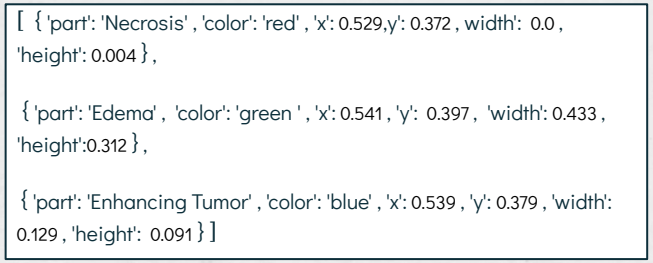
(Class, X , Y , Width , Height)

Class

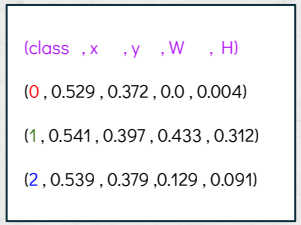
Necrosis : 0

Edema : 1

Enhancing Tumor : 2



Dict of annotation of different Tumor



Annotations.TXT

Methodology and Approach

- **Display the Bounding Boxes :** Ensure the accuracy and quality of annotations.

(class , x , y , W , H)

(0 , 0.529 , 0.372 , 0.0 , 0.004)

(1 , 0.541 , 0.397 , 0.433 , 0.312)

(2 , 0.539 , 0.379 ,0.129 , 0.091)

Annotations.TXT

Bounding Boxes

- **Validation of Annotations :** Ensure the accuracy and quality of annotations.

Key Results and Contributions

Challenges and Solutions

Learning Outcomes

Conclusion

In conclusion, my internship at the University of Galway allowed me to work on an important project that contributes to the field of object detection. I'm proud of the progress I made and the results I achieved. Looking forward, I believe there are opportunities to further refine the dataset and explore how it can be used in different applications. I want to thank my supervisor and the team for their support throughout this experience. I'm happy to answer any questions you may have.

Q&A

I'm now open to any questions or feedback you might have. Thank you for your attention