Newcom#

www.euracon.org/ASPHeN2014

N# Spring School on Advanced Signal Processing Techniques for Heterogeneous Networks

March 18-20, 2014 | Pisa, Italy

PROGRAM AT A GLANCE

	Tuesday March 18	Wednesday March 19	Thursday March 20
9.00 – 12.30	M. Luise	E. G. Larsson	E. Björnson
14.00 – 17.30	M. Kountouris	R. Couillet	P. Elia
19.30 – 22.00		*Banquet*	

Tuesday March 18, 2014

8.00-8.45: *Centro di Ricerca Matematica "E. De Giorgi", Palazzo del Castelletto, Via del Castelletto, 11, Pisa*
Registration

8.45-9.00: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Welcome & Introduction

9.00-12.30: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Lecture #1: Game theory for wireless communications and sensor networks
Speaker: Marco Luise

14.00-17.30: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Lecture #2: Analysis and design of heterogeneous cellular networks using stochastic geometry
Speaker: Marios Kountouris

Wednesday March 19, 2014

9.00-12.30: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Lecture #3: Fundamentals of massive MIMO
Speaker: Erik G. Larsson

14.00-17.30: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Lecture #4: Introduction to random matrix methods for wireless applications
Speaker: Romain Couillet

Thursday March 20, 2014

9.00-12.30: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Lecture #5: Signal processing for optimal radio resource management: Fundamentals and recent multi-cell advances
Speaker: Emil Björnson

14.00-17.30: *Room "Ulisse Dini", Centro "E. De Giorgi"*
Lecture #6: Anyhow, anytime feedback in classical multiuser channels
Speaker: Petros Elia

Social event: Wednesday March 19, 2014

18.00-19.00: Guided tour of *Scuola Normale Superiore*
19.30-22.00: Banquet at *Spaghetteria "ir Tegame"*

Technical Program

Tuesday March 18, 2014

9.00-12.30: Room "Ulisse Dini", Centro "E. De Giorgi"

Game theory for wireless communications and sensor networks

Prof. Marco Luise

Abstract: The ever-increasing demand for reliable and ubiquitous high-speed data communications and environment sensing services calls for new challenges in the design and the optimization of wireless networks, which may benefit from the adoption of sophisticated signal processing techniques at large. Recently, game theory has emerged as an effective framework for the network design, since it provides analytical tools to predict the outcome of interactions among rational entities. This tutorial provides an overview of the relevant applications of game theory, focusing on state-of-the-art techniques for resource allocation. The main focus will be on noncooperative techniques, although recent advances in the field of cooperative game theory will be also included in the discussion to provide a different perspective in the class of problems.

14.00-17.30: Room "Ulisse Dini", Centro "E. De Giorgi"

Analysis and design of heterogeneous cellular networks using stochastic geometry

Prof. Marios Kountouris

Abstract: Heterogeneous cellular networks are a comprehensive approach to provide high cellular network capacity by overlaying conventional macrocell-cellular architecture with heterogeneous architectural features such as small cellular access points (picocells and femtocells), low-power fixed relays, and distributed antennas. Heterogeneous cellular networks (HetNets) are expected to achieve higher data rates and better coverage by exploiting spatial reuse, while retaining at the same time the seamless connectivity and mobility of cellular networks. However, significant technical issues still need to be addressed for successful rollout and operation of HetNets. In the first part of this tutorial, we will introduce basic notions of stochastic geometry and some performance metrics related to wireless networks. In the second part, we will focus on the design of HetNets and show different scenarios in which stochastic geometry can be used to obtain crisp insights.

Wednesday March 19, 2014

9.00-12.30: Room "Ulisse Dini", Centro "E. De Giorgi"

Fundamentals of massive MIMO

Prof. Erik G. Larsson

Abstract: In this lecture we will discuss basic aspects of emerging massive MIMO technology for wireless communications. The focus will be on the following specific matters: How does massive MIMO work? What are the basic presumptions and limiting factors of massive MIMO? What makes massive MIMO fundamentally different from "conventional" MIMO? What is favorable propagation and when/why can we expect to have this? We will also review some results on capacity prediction/bounds for the uplink and downlink, and techniques for hardware-friendly waveform shaping.

14.00-17.30: Room "Ulisse Dini", Centro "E. De Giorgi"

Introduction to random matrix methods for wireless applications

Prof. Romain Couillet

Abstract: This tutorial introduces the basics of random matrix theory. After a short motivation through examples in signal processing and telecommunications, we will introduce the important tool that is the Stieltjes transform. The derivation of the popular Marcenko-Pastur law will be proposed based on this approach. Concrete applications to practical wireless communication problems, ranging from capacity estimation to optimal precoder structure in point-to-point MIMO, multiple access MIMO channels, to lineary precoded broadcast channels, will then be detailed. The objective of the tutorial is mostly for the audience to understand the basic tools and be able to apply them to various (more timely) wireless communication problems.

Thursday March 20, 2014

9.00-12.30: Room "Ulisse Dini", Centro "E. De Giorgi"

Signal processing for optimal radio resource management: Fundamentals and recent multi-cell advances

Prof. Emil Björnson

Abstract: Future cellular networks are expected to improve greatly in terms of both spectral efficiency and energy efficiency. The key to fulfilling these ambitious and conflicting goals is the resource management; that is, how the time, frequency, power, and spatial resources are divided among the users. The classical approach has been to allocate orthogonal time and frequency resources to the users, which guarantees low inter-user interference but is wasteful from the perspective of area spectral efficiency. Modern base stations are equipped with multiple antennas which enable adaptive interference suppression by precoding; thus, spatially separated users can be served in parallel by directing each signal towards its intended receiver. This tutorial presents a general framework for joint modeling, analysis, and optimization of different cellular scenarios, including clustered joint transmission, coordinated beamforming, heterogeneous soft-cell deployments, cognitive radio, and spectrum sharing between operators.

