(b)



Figure 1.1.1 T2 map for the noise-free dataset using the derived equation

(c)



Figure 1.2.1 ROI ellipse for white matter, noise-free image. Estimated T2 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 T2 value for white matter in the noisy T2 map is 71.26ms. Percentage-wise deviation from the noise-free dataset is 1.74%.

(e)



Figure 1.3.1 ROI ellipse for gray matter, noise-free image. Estimated T2 value for gray matter is 83.97ms.

Estimated T2 value for gray matter in the noisy T2 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 T2 value for CSF is 327.02ms.

Estimated T2 value for CSF in the noisy T2 map is 348.74ms. Percentage-wise deviation from the noise-free dataset is 6.64%.

(g)

The largest deviation in T2 estimation was seen in CSF. Between the three tissues, CSF has the T2 value, so in T2 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%