DOCTORAL PROGRAMME
IN
MATHEMATICS, COMPUTER SCIENCE, STATISTICS
Director prof. Matteo Focardi

XXXVII cycle – academic year 2021/2022

SCIENTIFIC AREA	
ADMINISTRATIVE OFFICE	Department of Mathematics and Computer Science "U. Dini" (DiMaI)
PARTNERS INSTITUTIONS	University of Perugia Istituto Nazionale di Alta Matematica "F.Severi" (INdAM)
CURRICULA	1. Mathematics 2. Computer Science 3. Statistics
	POSITIONS AVAILABLE: 16 Positions with Scholarship: 14 Positions without Scholarship: 2* ** standard ranking only*
RANKING LIST FOR STANDARD POSITIONS SCHOLARSHIPS AVAILABLE: 11	**6** - University of Florence **3** - University of Perugia **2** - Istituto Nazionale di Alta Matematica "F. Severi" (INdAM)
RANKING LIST FOR SPECIFIC RESEARCH TOPICS SCHOLARSHIPS POSITION AVAILABLE: 3	**2** - Department of Statistics, Computer Science, Applications "G. Parenti" – Progetto Ministeriale "Dipartimenti di Eccellenza 2018-2022" **Thematic:** "Data Science & Statistical learning". The Ph.D. student will be involved in the development of innovative statistical models and learning methods, together with computationally efficient algorithms, for the analysis of high-dimensional data and data with complex structure, to support research in substantive fields and across disciplines. **Thematic:** "Big Data & Data Science". The Ph.D. student will be required to design innovative statistical or algorithmical methods for the analysis of large complex dataset in order to answer significant research questions. This data can be often represented using graphs whose typical huge size demands for scalable methodologies, i.e. the algorithms or the statistical procedures must be computationally efficient. **1** - Department of Statistics, Computer Science, Applications "G. Parenti" Funded by project "Economic Uncertainty and Fertility in Europe: Narratives" - Ministero Dell'istruzione dell'Università e della Ricerca, FARE Ricerca in Italia: Framework per l'attrazione ed il rafforzamento delle eccellenze per la Ricerca in Italia. CUP B14I20001280001. **Thematic:** "Demographic Applications of Data Science".

	The Ph.D. project lies in the growing field of Digital and Computational Demography. The Ph.D. candidate will combine traditional (survey) and novel (internet and social media) data sources within a cutting-edge statistical framework to understand social dynamics and demographic change.
"VINCI PROGRAM" CALL 2021 – Université FRANCO ITALIENNE	In the frame of Vinci Program 2021 two projects have been submitted by the PhD course for the funding of as many scholarships. The results of the selection will be known by the end of June. For those candidates who wish to apply for these two scholarships, the knowledge of French language is required. More information on the Vinci Program Call 2021 here. **1. Thematic:** "Geometric models and computational methods for autonomous systems". University of Florence/ Inria The project will provide an innovative and versatile platform for the development of geometric models and computational methods for the guidance of autonomous systems. We will develop new approximation schemes that guarantee geometric features of key relevance for applications and continuity properties of high order. The objective is to suitably combine classes of smooth curves with innovative guidance laws and improve the performance of the vehicles even when continuous replanning of autonomous system trajectories is considered. We will design and develop a unified processing framework that promotes a seamless integration of modern spline constructions and learning technologies with flexible path planning schemes. The geometrical and numerical properties of the developed schemes will be exploited to suitably follow the input data stream (eg., positions, orientations, temporal and spatial constraints) and obtain optimal modules of autonomous guidance, also for real-time applications. **2. Thematic:** "State constrained optimal control problems. Sufficient conditions for strong local optimality". University of Florence/Université de Toulon This project is aimed at the application of Hamiltonian methods to the study of sufficient conditions for strong local optimality of Pontryagin extremals in optimal control problems. Hamiltonian methods have proved to be a powerful tool for obtaining sufficient conditions for optimality, and have been successfully applied to many interesting cases (Mayer's and minimum time problems with a control-affine dynamics). Furthermore, they are a valuable tool for proving the structural stability of optimal controls. Recently the use of such methods has been extended to problems with integral cost with a generalized L1 growth, that is, in which the cost to be minimized contains the L1 norm of the control. The project is aimed at extending these methods to the study of control problems with state constraints.
STUDY/RESEARCH PERIODS ABROAD	Not mandatory
DOCUMENTS REQUIRED FOR THE ADMISSION (under penalty of exclusion)	• Copy of the Identification Document • Self-declaration for qualifications (bachelor's/Master's/combined cycle degree) obtained in Italy with a list of all exams taken and their mark, title of the thesis and graduation mark (download the form **here** make sure you **fill in in all the fields**) • Foreign qualification required to access with a list of all exams taken and their mark, title of the thesis and graduation mark. *The same documentation except for the final mark must be submitted by those who will graduate by 31/10/2021*

DOCUMENTS REQUIRED FOR THE EVALUATION	**MANDATORY** • Curriculum vitae et studiorum • List of completed examinations with marks and with the Weighted average of the exams both for Bachelor and Master Degrees (or equivalent) • Research Project **OPTIONAL** • Publications • Any other qualification document
REFERENCE LETTERS	A section is provided in the online application to specify the e-mail addresses of two professors/researchers willing to provide information about candidates training path and activities performed within a scientific field related to the Ph.D. course.
RESEARCH PROJECT	The research project, consisting of 5,000 characters including references and notes, excluding spaces, may be discussed during the interview, possibly contributing to the evaluation of the aptness of the applicant for research.
EVALUATION PROCEDURE	• **Evaluation of the Curriculum, academic career (bachelor and master degree or equivalent), research project, possible publications and other qualification documents** • **Interview** As detailed in the section below **"Evaluation Marks"**
OTHER LANGUAGE FOR THE INTERVIEW	English
INTERVIEW MODE	**Remotely** (videocall)
FURTHER INFORMATION	The interview is aimed to evaluate the basic preparation and the research potential of the candidate and may include the discussion of the research project, Master's thesis, curriculum and other possible qualifications. For specific research topic scholarships part of the interview will be focused on the discussion of the topic; in addition, for Vinci Program 2021 scholarships, the knowledge of French language will be assessed.

EVALUATION MARKS	parameter	minimum score	maximum score
	Curriculum vitae, academic career, research project, publications and other scientific qualification documents.	40/120	60/120
	Applicants who obtain a mark of at least 40/120 in the evaluation of the above parameters will be admitted to the interview		
	Interview	40/120	60/120
	Eligibility is achieved with a minimum score of 80/120		

Further information available at the following web page:
https://www.dimai.unifi.it/vp-138-dottorato.html

EXAMINATIONS SCHEDULE		
	DATE	**TIME**
INTERVIEW	September 13th-14th-15th 2021	9:00 a.m.
The list of the candidates admitted to the interview and the final ranking will be published at the following web page: https://www.unifi.it/p12018.html		