Experiment Design for Computer Sciences

Week 04 – Inferential Statistics – Course Notes

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Course Notes/Warnings

Team Project – Don't procastinate on your team project!

- I have so far only received 1 team e-mail;
- We are almost at the halfway point of the course!

Send me an e-mail (caranha@cs.tsukuba.ac.jp) with the names, student IDs, and mail addresses of your team members.

If you send me the topic of your project, I would be very happy too.

Review of Last Class

- Concepts of Statistics
  - Goats, and why the world sometimes does not follow our intuition
  - Difference between sample and population
  - The Central Limit Theorem
- DAE Chapter 03 – Point Estimators
  - Estimating values for the population parameters from the sample parameters;
  - Bias and variance of estimators;
- DAE Chapter 04 – Interval Estimators
  - Confidence Interval for a parameter
  - How to interpret the Confidence Interval;

Review of Last Class – Examples

In Manaba, there was a “Chapter04.R” file with example code to calculate Confidence Intervals in R (and plot them).

Please take a look at the code and apply the calculations to your own data. (If we have time, we will review the code later today).

This week, on EDCS

- DAE Chapter 05 – Inferential Statistics:
  Where we take our concepts of statistical intervals, and use them to extrapolate information about the population;

Notes on the Lecture Notes 1

- Amos Nathan Tversky: Active Cognitive Psychologist on the field of human cognitive bias and handling of Risk. Humas are more irrational than we would feel comfortable with.
- Descriptive Statistics vs inference statistics;
  - Descriptive: Lets us characterize a population;
  - Inference: Lets us make decisions about a population; Requires a degree of certainty about characteristics of a population;
  - When you are making a claim about research, in many cases you are not making a *description*, you are making a decision to claim something about the data. The decision is:
    Is your claim *safe*?
    Is your claim *supported by the data*?
    How likely is your claim to verify/refute the data?

Notes on the Lecture Notes 1

- Hypothesis definition – Examples
- Karl Popper – Philosopher on the nature of truth. According to him, truth can only be obtained from observations. BUT the way that we obtain truth from observations must be well regulated. (Falsification, Black Swan Fallacy)
- Discussion of how to formulate scientific hypothesis;
- Peas Example – page 9: If mean of the sample is “much bigger” or “much smaller” than 500, then we refute the Null Hypothesis. But How Much is much bigger or much smaller? This is the key question – anyone has a good answer?
- Anyway, the idea is that once we calculate this “delta”, or this critical region, we can answer the question: Is the estimate value calculated from the sample inside this critical value? If it is, even if the value is the not the same as the hypothesis value, it is close enough that we say we can’t reject the null hypothesis.

Suggested Reading

- The Elements of Style(Willian Strunk Jr) – Recommended by Marco Antonio
  `http://www.amazon.com/Elements-Style-William-Strunk-Jr/dp/1557427283`
- How to do Good Research and get it Published (Eamonn Keogh) – Recommended by Mateus Cruz
  `http://www.cs.ucr.edu/~eamonn/Keogh_SIGKDD09_tutorial.pdf`