UNIVERSITY OF TORINO

Master's Degree in

Stochastics and Data Science

Class: LM-40 (Mathematics)

Student Information Booklet

(Manifesto degli Studi)

Academic Year: 2015/2016

Index

1 Introduction

What are "Stochastics" and "Data Science"?

The Master's Degree in Stochastics and Data Science aims at preparing students with a solid and modern education in probabilistic and statistical methods. Core topics will be advanced methodologies and techniques that are nowadays required tools for performing mathematical modelling and analysis under uncertainty (Stochastics) and for analysing and being able to interpret high-dimensional and complex data structures (Data Science). The emphasis of the course topics will be both theoretical and oriented towards computation and applications, providing not a "book of recipes" but the capability of discerning, combining and applying the most useful and modern methods available in Probability and Statistics.
The Master's Degree in Stochastics and Data Science draws inspiration from the best graduate programs in Data Science recently started in the USA and Europe, and is currently the only offer of this type in Italy.

Why should I be willing to obtain a degree in Stochastics and Data Science?

We live in an era with huge availability of information. Think for example about the amount of data the social networks generate, where every click is registered and archived for future use. Being able to model and interpret this information is crucial, whatever the scope.
It then comes to no surprise, that one of the leading job figures of the 21th century is going to be that of data scientist. In the past few years, jobs analysts have been constantly ranking Mathematicians, Statisticians and Data Scientists among the best and most requested jobs, with even better future scenarios (see Forbes, JobsRated, CNN). LinkedIn ranks Statistical Analysis and Data Mining as the hottest skill in 2014 (LinkedIn). The Wall Street Journal ranks both Mathematician and Statistician among the top 3 jobs in 2014 (Wall Street Journal).

What can I do after completing this Master's Degree?

Gaining solid skills related to the above outlined topics will enable to deal with and model data collected in a variety of disciplinary fields by exploiting a deep mathematical understanding of the underneath structures. Graduates in Stochastics and Data Science will have a solid knowledge in key topics from Applied Mathematics, Probability and Statistics combined with computational skills essential for modern interdisciplinary applications. Such preparation allows to use this theoretical knowledge for concrete tasks, for example for:

- autonomously formulating complex probabilistic models for describing static and dynamic phenomena of interest;
- developing the necessary mathematical and statistical tools for their analysis;
- using these models together with sets of available data to perform estimation, forecasting and uncertainty quantification of phenomena under study;
- designing and implementing computational strategies in the form of algorithms for concretely carrying out the statistical procedures.

Such skills are nowadays highly demanded in a variety of professional environments, both in the private and in the public sector.
Alternatively, those more interested in proceeding with PhD studies, will have gained a solid background which allows to enter programs in Statistics, Mathematics, Applied Mathematics, Operations Research, Computer Science, Economics and Mathematical Finance, among other topics.

Whom is the Master's Degree aimed at?

The Master's Degree in Stochastics and Data Science is aimed at highly motivated students who have obtained or are close to obtaining a Bachelor Degree (Laurea Triennale for students in Italian Universities) or an equivalent title. A Bachelor education in Mathematics, Statistics, Physics or Computer Science is ideal, but talented and motivated students with a different degree and willing to enrol in a challenging and exciting course are also welcome to apply for admission.
Students who need to consolidate their mathematical background will be given suggestions for self-organised study at the admission and during the first semester. To the same end, these are also encouraged to choose their free credits for the Bachelor

Degree (Laurea Triennale) on courses in quantitative methods, most notably analysis, probability, operations research, statistics and econometrics.

2 Careers

Graduates can work in companies, research institutions or as self employed. Among the possible career opportunities we can find banks and insurance companies, industries (in all industry sectors), universities, public administrations and laboratories and research centers in the fields of medicine, biology, ecology, politics, social sciences. Another possibility is to continue their studies with doctoral programs in probability, statistics, applied mathematics, operations research, computer science, economics and computational neuroscience in national and international universities or research centers.

