Master's Thesis

Predicting Droughts in the Amazon Basin based on Global Sea Surface Temperatures

Department of Statistics
Ludwig-Maximilians-Universität München

Dario Lepke

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Supervised by Dr. Fabian Scheipl (LMU) and Dr. Niklas Boers (PIK)

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Chapter 4

Clustering

In this chapter we will first summarize the main ideas of clustering and then apply it to the precipitation data. If not indicated otherwise the information is taken from Elements of Statistical Learning.

4.1 Main Idea Clustering

We can describe an object by a set of measurements or its similarity to other objects. Using this similarity we can put a collection of objects into subgroups or clusters. The objects in the subgroups should then be more similar to one another than to objects of different subgroups. This means inside the clusters we aim for homogeneity and for observations of different clusters for heterogeneity. With the clustering analysis applied to the precipitation data we want to study if there are distinct groups (regions) apparent in the CAB. So that if we later apply the regression models we predict the precipitation for each group and not for the whole region.

To explore the grouping in the data we need a measure of (dis)similarity. This measure is central and depends on subject matter considerations. We construct the dissimilarities based on the measurements taken for each month. We interpret this as a multivariate analysis where, each month is one variable. So given the area in the CAB (resolution 5°x5°), we have 612 cells and 432 months, resulting in a 612×432 data matrix. we want to cluster cells into homogen groups.

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4.2.3.1 K-medoids characteristics

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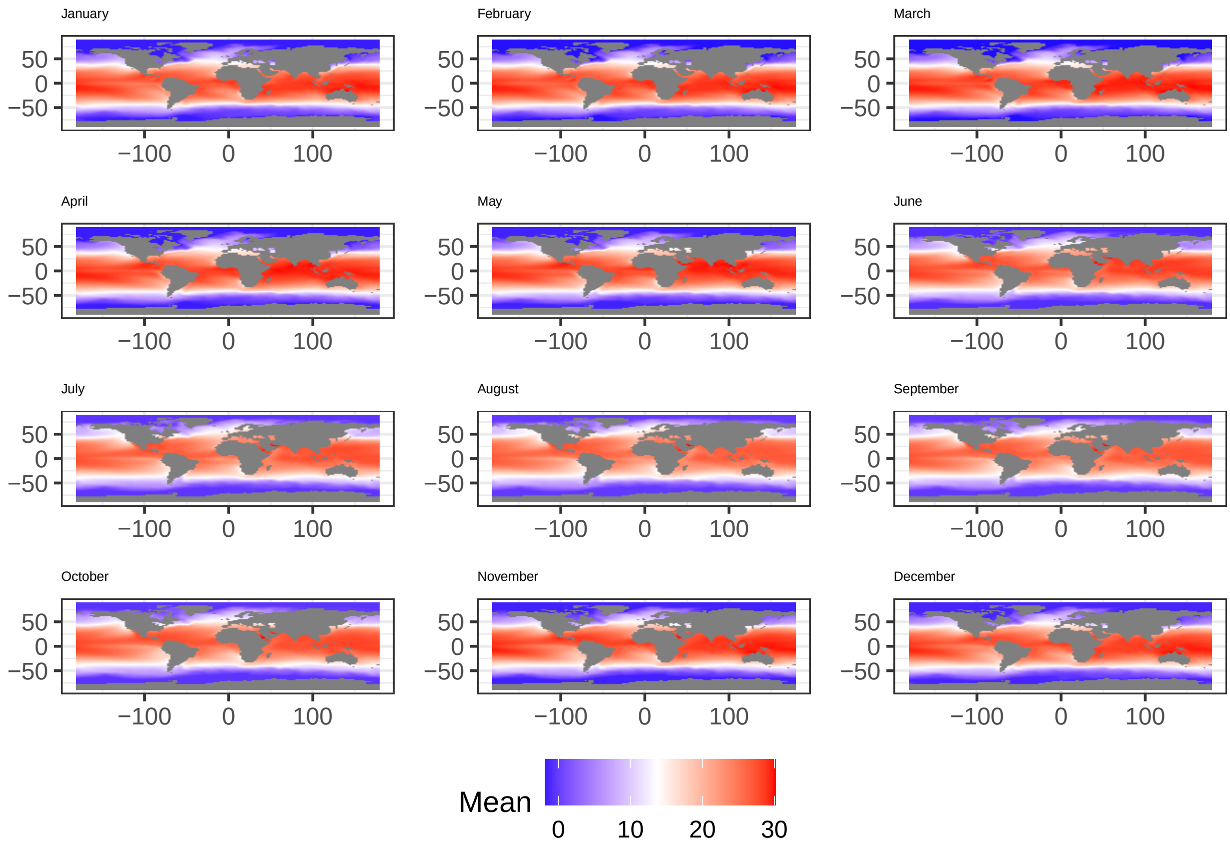
```
knitr::opts_chunk$set(warning = FALSE, message = FALSE, echo = FALSE, fig.align = 'center')
```

