Exercise MRI #3

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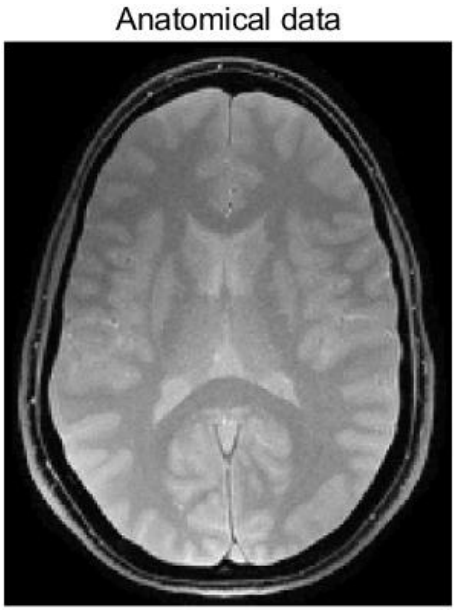
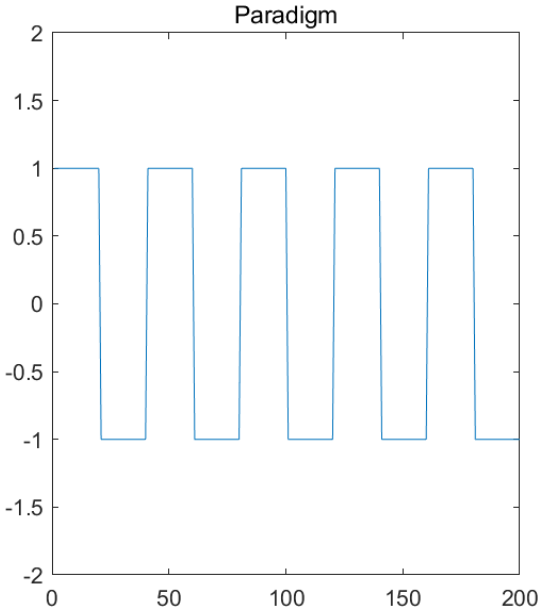
Task 3.1

1. Display and study the signal time series of individual pixels of your choice. Try to find pixels whose temporal fluctuation resembles the paradigm.

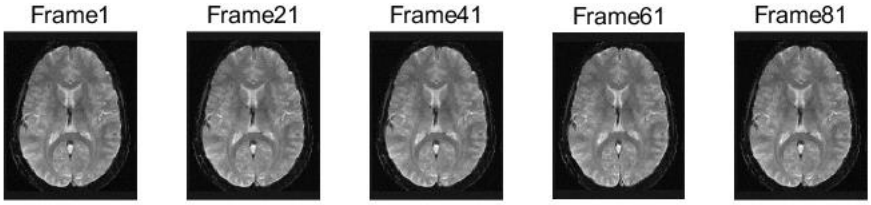
Anatomical data:

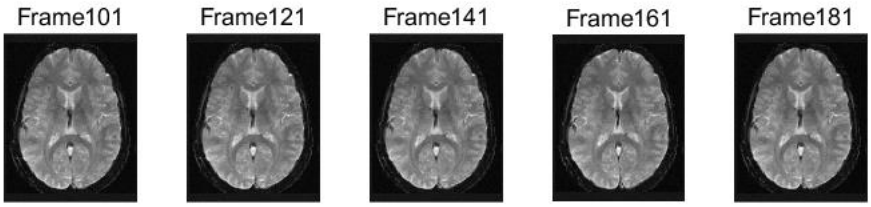


Paradigm:

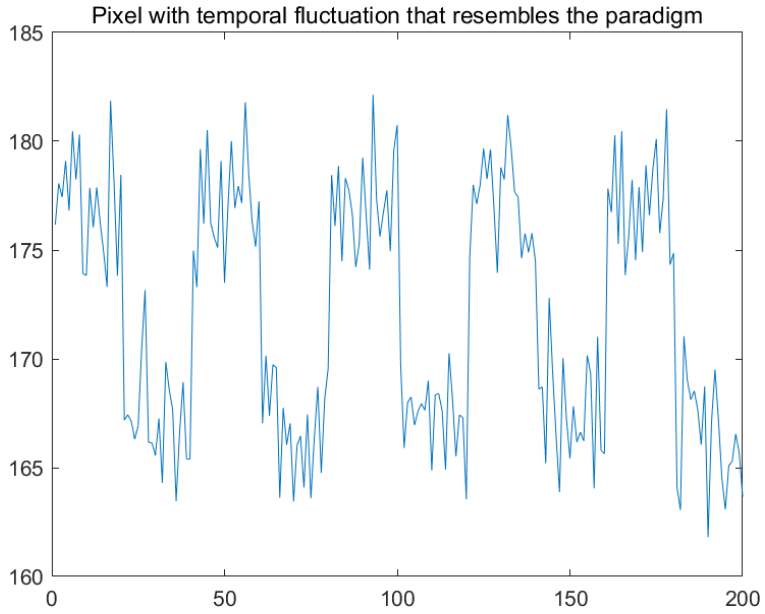


Functional data:

