

BIG DATA & DATA ANALYTICS

LAB PROJECT 3



This lab project is based on a meteorological dataset about forest fires in the northeast region of Portugal. The dataset is available from the UCI Machine Learning Repository (Lichman, 2013):

<http://archive.ics.uci.edu/ml/datasets/Forest+Fires>

EXERCISE 1 (2 MARKS)

[R-CODE]

Create a new column “quarter” in the dataframe `firedata` that describes the meteorological quarter of the observation based on the month. Distinguish between the following categories: “Q1”, “Q2”, “Q3”, “Q4”, referring to the four quarters of a calendar year. In particular, the year is divided into 4 quarters:

- Q1: January 1 to March 31
- Q2: April 1 to June 30
- Q3: July 1 to September 30
- Q4: October 1 to December 31

Use `ggplot()` to create a density plot for the relative humidity across different quarters (using the newly created quarter variable) and directly export this plot as png-file titled “rh_quarters.png” with a resolution of 900x900.



EXERCISE 2 (2 MARKS)

[R-CODE]

Use the `ddply()` function of the package “plyr” to create a data frame “summarystat” with the means of FFM, DMC, DC, ISI, temp, RH, wind, rain, and area. Also include the number of observations N for each of the four quarters. The output should look like this:

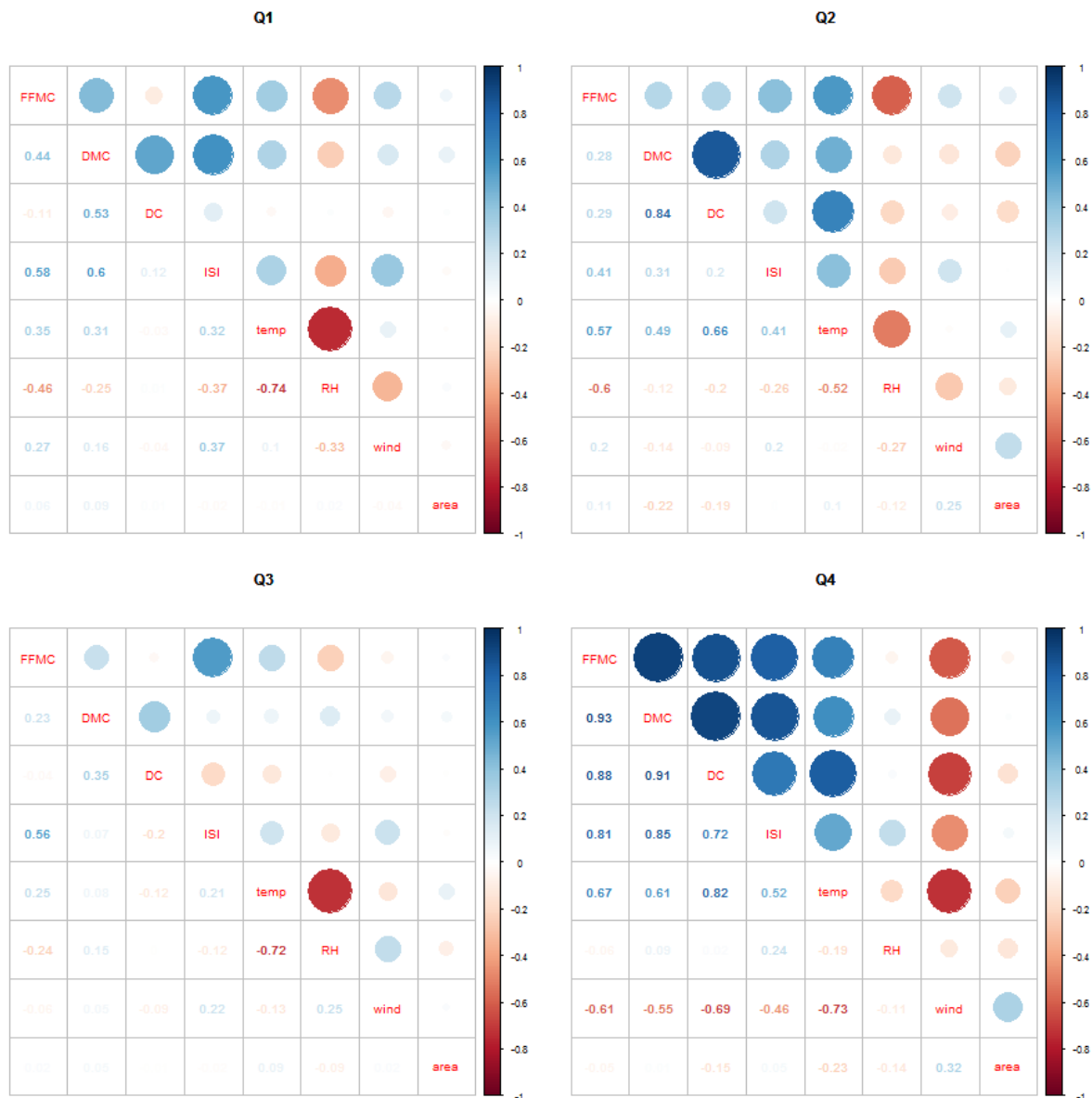
	quarter	N	ffmc_avg	dmc_avg	dc_avg	isi_avg	temp_avg	RH_avg	wind_avg	rain_avg	area_avg
1	Q1	76	86.70	27.10	70.72	5.97	11.97	45.42	4.57	0.00	4.75
2	Q2	28	88.11	63.72	203.05	9.21	17.36	47.25	4.33	0.00	7.78
3	Q3	388	91.77	135.61	666.83	9.83	20.78	44.29	3.82	0.03	15.06
4	Q4	25	88.04	34.38	539.72	5.58	12.36	37.56	5.01	0.00	8.78

