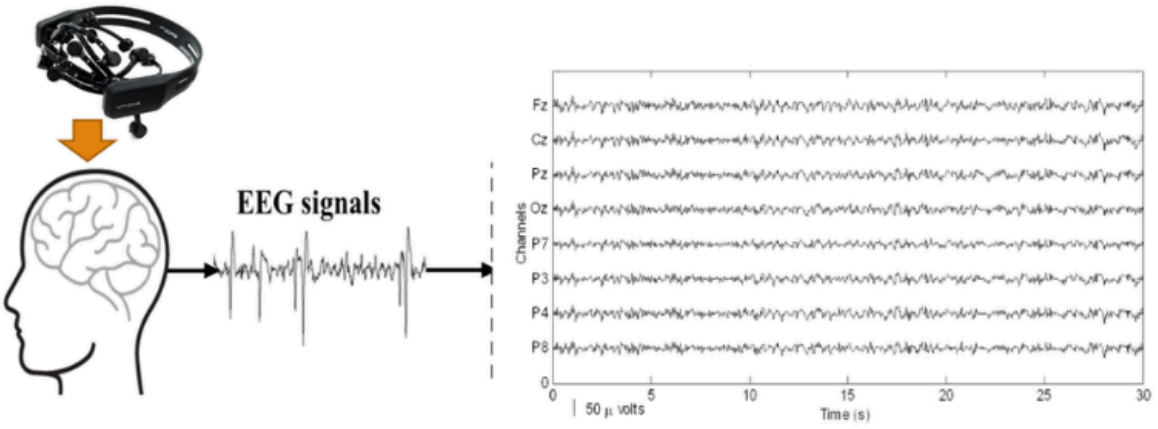
Autoregressive model on our data - Final Results



In this document we collect our final results after the conversations we had and our assurance about how our model works. Our final results align with our goal to use the AR model which was the comparison between raw and koopman-transformed data which we wanted to check how well the same model does the forecasting on time in each of the data sets for these two types.

Section 1 – Assumption

While we want to check this assumption, our initial belief was that the Koopman embedding space which we can reach using Deep Koopman Transform on the original data can increase linearity. Our model to do the forecasting task is a linear autoregressive (AR) model can have better performances on the data sets with more degree of linearity so we can conclude that we can give better performances for Koopman transformed data regarding to R^2 and whiteness metrics.

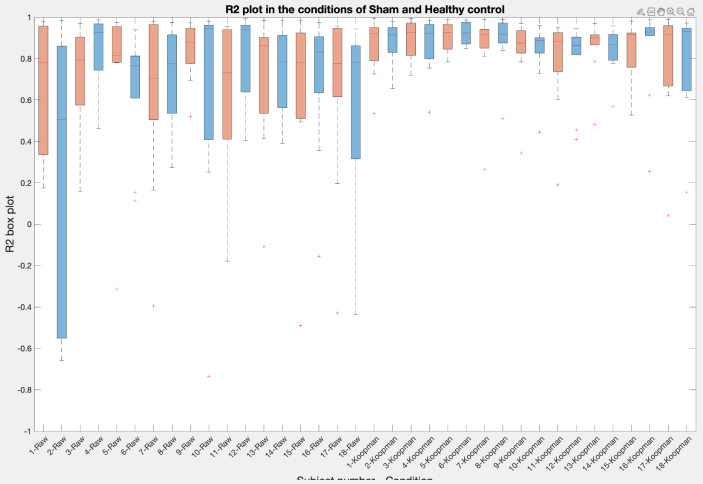
Based on this assumption we check these 2 metrics for each dataset and each subject in 2 types of raw and koopman-transformed.

