Ad hoc course announcement

Title: **Statistical data analysis
for science and engineering research**

Lecturer: **Prof. Roberto Pietrantuono**

Roberto Pietrantuono is researcher at Dipartimento di Ingegneria Elettrica e Tecnologie dell'Informazione (DIETI) of University of Naples Federico II. He carries out teaching and research activities since 2007 in the Dependable Systems and Software Engineering Research Team (DESSERT) of DIETI.
His research interests focus on experimental/empirical software engineering, software testing and software reliability engineering. Recently, he is working on machine learning applied to software testing and on testing of machine learning systems.
His publications are listed at: http://wpage.unina.it/roberto.pietrantuono.
Email: roberto.pietrantuono@unina.it

Credits: 4

Lectures are *online* on the University platform Microsoft Teams.
Team Code: sljq8n4

Overview

The course provides an overview of the experimental design and data analysis and is intended for PhD students in science and engineering disciplines who need to use statistical methods and data analysis as part of their research.

More specifically, the course introduces the main elements required to plan robust experiments according to the Design of Experiment (DoE) methodology and the basic statistics required to properly analyse the resulting data depending on the experimental settings. The course will also treat data analysis under unplanned experiments with observational data. Common errors in experimental planning and misuse of statistics will be highlighted throughout the course.

The course will show the application of what explained on exemplifying science and engineering research problems, possibly depending on the need of the participants.

There will be a final assessment.

The course foresees six two-hours lectures split in three weeks, two days per week.

Schedule

Lecture	Date	Time	Topics
1	February 17, 2021	10:00 12:00	**Why to experiment, how to experiment, how to NOT experiment: Introduction to Experimental Design.** Content: Design of Experiment (DoE) concepts, terminology, motivating examples for experimental planning.
2	February 19, 2021	10:00 12:00	**Designing the experiment (part I): response variables, factors and units sampling. Simple comparative experiments.** Content: Selection of dependent and independent variables. Sampling of experimental units. The case of one-factor two-levels experiments: pairwise comparison.
3	February 24, 2021	10:00 12:00	**Analysing the experimental data (part I): Who is the best between 2? Hypothesis testing, pairwise comparison and more.** Content: Sampling distributions. Hypothesis testing. Difference in means, randomized and paired comparison designs. Non-parametric tests for comparison.
4	February 25, 2021	10:00 12:00	**Designing the experiment (part II): Factorial and blocking designs** Content: The core concepts of controlled experiments: randomization, blocking, replication. Full factorial and fractional two-levels one-factor designs. Blocking factors and blocking designs. Quasi-experiments.
5	March 3, 2021	10:00 12:00	**Analysing the experimental data (part II): Who is the best between k? The Analysis of Variance (ANOVA).** Content: One-way ANOVA, n-way ANOVA. Non-parametric ANOVA. ANOVA for unbalanced data and for blocking designs. Analysis for quasi-experiments.
6	March 4, 2021	10:00 12:00	**Analysing data from unplanned experiments. Models for prediction and the Machine Learning jungle.** Content: Regression models, time-series analysis. Classification models. [Topics in this lecture may vary depending on the need of participants.]
	TBD	TBD	**Assessment test**

For information: Prof. Roberto Pietrantuono (DIETI, UniNA) – roberto.pietrantuono@unina.it