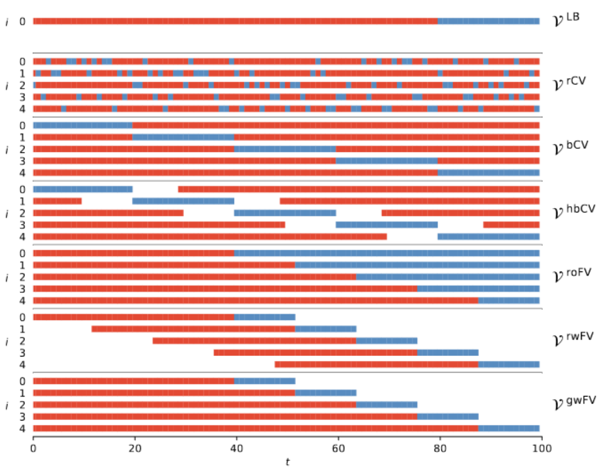
.1 EDA

.1.1 SST means



.2 Lasso

.2.1 Validation scheme



.3 Fused lasso

.3.1 Fused lasso, sub-graphs removed, no regularization

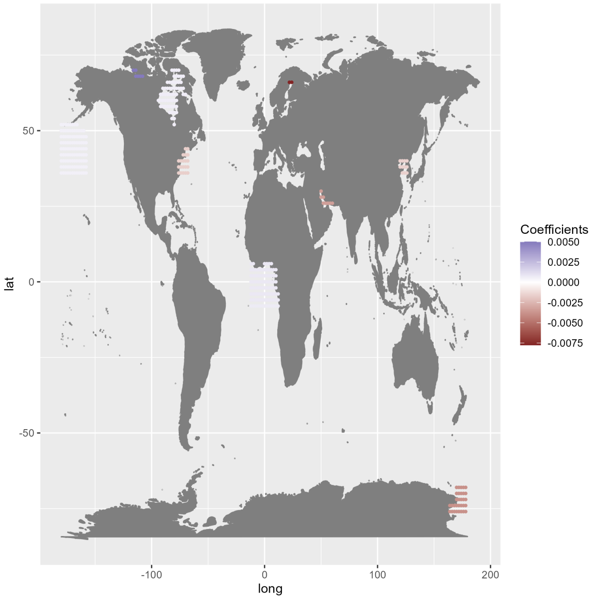


Figure 1: Coefficient plot of the full fused lasso model.Only the coefficients outside the interquantile interval are shown (quantiles of 2.5% and 97.5%).