3 Admissions and Enrolment

Admission requirements

Applications are open to anyone holding or being close to obtaining a Bachelor degree or an equivalent title (*Laurea Triennale* for students in Italian universities). Applicants not yet holding the undergraduate title by the time of the application must be in a position to receive it not later than the final enrolment deadline (December).
The Selection Committee will evaluate all applications individually on the basis of the supporting documentation provided by the applicant. The evaluation outcome notified to each applicant is one of the following:

- admitted, whereby the student can enrol as soon as the undergraduate title is obtained;
- not admitted, whereby the student cannot enrol for the current academic year;
- invited for an interview.

The interview aims at assessing the compatibility of the candidate academic profile with a program of this type, mainly on the basis of the academic background and curriculum, in order to evaluate the prospective student's proficiency.
The interview is held in person at the University of Torino on pre-announced dates (see below), or, upon request by the applicant, via VOIP (e.g. Skype). The interview is generally held in English, but Italian speakers are allowed to be interviewed in Italian.The English level requested to non native English speakers is the minimum level sufficient for following the courses proficiently.

After the interview, the Selection Committee will notify the candidate if she/he is admitted, admitted conditionally on completion of some additional requirements, or not admitted.

Special cases and exemptions

Case 1
Applicants whose previous studies or studies under completion satisfy one of the following requirements are considered to satisfy the minimal prerequisites and have a guaranteed access to the interview:

- for students of universities abroad: their study plan includes more than 1/3 of ECTS in one or more of the following disciplines: Mathematics, Computer Science, Physics, Information Engineering, Statistics, Econometrics, Mathematical methods for Economics;
- for students of Italian universities: their study plan includes more than 60 CFU in one or more of the following SSD: MAT/*, INF/01, FIS/01, FIS/02, ING-INF/*, SECS-S/01, SECS-S/06, SECS-P/05.

Case 2
Applicants whose previous studies or studies under completion satisfy the requirements of Case 1 above and *both* of the following requirements A and B, are considered to satisfy the prerequisites on the personal preparation and background and are admitted to enrol without the need of an interview:

A) one of the following holds:
- for students of universities abroad: their past study plan includes at least 1/5 of ECTS in Mathematics;
- for students of Italian universities: their past study plan includes at least 36 CFU in one or more of the SSD MAT/*;

B) one of the following holds:
- the final evaluation of the Bachelor degree is at least 95% of the maximum possible evaluation;
- at the date of the application the student has sustained at least 85% of the credits in the study plan (ECTS or CFU) with an average mark of at least 95% of the highest possible average.

Please note that all applicants, including those satisfying all the above exemptions, are required to submit the online application.

Application procedure and deadlines

Early applications are welcome. These are strongly advised for students who do not meet the exemption requirements mentioned in Case 1 and 2 above, as an early application increases the chances of admission and the time before the beginning of the classes can be used to fill possible gaps in the student's background.

Applications can be submitted at any time. They will be evaluated according to the following deadlines:
- 1st deadline: June 30, 2015; interviews on July 7, 2015;

- 2nd deadline: August 31, 2015; interviews on September 8, 2015;
- 3rd deadline: September 27, 2015; interviews on October 1, 2015.
- 4th and last deadline for the current academic year: to be announced.

The evaluation of the applications will be notified individually to the email address provided during the submission process.

In order to apply for admission, please visit the website

http://www.master-sds.unito.it/do/home.pl/View?doc=admmissions.html

Enrolment

Applicants who received notification of the admission from the Selection Committee should enrol prior to the beginning of the classes (second half of September) and in any case not later than the final enrolment deadline (December). The first semester covers fundamental topics in Mathematics, Probability, Statistics and Computer Science with the aim of building up a solid background; therefore, classes attendance from the beginning of the courses is strongly advised to all admitted students, even if they can enrol only at a later stage (e.g., after the Bachelor graduation).
Students coming from other universities should first register to the University portal, then follow the online enrolment procedure. Students coming from the University of Torino should only follow the online enrolment procedure. Please note that the enrolment procedure can be completed online usually from a few days after receiving the email notification which follows the interview (allow ten to fifteen days if admitted without interview), since the names of the admitted students need to be inserted into the online system first. The registration at the University portal can instead be done at any time.
International students should gather as early as possible all information concerning visas, permits of stay, certification of previous academic qualifications, and enrolment requirements. All this information can be found at the Masters' homepage at http://www.master-sds.unito.it

