Course: Statistics — credits: 4

Course code	ELVH17ASTA
Name	Statistics
Study year	2022-2023
ECTS credits	4
Language	English
Coordinator	T.W. Scholten

Modes of delivery	Assignment Individual supervision Lecture Practical / Training
Assessments	Statistics - Written, organised by STAD examinations

Learning outcomes

- In response to an engineering problem, the student calculates the probabilities of events to be used as input for risk assessment
- Based on experimental data, the student selects the appropriate distribution fit of the response variable by conducting goodness of fit tests
- In response to an engineering problem, the student will be able to compose baseline data by using experiments and using descriptives/confidence interval calculations
- Based on selected distribution and experimental data the student is able to predict a hypothetical sensor system outcome by using regression and hypothesis testing techniques
- Based on a given research question, the student justifies the to be used sample size by applying sample size and power calculations
- Based on experimental data, the student is able to analyse the statistical and practical factor and noise effect on the response variable of a sensor system by selecting the correct statistical test and by conducting the statistical analysis
- Based on experimental data, the student is able to assess the validity of a sensor system in relation to acceptance criteria by using the appropriate statistical hypothesis test and statistical analysis
- The student conducts design iterations and uses DOE (Design Of Experiment) considerations in order to evaluate the product capabilities and performance in an engineering setting

Content

In this study unit you will be introduced to a number of concepts and techniques from the closely-related fields of probability and statistics. These fields have numerous applications in engineering and many other areas, such as economics and medicine. The topics covered form a foundation for more advanced statistics, data mining, visualisation, reliability engineering, quality control and sensing under uncertainty. Probability also arises in certain algorithms for robot navigation and when modelling noise in signals, for instance.

In this study unit the following subjects will be addressed:

Probabilities
- Introduction to probability: trials, events, sample space, compound events, tree diagrams, mutually exclusive events, complementary events, conditional probability, and independent events
- Permutations, combinations and the binomial distribution; the Poisson, uniform and exponential distributions

Normal distribution
- Standard and non-standard normal distributions; Central Limit Theorem.
- Gaussian noise, being a special case of the normal distribution, and its relation to signals.
- Statistics in Research

Descriptives
- Plots and Graphs
- Confidence Interval

Sampling
- Sample size calculation
- Choice of samples

Hypotheses testing
- Product characterization and validation applications of z-test, (paired) t-test, f-test, proportion test chi-square testing and ANOV

Regression analysis: Modelling
- Linear regression (univariate, multivariate)
- Non-linear regression (univariate, multivariate)
- Model selection
- Test method against golden standard

Design of experiments

The lectures will be provided by tutorials and practicals. The statistical program R and Excel will be used to solve problems. Lecture notes and learning material are provided on black board. There will be an assignment and a written exam at the end of the study unit.

Included in programme(s)

Electrical Engineering Major Sensor Technology

School(s)

Institute of Engineering

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