

DISTRIBUTED OPTIMIZATION OVER COMPLEX NETWORKS

1. DESCRITTORI

- 1.1 SSD: ING-INF/03
- 1.2 Crediti: 6
- 1.3 Docente: Sergio Barbarossa
- 1.4 Calendarizzazione: secondo semestre
- 1.5 Offerto a: MCOR2
- 1.6 Tipologia di valutazione: esame con votazione in trentesimi

2. OBJECTIVES

Many current systems of interest in engineering are networked systems, as e.g. telecommunication systems, sensor networks, electricity system and so on. The objectives of this course are to teach fundamental tools to analyze complex networked systems and optimize parameters of interest. The first basic methodology is graph theory, as a systematic tool to study the interaction among the components of a complex system. The second basic tool is distributed optimization. Finally, the course introduces some basic principles of game theory. These tools are then applied to wireless sensor networks and to wireless communication systems. The course is self-contained. No prior knowledge of graph theory, game theory and distributed optimization is required. The students will be encouraged to develop Matlab programs implementing the algorithms developed during the classes, under the teacher supervision.

3. PREREQUISITES

Basic knowledge of optimization theory and algebra is welcome, but the fundamental mathematical tools will be recalled during the course.

4. PROGRAM

Basic elements of graph theory, main parameters of a graph, algebraic graph theory, random graphs, random geometric graphs, small world and scale-free graphs, fundamental properties of graphs (16); basic elements of convex optimization; distributed algorithms, alternative direction method of multipliers, optimization with sparsity constraints, examples of application to distributed detection and estimation problems (16) introduction to game theory, Nash equilibrium, pricing, potential games (12) Examples of application to wireless sensor networks and heterogeneous networks (16)

5. MATERIALE DIDATTICO

- Dimitri P. Bertsekas and John N. Tsitsiklis, "Parallel and Distributed Computation: Numerical Methods"
- M. O. Jackson, "Social and Economic Networks", Princeton Univ. Press;
- M. J. Osborne, "Game Theory", Oxford Univ. Press;
- Material provided by the teacher through his website

6. SITO WEB DI RIFERIMENTO

<http://infocom.uniroma1.it/~sergio/>