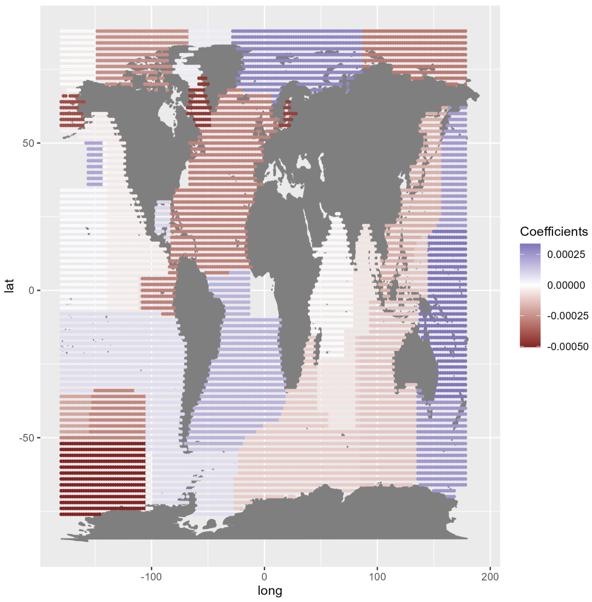
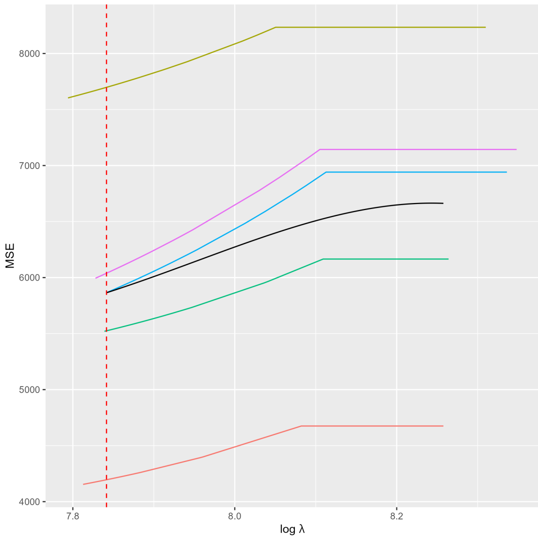


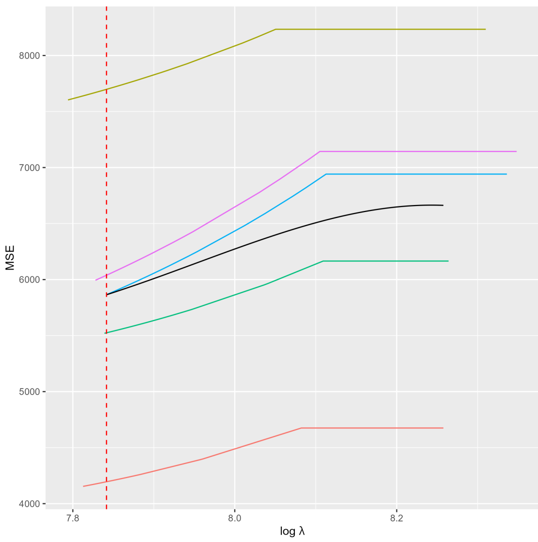
Figure 2: Coefficient plot of the full fused lasso model.Only the coefficients inside the interquantile interval are shown (quantiles of 2.5% and 97.5%).

