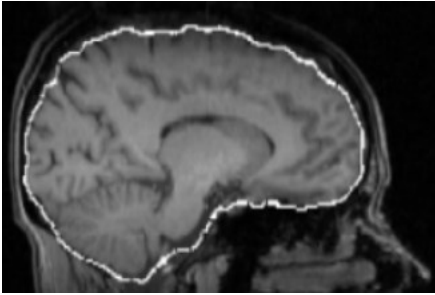


Assignment 4 – Due Monday July 19<sup>th</sup> at 11:59 PM

### Brain extraction (skull-stripping)

In this assignment, we will implement a model for brain extraction (see the famous 2002 paper by Stephen Smith “[Fast robust automated brain extraction](#)”).

**The goal** is to automatically isolate the brain from a T1-weighted image:



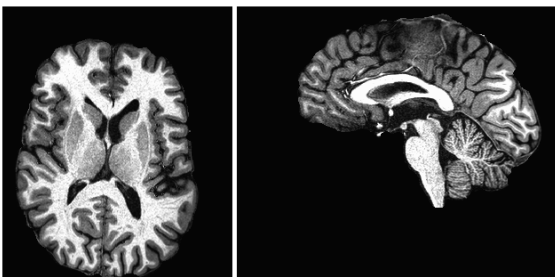
As you can see in the above image a white outline surrounds the brain, indicating that the brain has been successfully isolated from the surrounding tissue.

Your goal is to develop an algorithm in numpy that can isolate the brain from the surrounding tissue (skull, etc.). You are free to use any approach you want to isolate the brain. You should read the paper by Smith to get an idea of the problem and the conventional approach. If you want to copy the approach by Smith, you are free to do so (but it is quite complicated, as you will see by reading the paper!).

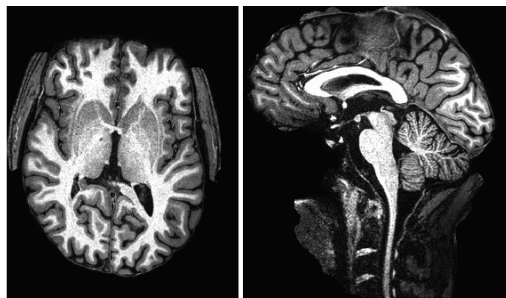
Test and apply your technique on 3 images I have supplied here ([link](#)). Your solution must be provided in numpy code. I will test your solution on some of my own images that I do not provide to you, so make sure your solution is robust (and quick to compute!). I have also supplied a t2.nii.gz image so you can try on a different modality.

Your approach should isolate the brain including the cerebellum, and reduce as much of the surrounding tissue as possible.

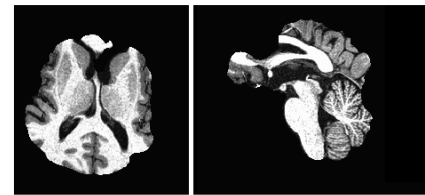
**Output:** Below are some good and bad examples. Your output should be an image with same dimension as input image, but all non-brain voxels set to zero (so that only the brain is showing) – see the first example below.



✓ good (brain is successfully removed from surrounding tissue)



✗ bad (much of the surrounding tissue remains, including some parts of the skull and neck)



✗ bad (too much of the brain was removed)

As with previous assignments, please submit a single zip file to moodle containing a report and numpy source code files so I can test your solution on my own images.