Statistics and Numerics

Lecture Prof. Dr. Jens Timmer

Exercises Helge Hass, Mirjam Fehling-Kaschek

Exercise Sheet Nr. 3

Exercise 1: Power of the t-test

- Generate sets of 1000 data points from the normal, exponential, and Cauchy distribution, and plot them. What differences do you see?
- Now, simulate M times two different data sets x_i and y_i, each with N data points from the following distributions:

  a) $x_i \sim N(0,1)$, $y_i \sim N(v,1)$

  b) $x_i \sim \text{Exponential}(1)$, $y_i \sim \text{Exponential}(1+v)$

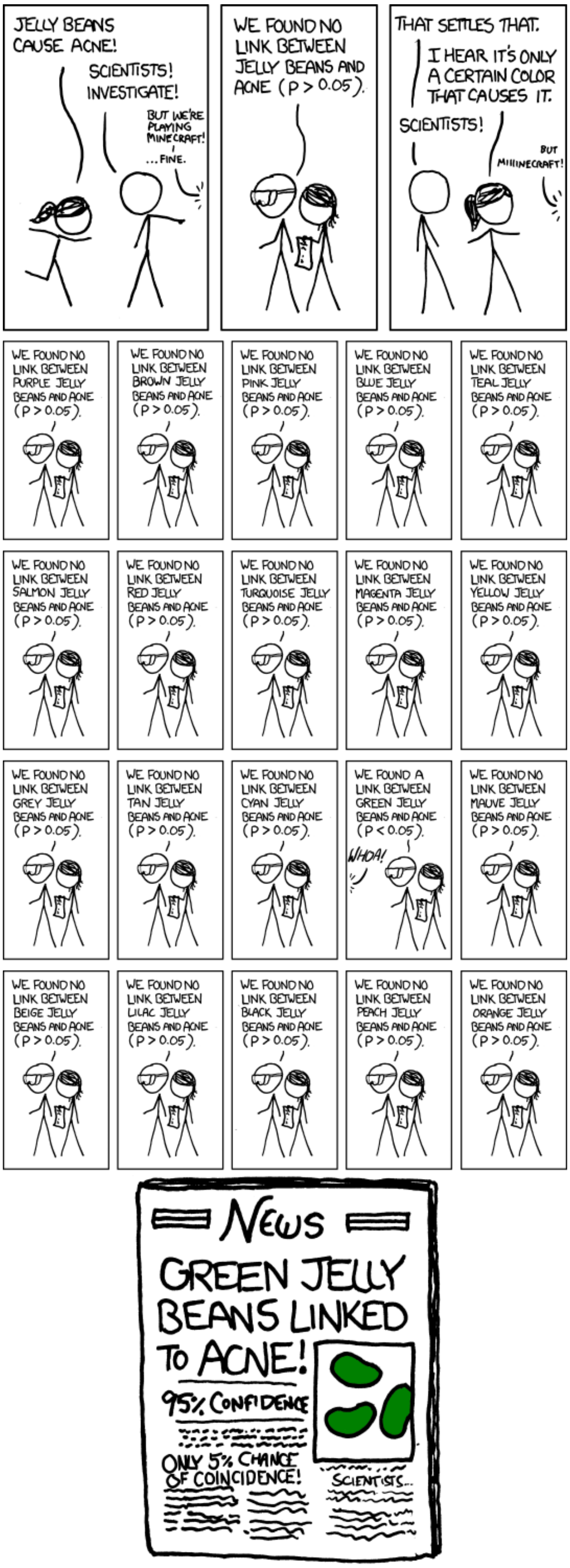
  c) $x_i \sim \text{Cauchy}(0,1)$, $y_i \sim \text{Cauchy}(v,1)$

  use $M = 1000$, $N = 100$, 1000, $v = 0$, 0.1, 0.2, $\ldots$, 2.

  Thereof, compute the power of t-tests for $\alpha = 0.05$ for the x_i-y_i dataset tuples for each class of distributions a)-c). Plot the power for different values of v, which denotes the deviation from the null hypothesis.
- Interpret the results, especially for the differences of exponential and Cauchy distribution.
- What do you learn regarding the assumptions for the t-test that have to be fulfilled?

Exercise 2: Power of the Wilcoxon test

- Repeat the previous exercise for the Wilcoxon test.
- What are the differences compared to the t-test?
- How would you judge, in this particular case, the *Dilemma V: efficiency vs. power*?
- Describe the advantages of the Wilcoxon test given data realizations from a Cauchy distribution.



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