Social Robotics

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Summer Semester 2019

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Classwork Sheet 2

Exercise 2.1 (Basics of Inference Statistics)

(a) Describe the difference between a sample and a population in your own words.

(b) What does a confidence interval of $p\%$ mean?

(c) Explain the difference between One-Tailed and Two-Tailed tests.

Exercise 2.2 (Type I and II errors)
While testing hypotheses Type-I and Type-II errors can occur.

(a) What is a Type-I error?

(b) What is a Type-II error?

(c) Give one example for each error.

Exercise 2.3 (Drawing samples)

- Imagine you want to evaluate ...
  - ... the educational value of a childcare-robot.
  - ... the effectiveness of an assistance robot for car building.

  Specify where/how you would draw a sample that represents the whole relevant population for each case.
- In the last classwork you've designed a research process for your groups' robo including a first hypothesis. What kind of sample would you use in order to represent the population?

Exercise 2.4 (Samples and Populations)

(a) Two samples are drawn from a population. One sample has $N = 5$ values, the other $N = 30$. For which of the two samples does the sample mean ($\overline{X}$) most probably lie closer to the population mean (μ)? Explain your answer.

(b) The following parameter is known for a population: $\sigma = 10$. Calculate the standard error of the mean ($\sigma_{\overline{x}} = \frac{\sigma_x}{\sqrt{n}}$) for the following sample sizes:

   (a) For a sample with $N = 4$
   (b) For a sample with $N = 25$
   (c) For a sample with $N = 100$

   What can you see in the results?

(c) A population with $\mu = 100$ and $\sigma = 20$ is given.

   (a) Consider a sample of size $N = 25$. Calculate the value limit of the confidence interval which seperates the middle 95% of the sample means from the extreme 5% at the edges. Use the following formula: $\Delta_{crit} = \mu \pm z_{2.5\%} * \sigma_{\overline{x}}$

(b) A sample mean of $\overline{X} = 106$ is calculated. Is this value part of the middle 95% of the sample means of the population?

Exercise 2.5

A robot was deployed at a bus stop to inform people about an important topic and afterwards ask them for a donation. After some weeks of work the population mean of donation amounts can be calculated ($\mu_0 = 6, \sigma_0 = 3$). Afterwards the robot is taken to the waiting area of an airport to compare which place is raising higher donations on average. After 200 interactions the robot has gained $\overline{X} = 7$.

- Formulate a H_1 hypothesis and its corresponding H_0 hypothesis.
- Use the z-Score to test the H_1 hypothesis at significance level $\alpha = 0.05$.