

# Intelligent Data Mining - Exercise 2

Michael Debono Mrđen

1 November 2017

## 1 Assignment 1: Bonferroni's Principle

a. The number of days of observation was raised to 2000.

- number of pairs of days

$$\binom{2000}{2} \approx 2 \times 10^6$$

- number of suspected pairs

$$5 \times 10^{17} \times 2 \times 10^6 \times 10^{-18} = 1,000,000$$

b. The number of people observed was raised to 2 billion (and there were therefore 200,000 hotels).

- number of pairs of people

$$\binom{2 \times 10^9}{2} \approx 2 \times 10^{18}$$

- chance that they will visit the same hotel

$$\frac{0.0001}{2 \times 10^5} = 5 \times 10^{-10}$$

- chance that they will visit the same hotel on two different given days

$$(5 \times 10^{-10})^2 = 2.5 \times 10^{-19}$$

- number of suspected pairs

$$2 \times 10^{18} \times 5 \times 10^5 \times 2.5 \times 10^{-19} = 250,000$$

c. We only reported a pair as suspect if they were at the same hotel at the same time on three different days.

- chance that they will visit the same hotel on three different given days

$$(10^{-9})^3 = 10^{-27}$$

- number of "triples" of days

$$\binom{1000}{3} \approx 1.7 \times 10^8$$

- number of suspected pairs

$$5 \times 10^{17} \times 1.7 \times 10^8 \times 10^{-27} = 0.085$$

## 2 Assignment 2: Base of the natural logarithm

- a. In terms of  $e$ , give approximations to

$$\begin{aligned} \text{(a)} \quad (1.01)^{500} &= (1 + 0.01)^{500} = e^{0.01 \times 500} = e^5 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad (1.05)^{1000} &= (1 + 0.05)^{1000} = e^{0.05 \times 1000} = e^{50} \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad (0.9)^{40} &= (1 - 0.1)^{40} = e^{-0.1 \times 40} = e^{-4} \end{aligned}$$

- b. Use the Taylor expansion of  $e^x$  to compute, to three decimal places:

$$\begin{aligned} \text{(a)} \quad e^{1/10} &\approx 1 + \frac{1}{10} + \frac{1}{200} + \frac{1}{6000} + \frac{1}{240000} \approx 1.105 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad e^{-1/10} &\approx 1 - \frac{1}{10} + \frac{1}{200} - \frac{1}{6000} + \frac{1}{240000} \approx 0.904 \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad e^2 &\approx 1 + 2 + \frac{4}{2} + \frac{8}{6} + \frac{16}{24} \approx 7.000 \end{aligned}$$

## 3 Assignment 3: TF.IDF with Mahout

This assignment is done separately.