Integrating AI into Clinical Workflow with Orthanc and OHIF Viewer

Creating an AI module for a Clinical Radiological System.

Overview

We are facing the power of bridge human and medical image AI to advance medical diagnostics to improve patient outcomes around the world, where radiologists are empowered with the most advanced medical diagnostics to facilitate optimal patient care and support. In addition, this technology can integrate seamlessly into an existing health system infrastructure to improve workflow, efficiency, and quality at scale.

Neurodegenerative diseases are frequently associated with structural changes in the brain. Magnetic Resonance Imaging (MRI) scans can show these variations and therefore be used as a supportive feature for several neurodegenerative diseases. The hippocampus has been known to be a biomarker for Alzheimer diseases (AD) and other neurological and psychiatric diseases. However, it requires accurate, robust, and reproducible delineation of hippocampal structures. Fully automatic methods are usually the voxel-based approach, for each voxel a number of local features were calculated.

Where and how AI can help in clinical workflow:

- AI can make sense of the overwhelming amount of data
- AI can improve Clinical reliability and be used to help identify relevant information
- AI tools can tackle tedious, mundane tasks
- AI can aid in data entry and administrative tasks
- AI can improve patient outcomes
- AI has the potential to improve resource utilization and efficiency
- AI can improve diagnostics
- AI can assist by analyzing structured and unstructured patient data

What we are proposing with this model

This study shows the development of an artificial intelligence (AI) system that can analyze and segment medical scans of hippocampal in brain to a similar standard as expert clinicians. The findings also show that this system can complete this process in a fraction of time, which means:

- AI can bring better treatments diagnostics and with less bias
- Create a less expensive, more accessible healthcare environment for patients
- We can have a accelerate the process workflow with low additional price

Areas of use:

- Triage

The model can interpret scans as they arrive to AI Server.

- Quality assessment

The model can provide a post-read analysis, checking a radiology report against the corresponding images to help prevent over or under called findings.

In the real world, clinicians need to measure the volume of the hippocampus using MRI scans and this process tends to be very tedious. Our AI algorithm can analyze the patient study in fraction of seconds and this information can be added to the Clinical Workflow [1], as showed in the screenshot of OHIF viewer.

Validation

Predicting a diagnosis for patients

This work has steps to ensure it can be clinically applicable. It includes the development of performance metrics used to access the model performance that I believe can be representative for clinical processes.

- The dataset used has 263 images of T2 MRI scans and was extracted from Medical Decathlon competition.
- A common computer with CPU was used to run the model in clinical workflow.
- The trained model takes around 2 seconds to process inference and send a report to AI server.
- Dice similarity coefficient of 90.0

The table shows the comparison this work with results of Manhua Liu [1] and it seems to be acceptable.

	Dice	Jaccard
This model	90.0	81.9
[2]	87.0	N/A

For the ground-truth, MRI scanner can provide 3D images that are compacted to NIFTI format, where the spatial information (Sagital, Coronal, Transversal) can be extracted during prediction segmentation and correlated with the resulting ground-truth image.

Future work.

In the future we can use the FastMRI [3] to unlock fast MRI scanning, in addition to AI in the clinical workflow, can really benefit patients everywhere.

References

[1] Carlos Lacerda, Integrating AI into Clinical Workflow

[2] Manhua Liu et al., A multi-model deep convolutional neural network for automatic hippocampus segmentation and classification in Alzheimer's disease.

[3] Anuroop Sriram, Jure Zbontar, Tullie Murrell, Aaron Defazio, C. Lawrence Zitnick, et al. End-to-End Variational Networks for Accelerated MRI Reconstruction