Proposal for Segmentation of Left Atrial from 3D CT and MRI Datasets using Deep Learning

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2 About the Dataset

The Left Atrial Segmentation Challenge (LASC'13) is a benchmark dataset that was part of the STACOM'13 workshop held in conjunction with MICCAI'13. The challenge aimed to evaluate algorithms for left atrial (LA) segmentation from Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) images. The benchmark consists of 30 CT and 30 MRI datasets, with 10 datasets for each modality provided for algorithm training and 20 datasets for evaluation.

3 Data Source

The MRI datasets are publicly available on Figshare:

1. Training Data: Training Data

2. Testing Data: Testing Data

Unfortunately, the data agreement for CT datasets expired on September 2018 and they are no longer available for sharing.

4 Data Format

The dataset is in 3D full volume format, which means that 2D slices will be extracted in two dimensions corresponding to the label. The segmentation task is to segment the left atrium, including a short part of the LA appendage trunk plus the proximal parts of the pulmonary veins.

5 Data Preprocessing

The following preprocessing steps will be applied to the dataset:

- 2D slice extraction: Since the dataset is in 3D full volume format, 2D slices will be extracted in two dimensions corresponding to the label.

- Crop Region of Interest: The extracted slices will be cropped to include only the region of interest, i.e., the left atrium and the pulmonary veins.

- Image Resizing: The extracted slices will be resized to a fixed dimension for ease of processing.

- Z-normalization: The pixel values of the resized slices will be normalized based on their mean and standard deviation.

- Data Augmentation: To increase the size of the dataset and improve model performance, data augmentation techniques such as rotation, scaling, and elastic transformations will be applied to the preprocessed images.

6 Task Pipeline

The task pipeline for this project will be as follows:

- Data Preprocessing: The dataset will be preprocessed as described above.

- Model Training: A Unet that will add into an Attention Filter Gate based on the FFT mechanism will tackle some problems such [Complexity algorithm, feature localization, and Learning from different Domain Space Frequency] architecture will be trained on the preprocessed dataset to perform left atrial segmentation.

- Model Evaluation: The trained model will be evaluated on the testing dataset using metrics such as dice coefficient and Jaccard index.

- Model Tuning: If necessary, the model hyperparameters will be tuned to improve performance.

- Model Deployment: The final model will be deployed for use in left atrial segmentation tasks.

7   Conclusion

The Left Atrial Segmentation Challenge dataset provides a benchmark for left atrial segmentation algorithms, and our project aims to tackle this problem using an Attention Filter based on the Fourier Transformation approach