Efe Eren Ceyani
21903359
EEE 473

(b)

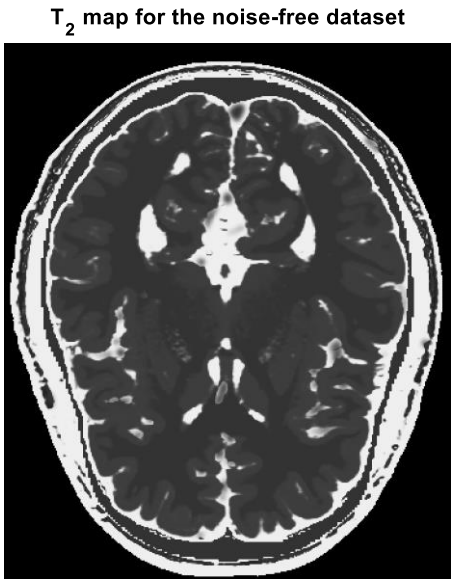

Figure 1.1.1 T_2 map for the noise-free dataset using the derived equation

(c)

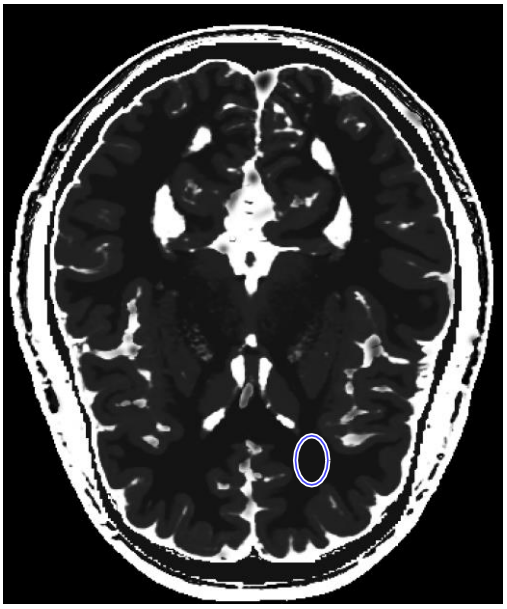

Figure 1.2.1 ROI ellipse for white matter, noise-free image. Estimated T_2 value for white matter is 70.05ms.

(d)

I used the same mask as in part (c), so there was no need to plot anything. Estimated T_2 value for white matter in the noisy T_2 map is 71.26ms. Percentage-wise deviation from the noise-free dataset is 1.74%.

Efe Eren Ceyani
21903359
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(e)

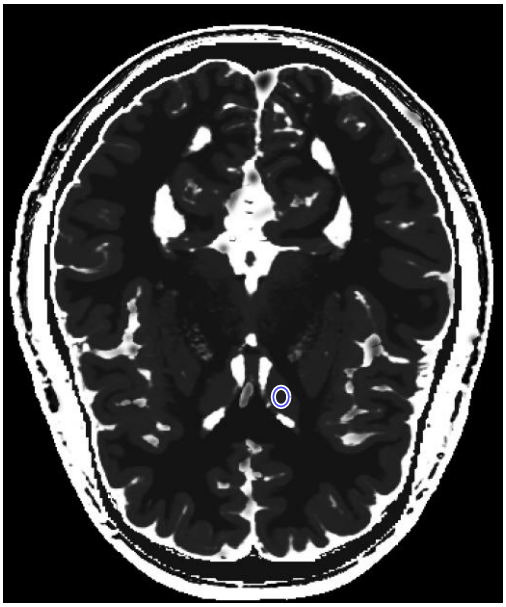

Figure 1.3.1 ROI ellipse for gray matter, noise-free image. Estimated T_2 value for gray matter is 83.97ms.

Estimated T_2 value for gray matter in the noisy T_2 map is 84.50ms. Percentage-wise deviation from the noise-free dataset is 0.63%.

(f)

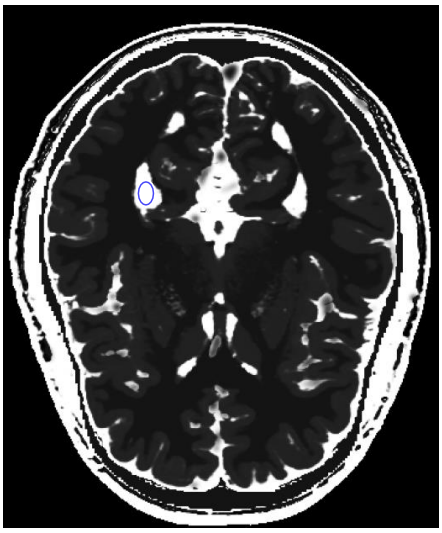

Figure 1.4.1 ROI ellipse for cerebrospinal fluid (CSF), noise-free image. Estimated T_2 value for CSF is 327.02ms.

Estimated T_2 value for CSF in the noisy T_2 map is 348.74ms. Percentage-wise deviation from the noise-free dataset is 6.64%.

Efe Eren Ceyani
21903359
EEE 473

(g)

The largest deviation in T_2 estimation was seen in CSF. Between the three tissues, CSF has the T_2 value, so in T_2 weighted contrast images, CSF is the brightest between the tissues. Hence, even a small noise in the scan will be strengthened drastically.

Code

```
%Homework 4 - Q4
dataset = load("brainT2_mri.mat");
TE = dataset.TE;
image1 = dataset.image1;
image2 = dataset.image2;
TR = dataset.TR;
flip_degree = dataset.flip_degree;
image1_noisy = dataset.image1_noisy;
image2_noisy = dataset.image2_noisy;

%% b
T2map = (TE(1)-TE(2))./(log(image2)-log(image1));
figure;
imshow(abs(T2map),[0 350]);
title("T_2 map for the noise-free dataset");

%% c
figure;
imshow(T2map, []);
mask_wm = roiellipse;
T2_est_wm = mean(T2map(mask_wm));
%T2_est_wm = 70.0480 ms

%% d
T2map_noisy = (TE(1)-TE(2))./(log(image2_noisy)-
log(image1_noisy));
T2_est_wm_noisy = mean(T2map_noisy(mask_wm));
%T2_est_wm_noisy = 71.2636 ms

deviation_wm = (abs(T2_est_wm -
T2_est_wm_noisy)/T2_est_wm)*100;
%deviation_wm = 1.7355%

%% e
figure;
imshow(T2map, []);
mask_gm = roiellipse;
T2_est_gm = mean(T2map(mask_gm));
%T2_est_gm = 83.9685 ms
```

```
T2_est_gm_noisy = mean(T2map_noisy(mask_gm));
%T2_est_gm_noisy = 84.5014 ms

deviation_gm = (abs(T2_est_gm -
T2_est_gm_noisy)/T2_est_gm)*100;
%deviation_gm = 0.6347%

%% f
figure;
imshow(T2map, []);
mask_csf = roiellipse;
T2_est_csf = mean(T2map(mask_csf));
%T2_est_gm = 327.0154 ms

T2_est_csf_noisy = mean(T2map_noisy(mask_csf));
%T2_est_csf_noisy = 348.7403 ms

deviation_csf = (abs(T2_est_csf -
T2_est_csf_noisy)/T2_est_csf)*100;
%deviation_csf = 6.6434%
```