SORBONNE UNIVERSITÉ

Département des Masters de Sciences de l'Ingénieur
Mention Automatique, Robotique

MASTERS Sdi Sciences de l'ingénieur

Intitulé de l'Unité d'Enseignement (UE) : Statistiques pour l'ingénierie fondée sur les preuves

Responsable de l'UE : Stéphane Genet (stephane.genet@upmc.fr)
Code UE :
Volumes horaires / étu : 12 h Cours, 9 h TD, 7 h TP
Nombre de crédits de l'UE/EC : 3 ECTS
Parcours-type : ☒ ROBOT (option) ☒ SI (option) ☒ MeDH
Semestre où l'enseignement est proposé : ☐ S1 ☐ S2 ☒ S3 ☐ S4
Langue d'enseignement : ☐ Français ☒ Anglais
Public concerné : ☒ Département SDI ☐ Autre (préciser) :
Localisation : ☒ Campus PMC ☐ Autre (préciser) :

Thématique

In a world full of noise, statistical methods are indispensable, and drawing reliable conclusions without them is impossible. This course focuses on the creation of protocols and statistical analysis of results for small sample sizes in human-interactive systems. Students will learn to understand and manage variability, enabling them to evaluate intelligent systems effectively. Emphasis will be placed on designing robust experiments and applying appropriate statistical methods to analyze and interpret data. The course will also introduce Bayesian statistics, providing a comprehensive foundation for advanced statistical approaches in evidence-based human-interactive systems.
Mots-clés : Protocol Design, Statistical Analysis, Small Sample Sizes, Variability Management, Intelligent Systems Evaluation, Bayesian Statistics

Prérequis

Afin de suivre cette UE, doivent être acquis précédemment :

- Analysis of a function of R in R, integration
- Basics of linear algebra (vector, matrix)
- Fundamentals of probability theory : - The two Bayes' formulas - Law of large numbers - Combinatorial analysis - Central limit theorem
- Discrete and continuous random variables
- Familiarity with the Laplace-Gauss law, Bernoulli law, binomial law, Poisson law
- Programming

Acquis d'apprentissage visés (AAV)

À l'issue de cette UE, les étudiantes ou étudiants seront capables de :

1. 1. Understand and Manage Variability : • Take into account variability in result analysis. • Recognize that biological measurements often have a standard deviation of the same order as their mean. • Infer the effect size to select an appropriate sample size.
2. Apply Statistical Testing : • Identify the relevant statistical test based on the research question (number of random variables and factors). • Know and apply classical tests (Student's t-test, ANOVA, MANOVA, Chi-square, regressions). • Use generalized linear models to study repeated measures.
3. Formulate and Analyze Hypotheses : • Propose a protocol and corresponding analysis based on a hypothesis (experimental design, statistical methods). • Reason probabilistically about events. • Understand that proving a hypothesis as true is impossible due to the infinite population size ; focus on proving a probability.
4. Implement Bayesian Statistics : • Understand Bayesian statistical tests corresponding to classical tests and their limitations. • Conduct Bayesian analysis using JASP in the final project

Séquencement et modalités de l'enseignement (indicatif)

Semaine	C/TD/TP	Contenu	Préparation	AAV associé(s)
S1	C1-C2	Introduction to Statistics and Variability (2 hours) • Understanding variability and its implications • Basics of statistical methods 2. Probability Theory and Event Analysis (2 hours) • Fundamental probability concepts • Applications in statistical reasoning		
S2	C3-C4	Experimental Design and Hypothesis Testing (2 hours) • Creating protocols and analyzing hypotheses • Experimental design principles Classical Statistical Tests (2 hours) • Overview of classical tests (Student, ANOVA, MANOVA, Chi-square, regressions) • Selection criteria based on research questions		
S3	C4-C6	Generalized Linear Models (2 hours) • Introduction to GLMs for repeated measures • Practical applications Introduction to Bayesian Statistics (2 hours) • Basics of Bayesian methods • Comparison with classical approaches		
S4	TD			
S5	TP			
S6	Revue de projet			

Modalités d'évaluation des acquis d'apprentissage (1ère session)

Semaine	Indiv/collectif	Présentiel/distanciel	Type d'examen	AAV évalué(s)	Barème %
S15	Individuel	Distanciel	Autre	AAV1	100 %

2nde session

Session	Indiv/collectif	Présentiel/distanciel	Type d'examen	AAV évalué(s)	Barème %
2	Collectif	Présentiel	Écrit	AAV 1-10	50 %
1	Collectif	Présentiel	Quiz	AAV1-8	50 %

Date de génération de la fiche d'UE : 6 octobre 2026