Use the package “rtf” to create an rtf document called “output.rtf” and include the newly created data frame “summarystat” as a table in this document.

EXERCISE 3 (2 MARKS)

[R-CODE]

Use the functions “tapply” and “cor” to create a Pearson correlation matrix for FFMC, DMC, DC, ISI, temp, RH, wind, and area, separately for each of the four quarters (Q1-4). Use the newly created correlation matrices to create a set of mixed correlation plots with the corplot command. Save the result as a PDF file “corrplots.pdf” with a 9x9 resolution. Identify and interpret at least three differences across two or more quarters.

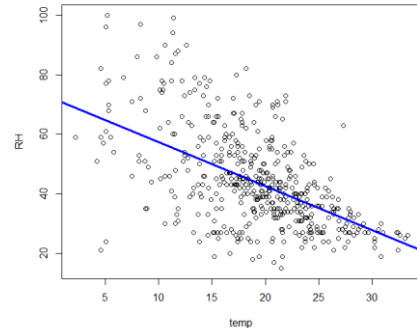


Optional: Try using “par(mfrow =c(2,2))” before creating the plots to display all four plots into one bigger plot.

EXERCISE 4 (1 MARK)

[R-CODE]

Use “plot” to draw a scatterplot showing RH and temp. Add a blue regression line to the plot.



EXERCISE 5 (2 MARKS)

[R-CODE]

Use R to create a simple linear regression that regresses RH on temp. Interpret the coefficients. Retrieve and interpret the R^2 .

EXERCISE 6 (1 MARK)

[R-CODE]

Use the function “skewness” of the package “moments” to investigate the distribution of the variable area. Interpret the result.

REFERENCES

Lichman, M. (2013). UCI Machine Learning Repository [<http://archive.ics.uci.edu/ml>]. Irvine, CA: University of California, School of Information and Computer Science.

DATASET

Forestfires

Forest Fires Dataset

Description

A meteorological dataset about forest fires in the northeast region of Portugal. Some of the data includes measures from the Fire Weather Index (FWI).

Usage

Forestfires

Format

A data frame with 517 observations on the following 13 variables.

X	x-axis spatial coordinate within the Montesinho park map: 1 to 9
Y	y-axis spatial coordinate within the Montesinho park map: 2 to 9
month	month of the year: 'jan' to 'dec'
day	day of the week: 'mon' to 'sun'
FFMC	FFMC (Fine Fuel Moisture Code) index from the FWI system: 18.7 to 96.20. This is a numerical rating of the moisture content of surface litter and other cured fine fuels. It shows the relative ease of ignition and flammability of the fine fuels.
DMC	DMC (Duff Moisture Code) index from the FWI system: 1.1 to 291.3. The DMC is a numerical rating of the average moisture content of loosely compacted organic layers of moderate depth.
DC	DC (Drought Code) index from the FWI system: 7.9 to 860.6. is a numerical rating of the moisture content of deep, compact, organic layers. It is a useful indicator of seasonal drought and shows the likelihood of fire involving the deep duff layers and large logs.
ISI	ISI (Initial Spread Index) index from the FWI system: 0.0 to 56.10. This indicates the rate fire will spread in its early stages.
temp	temperature in Celsius degrees: 2.2 to 33.30
RH	relative humidity in %: 15.0 to 100
wind	wind speed in km/h: 0.40 to 9.40
rain	outside rain in mm/m2 : 0.0 to 6.4
area	the burned area of the forest (in ha): 0.00 to 1090.84

Source

Lichman, M. (2013). UCI Machine Learning Repository [<http://archive.ics.uci.edu/ml>]. Irvine, CA: University of California, School of Information and Computer Science.

Cortez, P. & Morais, A. (2007). A Data Mining Approach to Predict Forest Fires using Meteorological Data. In J. Neves, M. F. Santos and J. Machado Eds., *New Trends in Artificial Intelligence*, Proceedings of the 13th EPIA 2007 - Portuguese Conference on Artificial Intelligence, December, Guimaraes, Portugal, pp. 512-523, 2007. APPIA, ISBN-13 978-989-95618-0-9.

FWI (Fire Weather Index) descriptions are taken from: <http://www.malagaweather.com/fwi-txt.htm>