

Social Robotics

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Exercise Sheet 9

Due: July 15, 2019

Exercise 9.1

The mayor of a city wants to see if pollution levels are reduced by using autonomous cars instead of traditional ones. The rate of pollution gets measured every 60 minutes (8am to 22pm: total of 15 measurements) in a day when traffic is open to everybody, and in a day with allowance only for autonomous cars. The scores of air pollution measured are:

Open for everybody (T1): 214, 159, 169, 202, 103, 119, 200, 109, 132, 142, 194, 104, 219, 119, 234

Open for Autonomous Cars (T2): 159, 135, 141, 101, 102, 168, 62, 167, 174, 159, 66, 118, 181, 171, 112

- (a) Test whether the median pollution before the closure for traditional cars is higher than the median pollution during the allowance for only autonomous cars. Which test do you use and why?
- (b) Report your results and give a brief interpretation (discussion).

Exercise 9.2

You want to see if the mean number of goals suffered by two robot soccer teams over the years is the same. Below the number of goals suffered by each team in 9 games for each year.

Team A: 6, 8, 2, 4, 4, 5, 7, 3, 6

Team B: 7, 10, 4, 3, 5, 6, 8, 5, 6

- (a) First, create the data for each group as a numeric vector.
- (b) Now, build a dataframe including those vectors.
- (c) Create a boxplot for your data.
- (d) There are two possible ways to use `wilcox.test` with your data: You can either use vectors as arguments, or the columns in a dataframe. Try both ways in order to find out whether the soccer teams suffer a significantly different mean number of goals. Which Wilcoxon test do you use and why?
- (e) Give a brief interpretation of the results.

Exercise 9.3

In the built-in data set named `airquality`, the daily air quality measurements of a city from May to September, are recorded. The ozone density are presented in the data frame column `Ozone`.

- (a) Find out whether the ozone density differs over the months. Which test do you use and why?

- (b) Give a brief, but clear interpretation of the results.

Exercise 9.4

A company has invented a new home learning tutor robot and promises that it helps children with their grammar skills. A scientist becomes very curious and buys one of those robots. She recruits 13 families with children to let them take the robot home for one week. During this week the robot measures the time it interacts with the child. When the families bring back the robot, the scientist conducts a grammar test with the child. The interaction times and points scored in the grammar test are as follows:

Time in minutes: 123, 95, 130, 83, 148, 157, 125, 164, 104, 147, 155, 131, 144

Points: 70, 53, 87, 42, 73, 66, 64, 82, 49, 78, 87, 81, 98

- (a) Create a scatterplot for the data.
- (b) Conduct a parametric and a non-parametric test for correlation.
- (c) Which test is more appropriate for the given data?