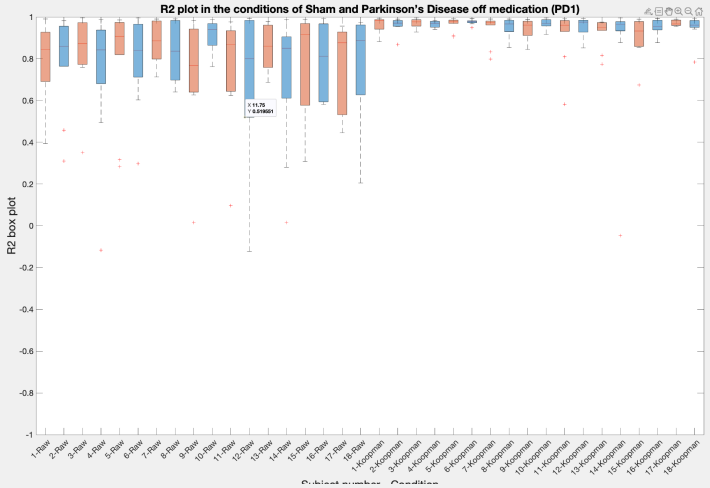
Section 2 – Results

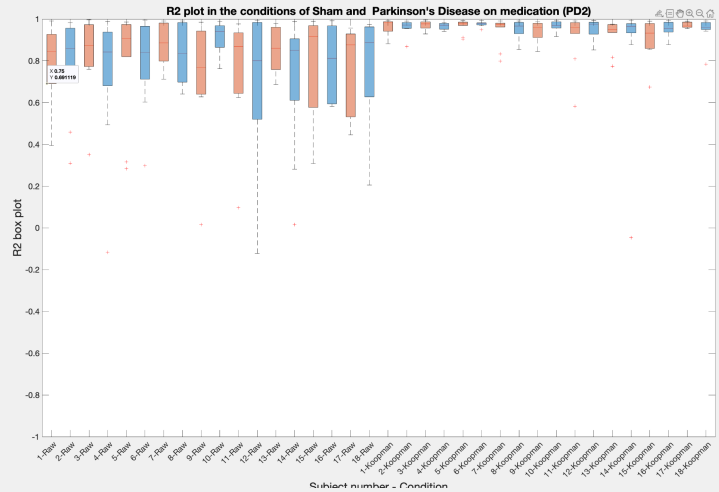
In this part after some exploration we've chosen AR-100 model explained in this paper as reference of model: Macroscopic resting-state brain dynamics are best described by linear models

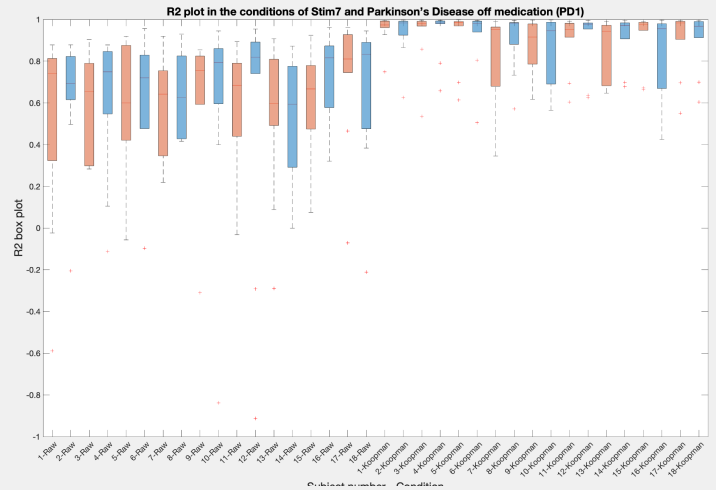
But note that as I have checked, these results stay correct by changing parameters of the model.

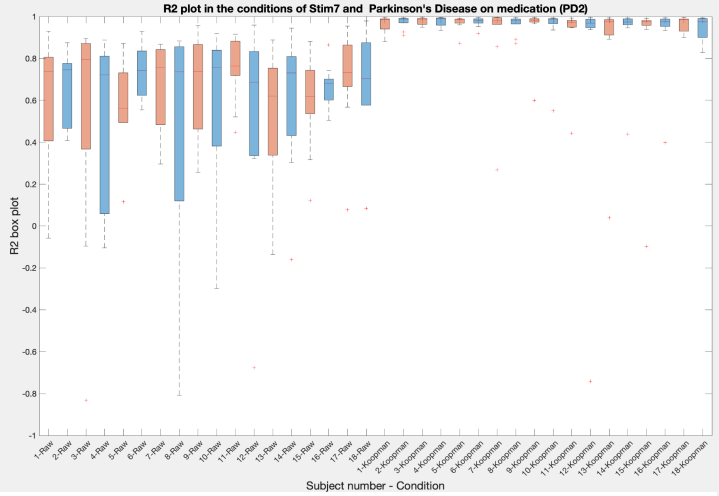
A) First, we check R^2 as a performance metric for the prediction task:

