**(Image Processing) Technical Task**

**T1w MRI processing and CNN model building**

**Task 1**

Build a 3D CNN model to perform automated skull-stripping of T1w MRI scans. Here are the overview notes of the assignment:

* Refer to the [NFBS Skull-Stripped Repository](http://preprocessed-connectomes-project.org/NFB_skullstripped/) for the T1w MRI and ground truth + brain mask dataset
* Perform the required T1w MRI preprocessing steps such as intensity normalization, bias field correction, etc. to remove noise from the imaging scans. Refer to [nipype](https://nipype.readthedocs.io/en/0.12.1/index.html), a python-based neuroimaging library that provides you with these preprocessing functions.
* There are existing ready tools that use statistical approaches to perform skull-stripping (E.g. FSL based BET, BrainSuite’s Skull-strip, and other CNN based approaches etc.). Your task is to build a custom CNN model that maximizes the accuracy and performs the best automated skull-stripping.
* BrainSightAI’s T1w MRI scans (<https://drive.google.com/file/d/1y8N6JpKhyoLDQcscdudwMCgqubjQyfd1/view?usp=sharing>) to test the validity of the custom trained model. Since the data distribution of our scans might be slightly different from that of the NFBS dataset, preprocessing becomes very crucial.
* Since the input scans are in NIfTI format, we require the skull-stripped scans to be in the same format too. This is to ensure that the [header information](https://nipy.org/nibabel/nifti_images.html) in these scans are preserved.
* We recommend you to train a GAN-based segmentation or an Autoencoder-based segmentation model (Vanilla UNET is strictly prohibited) on Google Collab for now. The objective of this assignment is to assess your DNN model building skills so we don’t necessarily require your model to give out start-of-the-art accuracy. If you require, we can provide you with Azure resources to further optimize your model.
* Since the objective of the task is to build an end-to-end pipeline, create a final inference code, where the model takes in raw T1w MRI scan and outputs the required skull-stripped image.

**Task 2**

* Build a CNN model to perform tumour classification using any one of the two given datasets:
  + <https://www.kaggle.com/sartajbhuvaji/brain-tumor-classification-mri>
  + <https://figshare.com/articles/dataset/brain_tumor_dataset/1512427>
* Develop an API/Script to track or visualize the salience maps/heat maps for the CNN to interpret what the model has learned to infer tumour classes.
* Create a final inference code where the model takes a T1w image and prints the class of the tumour.

**Note:** The Deep Learning models can be built using PyTorch or TensorFlow.