MATHEMATICAL STATISTICS 2

Course title – Intitulé du cours	MATHEMATICAL STATISTICS 2
Level / Semester – Niveau /semestre	M2 / second semester
School – Composante	Ecole d'Economie de Toulouse
Teacher – Enseignant responsable	Sébastien Gadat
Other teacher(s) – Autre(s) enseignant(s)	Abdelaati Daouia
Other teacher(s) – Autre(s) enseignant(s)	
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Lecture Hours – Volume Horaire CM	30 (Part 1 15H; Part 2 15H)
TA Hours – Volume horaire TD	15 (Part 1 7,5H; Part 2 7,5H)
TP Hours – Volume horaire TP	
Course Language – Langue du cours	English / Anglais
TA and/or TP Language – Langue des TD et/ou TP	English / Anglais

Teaching staff contacts – Coordonnées de l'équipe pédagogique :

1. Abdelaati Daouia
   Office number: T216 abdelaati.daouia@tse-fr.eu
   Preferred means of interaction: at the end of class, by appointment
2. Sébastien Gadat
   Office number: T586 sebastien.gadat@tse-fr.eu
   Preferred means of interaction: at the end of class, by appointment

Course Objectives – Objectifs du cours :

The first part of the course is dedicated to the theory of point estimation of a parameter in a parametric statistical model with an introduction to the Fisher information theory. The second part of the course is about the theory of interval estimation and testing theory. The aim of the course is to give students theoretical tools to compare estimators and tests and have arguments to defend their choices. The course outline is the following:

- Elements of information theory.
- Point estimation (maximum likelihood, method of moments, asymptotic behavior, optimality, efficiency).
- Interval estimation.
- Testing theory: rejection region, first and second kind risk, level, power, empirical significance level.
- Classical tests (about means, variances, proportions, independence)
- Neyman theory: uniformly most powerful tests for a simple hypothesis.
- Likelihood ratio tests, tests of a one-sided hypothesis in a monotone likelihood ratio model, Wald test, score test.
- Introduction to statistical learning theory (binary classification, Bayes classifier, plug-in classifier: logistic regression, linear discriminant analysis, nearest neighbor)
- Empirical Risk minimization: excess risk and concentration inequalities

Prerequisites – Pré requis :

Mathematical statistics 1

Practical information about the sessions – Modalités pratiques de gestion du cours :

Personal laptops and tablets are accepted in the class

Grading system – Modalités d'évaluation:

Mid-term (Part 1) and final exam (Part 2). The final grade is the average mark of the two parts.

Bibliography/references – Bibliographie/références :

- Mathematical Statistics, Jun Shao, Springer texts in Statistics, 1999.
- Theory of Statistics, Mark Schervish, Springer series in Statistics,1995.
- A course in mathematical statistics, G. Roussas, Academic Press, second edition, 1997.
- Learning theory from first principles, F. Bach, https://www.di.ens.fr/%7Efbach/ltfp_book.pdf
- Introduction to Mathematical Statistics: Hogg, McKean, Craig, 8 edition, 2019

Session planning – Planification des séances :

January to March.

Distance learning – Enseignement à distance :

If needed, distance learning will be conducted through:

 - Interactive virtual classrooms

 - MCQ tests and other online exercises and assignments

 - Remote (online) tutorials (classes)