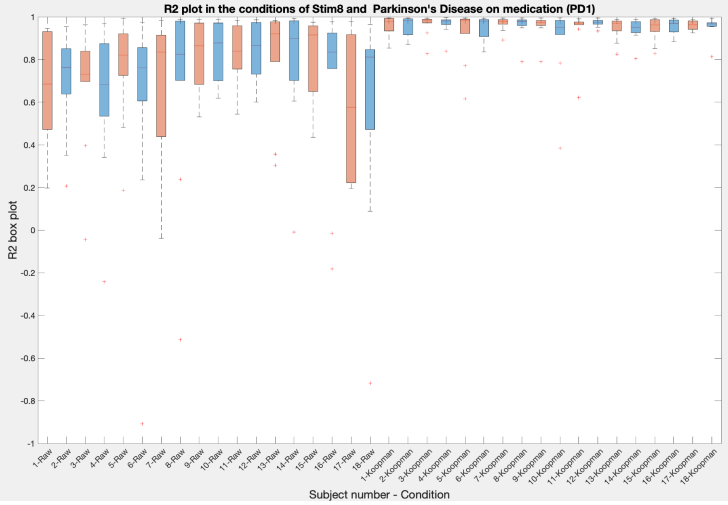


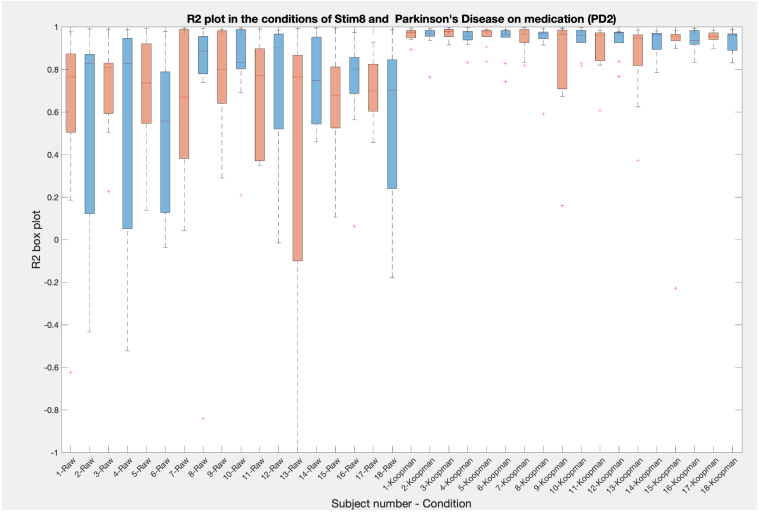






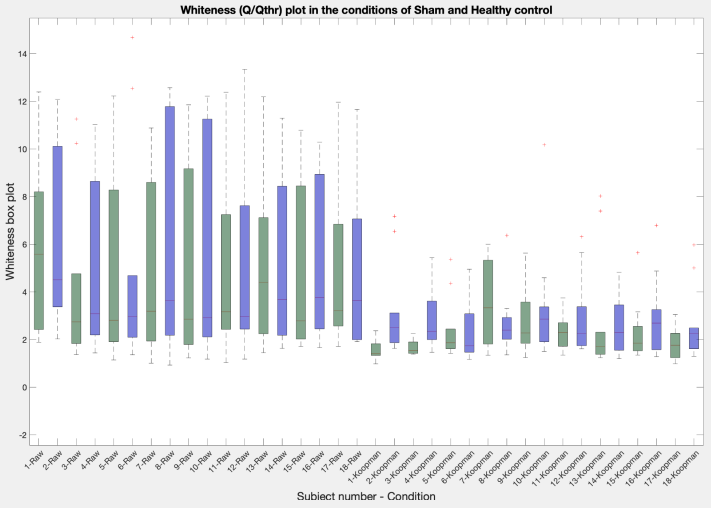


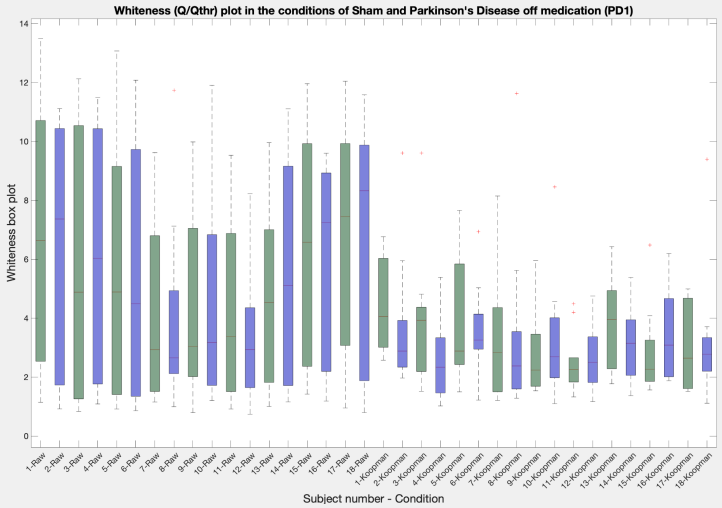


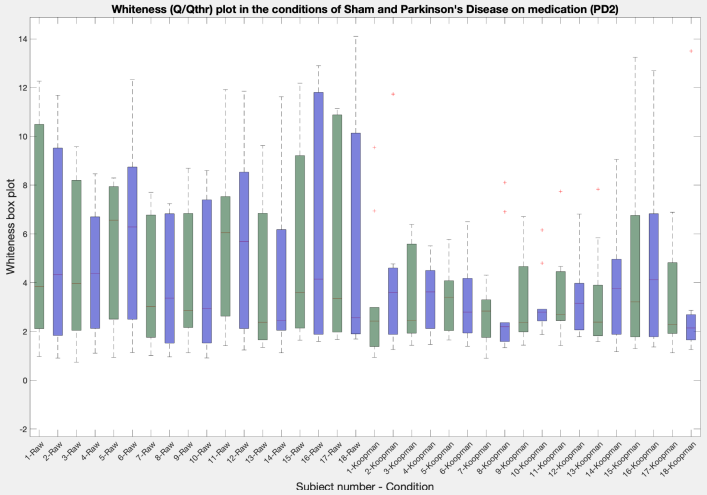


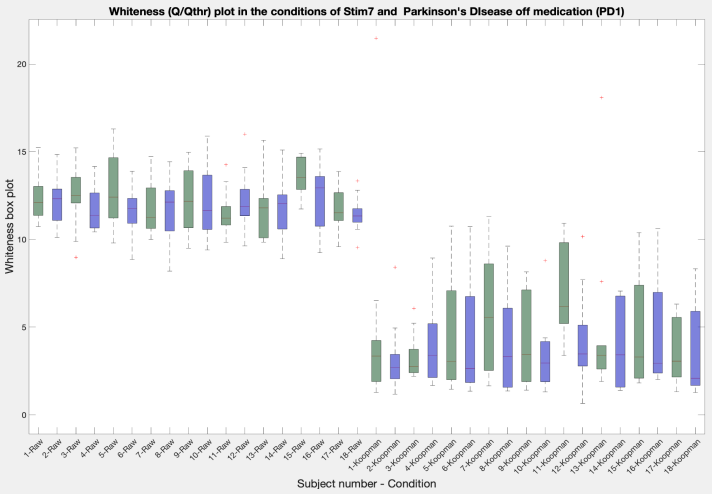
As you can see in the results below we find that in koopman transformed