Politecnico di Milano
Scuola di Ingegneria Industriale e dell'Informazione
Applied Statistics
September 6th, 2021

Problem n.4

The file `wind.txt` contains hourly measurements of wind intensity in Porto Cervo recorded for the last 30 days. Consider a functional data analysis approach where, for each day, the measurements provided are considered as discrete sampling of underlying smooth functions.

a) Perform a smoothing of each daily data through a projection over a B-spline basis with 12 basis elements of degree 2. Provide a plot of the smoothed data and report the first 3 coefficients obtained for Day 1.

b) Perform a functional principal component analysis of the smoothed data obtained at point (a). Report the variance explained along the first 3 functional principal components, the screeplot and a plot of the first 3 eigenfunctions.

c) Propose a possible dimensionality reduction for the data and justify your choice. Plot the retained principal components as perturbation of the mean. Interpret the retained principal components.

d) Provide a plot of the scores along the first two principal components, highlight in the plot the point corresponding to Day 1 and comment on the characteristics of Day 1.

Upload your results here:
`https://forms.office.com/Pages/ResponsePage.aspx?id=K3EXCvNtXUKAjjCd8ope612LHtvIHvFEsEi2L6mhPglUREJSTVI5NOxWNE5FMlRNVlhJVkVaTTIwRS4u`