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 and Secure Software Engineering and Real-Time systems (DESSERT) research team.
His research interests focus on 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 will be delivered in blended mode: (possibly) in-class and on 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	March 22, 2022	10:30 12:30	**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	March 24, 2022	10:30 12:30	**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	March 29, 2022	10:30 12:30	**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. Linear regression.
4	March 31, 2022	10:30 12:30	**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.
5	April 5, 2022	10:30 12:30	**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. Post hoc ANOVA. Response surface methodology.
6	April 7, 2022	10:30 12:30	**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**

Time can be subject to change

Participants have to request registration to the Team providing: student given and last name, name of the PhD course, PhD cycle.

Microsoft Teams (Team Code: sljq8n4)

https://teams.microsoft.com/l/team/19%3a4a832f315e80454ebd40a7184ddae672%40thread.tacv2/conversations?groupId=08d19bc7-f719-473b-ba3e-ff645ea01079&tenantId=2fcfe26a-bb62-46b0-b1e3-28f9da0c45fd

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