data and for almost all subjects and conditions there is better performance in forecasting by auto-regression. (Need to have a discussion with Dr.Mirian and Maryam :))

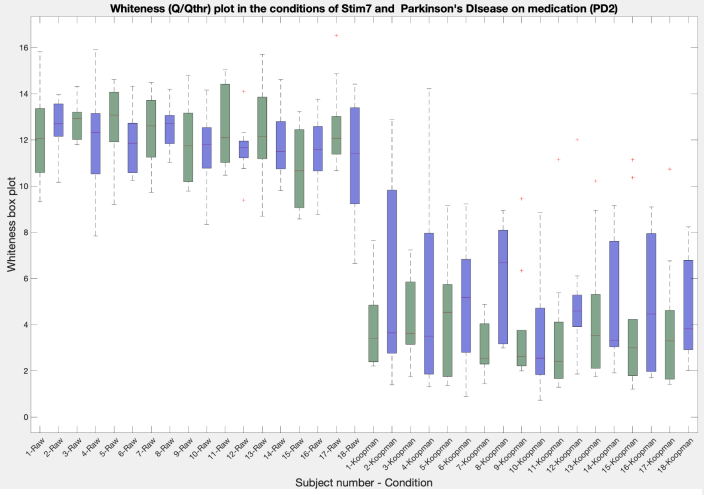
B) Now in this part we check our second metric which is the measure of whiteness of the regression we did using AR:

