



CMPE 594 Statistics in Mobile Computing

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CMPE 594 introduces basic concepts of statistical data analysis and their practical application in mobile computing. The course covers the entire range of statistical data analysis. Topics include how to design an empirical data collection in a statistically valid way, how to collect data from daily life with the help of mobile computing, and how to achieve statistical test results. Lessons learned will be applied in practice by conducting empirical experiments with mobile phones. There are no special requirements to attend this lecture since all needed background knowledge is provided within the course. Course material is available from

http://www.barnrich.ch/wiki/doku.php?id=pub:lectures:2016_statistics_in_mobile_computing:start

Lecture Program

(1) Introduction

- Course Objectives
- Course organization and examination procedure
- Intro general approach of statistical data analysis
- Intro Mobile Computing
- Examples of Mobile Computing Research

(2) Tools

- Mobile Sensor Data Logging
- The R Project for Statistical Computing

(3) Feasibility Study

- Design and conduct a feasibility study
- Collect experimental data with Sensor Log
- Data export
- Import collected data into R
- Data preprocessing
- Data frame indexing and filtering
- Add and transform features



- Scatter plots
- Compute data characteristics
- Define research hypotheses
- From the feasibility study to the real experiment

(4) Distribution Graphics

- Correct coding of categorical data
- Subsets of data
- Graphical display of distributions
- Histogram
- Empirical cumulative distribution
- Q-Q plots
- Boxplots

(5) Grouped Data

- Graphics for grouped data
- Figure array
- Comparison between histograms, ECDFs and Q-Q plots
- Boxplots for grouped data
- Stripcharts
- Summary statistics by groups

(6) Student's t-test

- Intro Student's t-test
- Student's t distribution
- Example: mean acceleration during walking and running
- Student's t-test in R
- One-sample t-test
- Two-sample t-test

(7) Two-Sample Tests

- Recap Midterm
- Two-sample Student's t-test



- t-test for paired samples
- t-test for independent samples
- Distribution-free Methods
- Wilcoxon tests

(8) Variance Tests and Power Calculations

- F-test
- Levene's test
- Fligner-Killeen test
- Power of a statistical test
- Computation of sample size
- Principles of power calculations
- Approximate Power Calculations
- Two-sample power calculation
- One-sample and paired tests power calculation

(9) Tabular Data

- Discrete Distributions
- Point probabilities
- Single Proportions Approximate Test
- Exact Binomial Test
- Binomial Test for Walking and Running
- Two or more proportions
- 2-sample test for equality of proportions
- Fisher's test
- Chi-Square Test
- Test for Trend
- Contingency Tables

(10) Comparisons among more than two groups

- One-way analysis of variance
- F-Test
- Pairwise comparisons
- Multiple testing



- Bonferroni correction
- Holm correction
- Non-parametric approaches
- Welch test
- Pairwise t-test
- Repetition and mixed design