.3.2 Fused lasso, sub-graphs removed, with regularization

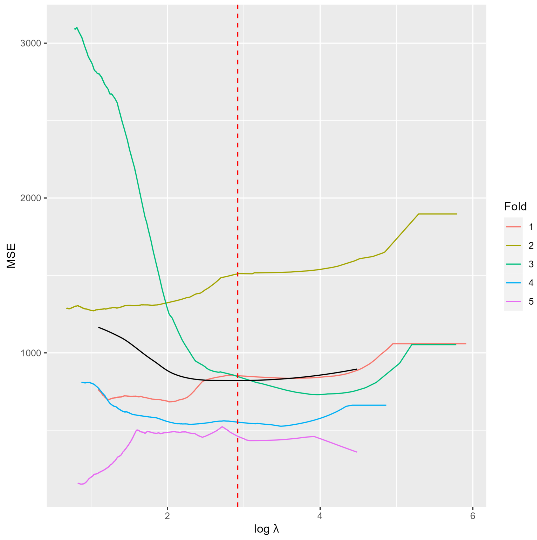
.3.2.1 gamma 0.1



.3.2.2 gamma 0.05



.3.3 Fused lasso, sub-graphs included



The error lines in the different folds differ in their trajectories as well as in their starting points (??). Note that we cut off fold 3 for better readability of the plot (the MSE reaches until 3000). The black line indicates the mean, computed for the area that is covered by all error lines (after interpolation).

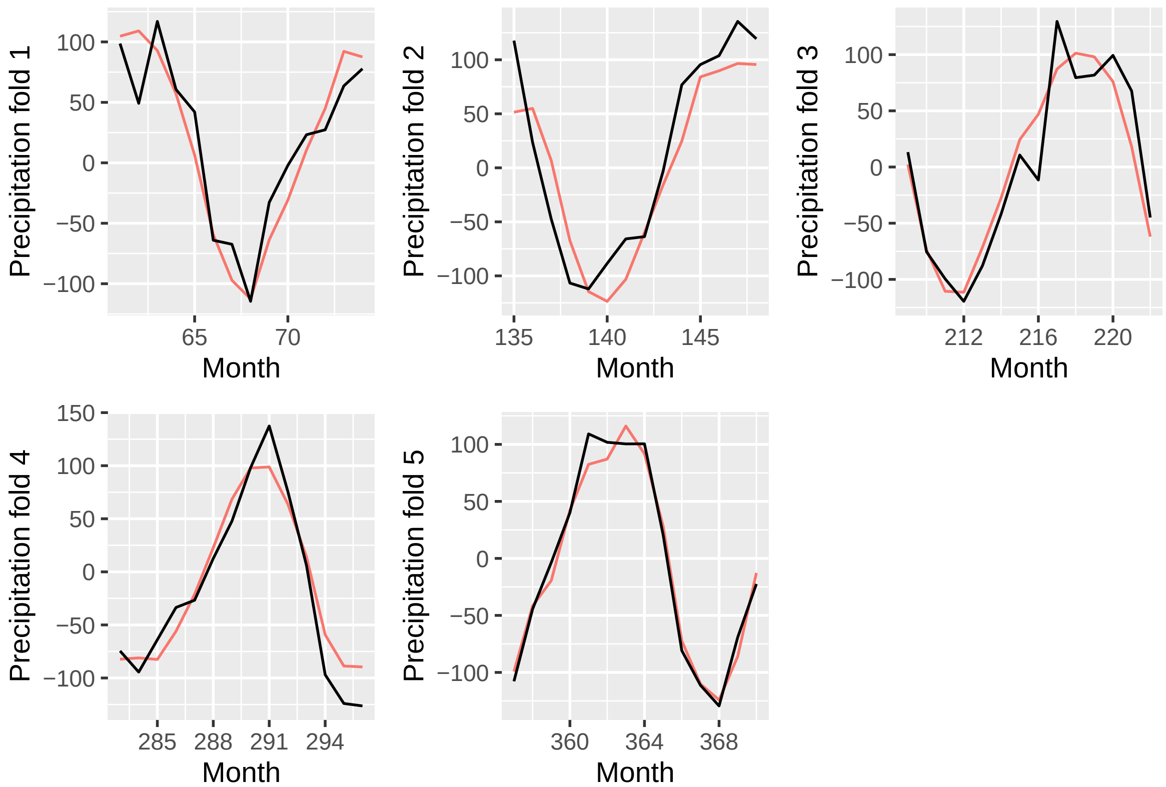


Figure 3: Precipitation prediction and target values in the test set in each fold. Predictions in red and target values in black.