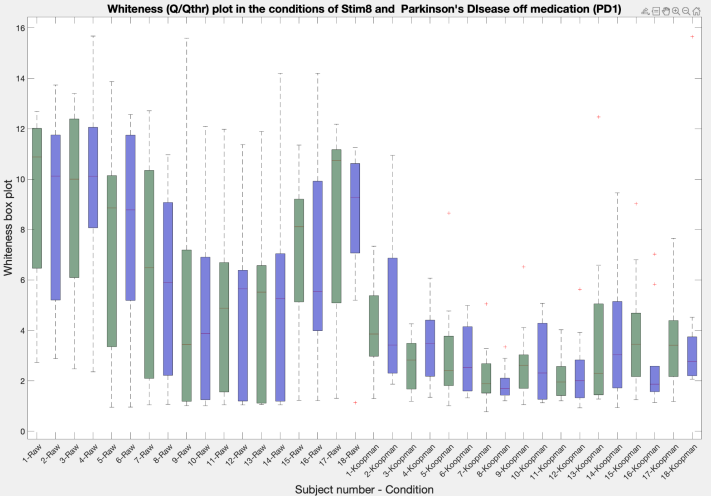


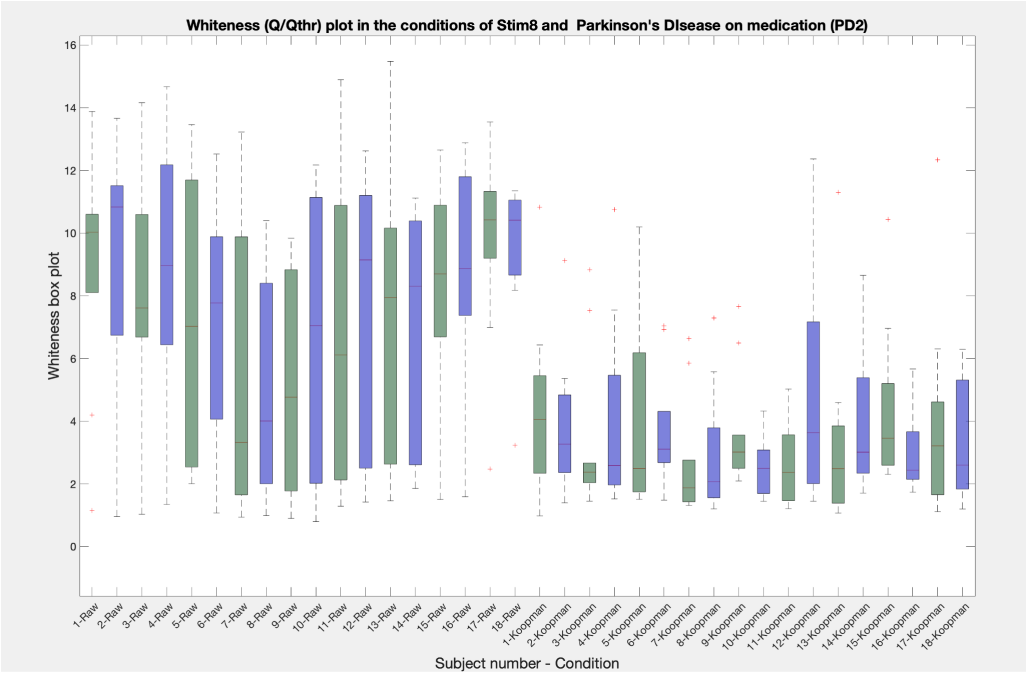












As you can see in the koopman transformed data the whiteness statistics is significantly lower than in raw data. A decrease in the whiteness metric (Q/Qthr) after a transform on data for the regression task indicates that the residuals have become more normally distributed, suggesting an improved model fit and better prediction accuracy.