UNIVERSITÀ DEGLI STUDI DI TORINO

ID
TM13_DIP_MAT

Teach Mob – Visiting Professors
Academic year 2017/2018

2nd Term
COURSE TITLE **Biomathematics**
Scientific area **Numerical Analysis**
Department of Mathematics "Giuseppe Peano"
Language used to teach: English
Teaching Commitment: 48 hours
Course summary A basic approach in recent research developments in bioinformatics and applications in biotechnologies, in particular proteomics. To this end, tools in linear and nonlinear optimization techniques need to be developed, a topic that in our course of study is at present neglected, in view of the paucity of human resources. We had indeed for the coming academic year to cancel a course in this topic at the undergraduate level (laurea triennale) as at present we do not have the manpower to cover it. The course is organized in four broad topics: A. Linear Programming (Formulating linear programs; The simplex algorithm; Certificates of optimality, infeasibility and unboundedness; Duality and sensitivity analysis). B. Unconstrained Nonlinear Programming (Optimality condition; Newton's method and other basic algorithms; Conjugate direction algorithms for convex quadratic problems; Line search algorithms on Rn). C. Constrained Nonlinear Programming (KKT Optimality conditions for nonlinear programming; Basic nonlinear programming algorithms; Optimality conditions for convex optimization; Interior point methods). D. Applications in Proteomics.
Learning objectives The course is meant in part to fill a hole that we have in the offer. The course is self-contained, in that it will develop the optimization tools needed for the applications to bioinformatics, biotechnologies and proteomics. Indeed for the coming academic year, because of the lack of enough personnel, we had to close an optimization course (at the Bachelor – laurea triennale – level), but by offering this biomathematics course, we will fill the gap. The purpose of the course is to make our students aware of the latest developments in bioinformatics and proteomics, by developing optimization tools, from a leading authority in the field. Also PhD and graduate students in other life sciences departments will benefit from it. By the end of this course, students will 1. Understand the theoretical basis for linear and nonlinear programming methods. 2. Know how to choose appropriate numerical methods to solve a particular bioinformatics problem.

3. Be able to implement, test and validate codes to solve an optimization problem numerically.
4. Have the ability to interpret and present the results of computational simulations for proteomics.

Tutorship activities

The instructor will hold office hours both on a regular basis and by appointment to help students individually. Furthermore, if the course is approved, support from PhD students and junior and senior faculties will be provided.

Lab activities

They will be considered and set up if the course is approved, organizing and providing support from PhD students and junior and senior faculties. In the lab, the various methods will be tested. Students will be guided to learn with "a hands on the computer" approach. This will help in developing their skills and make them able to implement, test and validate codes to solve an optimization problem numerically, apply it to situations that arise in the life sciences. In this process they will also be made knowledgeable with the latest developments and applications in bioinformatics, biotechnologies and proteomics and with the available relevant scientific packages in these research fields.

Other activities besides the course: i.e. seminars and conferences addressed to PhD students and research fellows, dissemination conferences

During the permanence of the guest, he/she will offer state-of-the art specific talks at the doctoral level, and joint research is foreseen on topics of mutual agreement with some interested faculties in our Department. Also, by his/her presence, some effective support at the highest scientific level for the research activities of interested PhD and Master students will be fostered.

Visiting Professor Profile

We seek a leading authority in the field of optimization techniques with applications to the life sciences, with a wide international experience. The prospective applicant must be a full professor in a high ranking institution, be at least associate editor of no less than four leading international journals in the fields of bioinformatics and/or optimization. She/he must have a substantial record of invited colloquium talks at international high level research institutions, a wide international expertise in numerical analysis, computational mathematics and its applications, bioinformatics and optimization, a large publications record in well-reputed refereed international journals, have a strong record in having earned continuous financial support for his/her research along the years. She/he must also be willing to scientifically interact with the faculty of the Department and other potentially interested researchers in our University.

Contact person at the Department

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