4 Study plan

1st Year

1st Semester

- Analysis (9 credits)
- Probability Theory (9 credits)
- Statistical Inference (9 credits)
- Programming for Data Science (3 credits)

2nd Semester

- Stochastic Processes (6 credits)
- *One course chosen between:*
    - Statistics for Stochastic Processes (6 credits)
    - Stochastic Modelling for Statistical Applications (6 credits)
- Multivariate Statistical Analysis (6 credits)
- Databases and Algorithms (12 credits)
- *One course freely chosen (6 credits) (see note below)*

2nd Year

- Stochastic Differential Equations (6 credits)
- *One course chosen between:*
    - Bayesian Nonparametric Statistics (6 credits)
    - Statistical Machine Learning (6 credits)
- *Two courses chosen among:*
    - Complex Networks (6 credits)
    - Decision Theory (6 credits)
    - Econometrics (6 credits)
    - Game Theory (6 credits)
    - Information Theory (6 credits)
    - Introduction to Data Mining (6 credits)
    - Simulation (6 credits)
    - Simulation Models for Economics (6 credits)
- *One course freely chosen (6 credits) (see note below)*

Thesis elaboration under the supervision of a faculty member. There will also be the possibility of writing the thesis in connection with an internship.

Credits system and free credits

The above indicated credits correspond to Italian CFU and to European ECTS. The typical courses lengths for this study plan based on the credits conversion into classes hours are as follows:

- 3 credits = 24 hours
- 6 credits = 48 hours
- 9 credits = 72 hours
- 12 credits = 96 hours

The two courses freely chosen correspond to 6+6 free credits that can be used for choosing any course among all those available in that academic year at the University of Torino, excluding those whose content is already covered in other courses of the present degree. The students are encouraged to select as free credits the optional courses of this degree they choose not to include in their individual study plan (e.g., if course A is chosen from the list (A,B), then course B can also be included by using the free credits).

5 Thesis

The final exams consists on writing and discussing a Masters' Thesis in front of a Graduation Committee. The Thesis is elaborated by the student under the supervision of a faculty member. The Thesis is written in English on a topic agreed with the supervisor. The preparation of the thesis can be part of an internship (stage). The Graduation Committee is composed of at least seven faculty members, including an examiner appointed to investigate the evaluation of the Thesis. The final graduation mark (in 110) will take into account both the student's study career and the final discussion of the Thesis. The starting value of the final graduation mark is the weighted average of the exam's evaluations (in 110). The Graduation Committee can additionally assign a maximum of 8 points for the discussion. If the quality of the work is considered excellent, with a unanimous vote of the Graduation Committee, the maximum is increased to 10 points. The student who has achieved a score of 110/110, can be receive the summa cum laude.

6 Calendar

Classes

First Semester: from September 28, 2015 to January 15, 2016
Second Semester: from February 29, 2016 to June 10, 2016

Examinations

First Session: from January 18, 2016 to February 26, 2016
Second Session: from June 13, 2016 to July 29, 2016
Third Session: from September 1, 2016 to September 23, 2016

Lectures will not be delivered on the following days.

- December 7-8, 2015;
- from December 23, 2015 to January 6, 2016;
- from March 24, 2016 to March 29, 2016;
- April 24, 2016;
- June 2-3, 2016.

7 Students mobility

All the information on international student mobility can be found at

http://en.unito.it/international-relations/students-mobility

8 Job Placement

The University's Job Placement Service has been established in order to help its students and new graduated (who held their university degree within 18 months) to enter the labor market. All the updated information can be found at http://en.unito.it/services/job-placement

9 Contacts

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