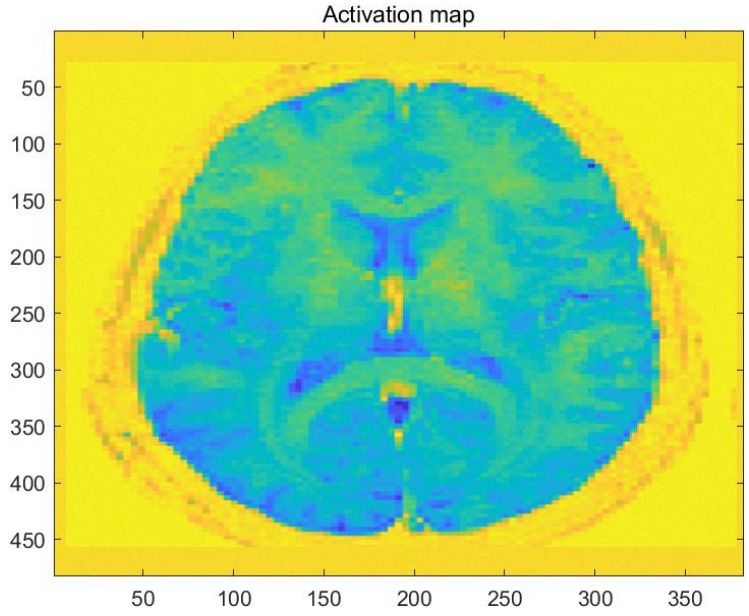




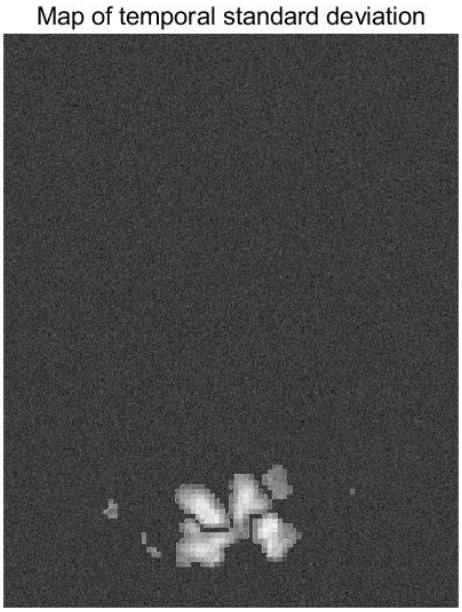
In order to find pixels whose temporal fluctuation resembles the paradigm, we can loop over all individual pixels and examine if the temporal fluctuation that resembles the paradigm. We firstly normalize each fluctuation and calculate the difference between the paradigm and it. Our result is x = 221, y = 417.



2. Quantify the resemblance with the visual paradigm by calculating the scalar product (product summed over time) of the pixel time series and the paradigm. Calculate the scalar product for all pixels and display the results as an image ('activation map').

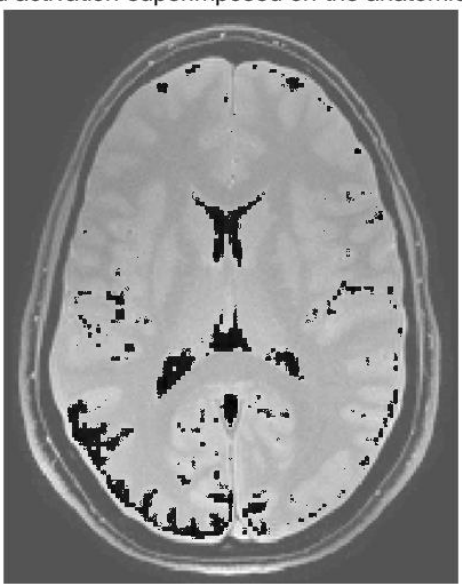


3. Calculate the temporal standard deviation of the time series and display it as map. Estimate the thermal noise level from an area without activation.



4. To distinguish activations from noise choose a threshold and mask the activation map accordingly. Display the masked activation superimposed on the anatomical data. Propose an interpretation of the result. What does the sign of the activation indicate?

Masked activation superimposed on the anatomical data



We chose the factor as 4.5 and multiply it with the noise level to get the threshold. If the activation is lower than the threshold, it will be filtered out. The superimposed result shows the activation levels of how different parts of the brain respond to the visual stimuli. The most active parts mainly locate in the back of the head. Each hemisphere has a portion of the visual cortex, with the left hemisphere receiving information from the right visual field and the right hemisphere receiving information from the left visual field. According to the result, the activation map of the left and right cortexes is different, which means the visual stimulation levels of the two eyes are different.