# Validation plan for the Hippocampal Volume Quantification in Alzheimer's Progression Model

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that results in impaired brain function and eventually, death of the neurons. AD is the most common cause of dementia. Clinically, it is characterized by memory loss, inability to learn new material, loss of language function, and other manifestations.

One of the main ways that Doctors can track the progression of the disease is through a radiological MRI exam. In this exam, the hippocampal volume is measured, as this disease is characteristic of reducing the volume of the hippocampus.

In order to aid the study of the hippocampus relationship with AD, the team has developed an algorithm that automatically measures the volume of the hippocampus of new patients.

**What is the intended use of the product?**

The intended use of the algorithm is to accurately measure the hippocampal volume (in mm3) of new patients that are suspected to show early symptoms of Alzheimer's Disease.

**How was the training data collected?**

The data was collected from a dataset from the Medical Decathlon competition. This data contains a collection of NIFTI files. These files contain MRI brain scans from people with diverse age groups, gender, and brain hemisphere. The dataset has been cropped to only contain the hippocampal region. This was done with the intention of having a smaller dataset that could allow the model to be trained more efficiently.

The dataset was cleaned by removing outliers in the data (volumes <2200 mm3 and > 4,500 mm3) and any other image with no matching associated label.

**How did you label your training data?**

The utilised labels were previously classified by professionals, they contain values for each slice of the hippocampal area (anterior and posterior)

**How was the training performance of the algorithm measured and how is the real-world performance going to be estimated?**

The performance of the algorithm was measured by checking the training and validation loss of the model. The data was split into 3: training, testing and validation, this would allow us to check that the predictions were accurate in a safe environment.

The algorithm uses a Unet Architecture and uses the images and labels of each MRI scan result. A tensorboard was used to track the loss for the duration of 10 epochs, the final loss remained at a value of 0.013, which is considered as acceptable.

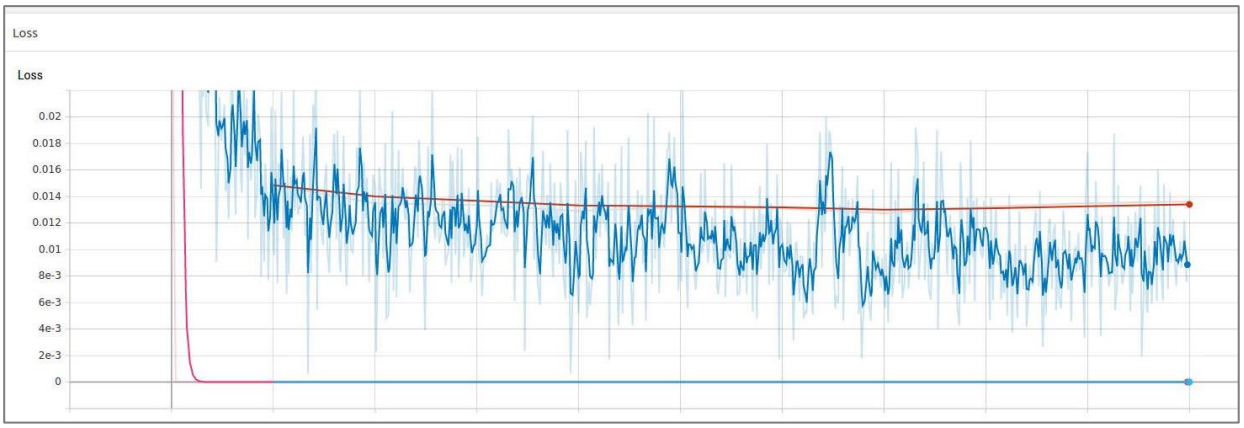


Figure 1 - Loss profile for 10 epochs

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The dice 3d and jaccard 3d coefficients were chosen as metrics to determine the accuracy of the calculated volume. The table below displays the results for 2 files.

| filename: "hippocampus_039.nii.gz" | filename": "hippocampus_166.nii.gz" |
|---|---|
| "dice": 0.91<br>"jaccard": 0.84 | "dice": 0.93<br>"jaccard": 0.88 |

In the real world the model would receive images through the PACS system, if the images are adequately formatted the model will estimate the hippocampal volume and recreate the volumes.

The results would be able to be seen with 3D imaging tools/

**What data will the algorithm perform well in the real world and what data it might not perform well on?**

The data needs to be properly labelled and the volume of the hippocampus needs to be within the range of 2,200 mm3 and 4,500 mm3. Any data outside of this range would not perform correctly.