14.00-17.30: Room "Ulisse Dini", Centro "E. De Giorgi"

Anyhow, anytime feedback in classical multiuser channels

Prof. Petros Elia

Abstract: In the setting of multiuser wireless communications, the challenge is to accommodate for many users, and do so at high rates and reduced power consumption. A crucial tool towards achieving this challenge can be found in feedback, i.e., in the ability to communicate information to the transmitter regarding the state of each user's channel. Whereas having no feedback often forces communicating to just one user at a time, having perfect feedback can in many cases allows for simultaneous treatment of many users. While crucial, feedback is also notoriously hard to get. Our aim here is to give an exposition of the problem of communicating in the presence of limited, imperfect and delayed feedback. We will focus mainly on the broadcast channel, and offer an exposition of very new results, most of them from this same year.

Useful information

School venue

The school will take place at the premises of the *Centro di ricerca matematica "E. De Giorgi"*, located in the very heart of the city of Pisa (address: Palazzo del Castelletto, Via del Castelletto 11, Pisa). For further information, please visit the website www.crm.sns.it/. All lectures will be given in the room "Ulisse Dini" (crm.sns.it/classroom/9/).

Wifi access

Connect to the network `SNS-GUEST` with WPA `sns-guest`. After opening the browser, you will be redirected to the login interface. Choose "register" and go to the registration page. After filling the forms, you will obtain your username and password via SMS through your mobile phone. Please do not use spaces in your username, and include the country code (even Italian users) in your mobile phone number. After registering, please go back to the login page and insert username and password. Note that your username will be something like name.surname@meeting.sns.it.

Meals

The registration fee will cover all the coffee breaks (6) and the banquet. Coffee breaks will be served 10.30-11.00 and 15.30-16.00 in the garden of *Centro di ricerca matematica "E. De Giorgi"*. Lunches (not included in the registration) can be enjoyed in the myriad of restaurants and cafés around the school premises. For further information, please visit www.turismo.pisa.it/en/ and the list provided on the school website: www.euracon.org/ASPHeN2014.

Banquet

The banquet will be held at the *Spaghetteria "ir Tegame"* (www.irtegame.it), a restaurant placed nearby the river Arno. The banquet will take place on **Wednesday March 19th, 2014, h. 19.30-22.00**, after the guided tour. This dinner and is included in the registration fees. Participants with special **dietary constraints** are invited to contact the organizing committee to receive an alternative menu.

Guided tour of Scuola Normale Superiore

The guided tour will take place on **Wednesday March 19th, 2014, h. 18.00**, right after the afternoon lecture. The theme of this tour is the underground tunnel that hosts the library of the *Scuola Normale Superiore*, connecting two main buildings of the school, the *Palazzo della Carovana* and the *Palazzo dell'Orologio*, which are landmarks in the world-renowned *Piazza dei Cavalieri*. The tour is included in the registration fee. Please note that **no bags and backpacks** are allowed into the tunnel for safety reasons.

Organizing committee

Technical Program

Prof. Luca Sanguinetti, CNIT-University of Pisa, Italy
Dr. Giacomo Bacci, CNIT-University of Pisa, Italy
Prof. Filippo Giannetti, CNIT-University of Pisa, Italy

Local Arrangements

Dr. Riccardo Andreotti, CNIT-University of Pisa, Italy
Dr. Andrea Emmanuele, CNIT-University of Pisa, Italy
Mr. Carmine Vitiello, CNIT-University of Pisa, Italy

Useful contacts

Giacomo Bacci: giacomo.bacci@iet.unipi.it, +39 347 80 23 100
Luca Sanguinetti: luca.sanguinetti@iet.unipi.it, +39 347 67 57 004
Carmine Vitiello: carmine.vitiello@iet.unipi.it, +39 320 19 23 501

School website: http://www.euracon.org/ASPHeN2014
Pisa Intl. Airport: http://www.pisa-airport.com/
Florence Intl. Airport: http://www.aeroporto.firenze.it/
Italian Railways: http://www.ferroviedellostato.it/
Bus Services: http://www.cpt.pisa.it/, http://www.lazzi.it/

www.euracon.org/ASPHeN2014

N# Spring School on Advanced Signal Processing Techniques for Heterogeneous Networks

SPONSORED BY

Newcom#

cnit consorzio nazionale interuniversitario per le telecomunicazioni

IN SUPREMÆ DIGNITATIS 1343

WITH THE TECHNICAL SPONSORSHIP OF

IN SUPREMÆ DIGNITATIS 1343

SCUOLA NORMALE SUPERIORE

SCHOOL VENUE

SCUOLA NORMALE SUPERIORE

Scuola Normale Superiore - Centro di ricerca matematica "E. De Giorgi"
Palazzo del Castelletto, Via del Castelletto, 11 - Pisa, Italy
Tel.: +39 050 509 111 • Fax: +39 050 563 513 • Web: www.sns.it

ORGANIZING SECRETARIAT

EURACON
European Association of Communications and Networking

European Association of Communications and Networking
Web: www.euracon.org • Email: info@euracon.org