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SEVENTH FRAMEWORK PROGRAMME

Network of Excellence

NEWCOM#

Network of Excellence in Wireless Communications#

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Report on Education and Training Activities during Year 3

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Abstract:	This deliverable describes the efforts of NEWCOM# researchers relating to education and training within WP3.2 during the third project year. The events organized in this time period are: one Winter School, two Summer Schools, one EuWIn Training Session, and one Emerging Topic Workshop. The deliverable summarizes the key facts (dates, venues, organizers) of these events and provides details about the corresponding technical program and the implementation of these events.
Keywords:	summer school, winter school, emerging topic workshop, training session, EuWIn

Authors

Full Name	Beneficiary / Organisation	e-mail	Role
Gerald Matz	VUT	gmatz@nt.tuwien.ac.at	Overall Editor
Giusi Alfano	CNIT/PoliTo	alfano@tlc.polito.it	Contributor
Guido Montorsi	CNIT/PoliTo	guido.montorsi@polito.it	Contributor
Riccardo Zecchina	CNIT/PoliTo	riccardo.zecchina@polito.it	Contributor
Florian Kaltenberger	CNRS/Eurecom	florian.kaltenberger@eurecom.fr	Contributor
Raymond Knopp	CNRS/Eurecom	raymond.knopp@eurecom.fr	Contributor
Roberto Verdone	CNIT/Bologna	roberto.verdone@unibo.it	Contributor
Jossy Sayir	UCAM	jossy.sayir@eng.cam.ac.uk	Contributor
Pau Closas	CTTC	pau.closas@cttc.cat	Contributor

Reviewers

Full Name	Beneficiary / Organisation	e-mail	Date
Carles Antón-Haro	CTTC	carles.anton@cttc.es	Nov. 13, 2015

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Executive Summary

The three main activities relating to education and training within WP3.2 of NEWCOM# are:

1) Seasonal Schools: here, new concepts and theories are covered by lectures;

2) Training Sessions: hands-on training on actual hardware platforms is provided by the European Lab on Wireless Communications for the Future Internet (EuWIn);

3) Emerging Topics Workshops: these events are dedicated to timely hot topics in the field and are supposed to stimulate a scientific exchange between project partners.

During the third (and last) year of NEWCOM#, one Winter School, one Training Session, two Summer Schools, and one Emerging Topic Workshop have been organized by NEWCOM# researchers. In most of the occasions, administrative support was provided by the European Association of Communications and Networking (EurACoN). Here are the details of these events:

- Winter School; PoliTo, Torino (Italy); Nov. 19-21, 2014; 25 attendees
- Emerging Topics Workshops; UCAM, Cambridge (UK); June 25-26, 2015; 32 attendees
- Summer School; CTTC, Castelldefels (Spain); June 22-26, 2015, 37 attendees.
- Training Session/Summer School; Eurecom, Sophia Antipolis (France); Sept. 14-16, 2015, 17 attendees

All events addressed fundamentally important and relevant topics in wireless communications and featured a top-notch technical program that was very well received by the participants. All WP3.2 milestones during year 3 have thus been achieved. In fact, the actual number of seasonal schools (3), exceeds the contractual obligations of the consortium (2).

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List of Acronyms

eNB ..... evolved Node B
EurACoN ..... European Association of Communications and Networking
EuWIn ..... European Lab of Wireless Communications for the Future Internet
ETW ..... Emerging Topics Workshop
GFDM ..... Generalized Frequency Division Multiplexing
IoT ..... Internet of Things
LTE ..... Long-Term Evolution
MTC ..... Machine type Communication
UE ..... User Equipment
UFMC ..... Universal Filtered MultiCarrier
USRP..... Universal Software Radio Peripherals

1. Introduction

Education and training are key integration activities within NEWCOM#. These activities are subsumed in WP3.2 (lead by Gerald Matz of VUT) and are considered fundamental for achieving excellence in research. There are three types of events organized within this WP, each corresponding to a task:

Task 3.2.1 Seasonal schools; lead by Roberto Verdone (CNIT)

Task 3.2.2 EuWIn training sessions; lead by Sylvain Azarian (Supelec)

Task 3.2.3 Emerging topics workshops (ETW); lead by Miquel Payaró (CTTC)

The *European Lab of Wireless Communications for the Future Internet* (EuWIn, the experimental branch of NEWCOM#) plays a key role for Task 3.2.2. Specifically, EuWIn provides the infrastructure, facilities, and equipment for the hands-on training sessions at the three lab sites (CTTC in Barcelona, CNIT/UniBo in Bologna, and CNRS/Eurecom in Sopiha Antipolis).

The *European Association for Communications and Networking* (EurACoN, http://www.euracon.org/) acts as the administrative backbone for the organization of the seasonal schools and ETWs, taking care of booking the catering and accommodation, preparing meeting materials, advertising the school, and handling registration.

The seasonal schools typically last for a couple of days and consist of short-courses and tutorials on advanced topics in wireless communications. These courses are given by leading international experts from within and outside NEWCOM#. ETW are held in order to foster the exchange of ideas regarding new trends in wireless communications research and to provide a platform for PhD students to identify suitable topics for PhD theses. Practical training sessions at the EuWIn facilities allow the participating PhD students to gain hands-on experience regarding various wireless hardware platforms. All events during year 3 were open to the researchers from within and outside NEWCOM#.

The timing of the seasonal schools in year 3 was slightly changed (to M25 and M35) as compared to the Description of Work. On the one hand, this is due to the fact that in year 2, three Seasonal Schools have been organized instead of two as originally planned; on the other hand, collisions with important conferences and workshops in the area of wireless communications and networking had to be avoided.

In the remainder of this deliverable, we report the education and training activities during the third year of NEWCOM#. Section 2 provides information of the Winter School organized in Torino, Italy. Section 3 discusses the joint Summer School and EuWIn Training Session that took place at Eurecom in Sophia Antipolis, France. Section 4 is dedicated to the 3rd NEWCOM# Emerging Topics Workshop (Cambridge, UK). Next, in Section 5, we give an overview of the Summer School on Foundations and Advances in Stochastic Filtering held in Castelldefels (Barcelona). A summary of WP3.2 achievements during year 3 is given in Section 6.

2. MAFFIN Winter School

2.1 Rationale

Winter and summer schools in NEWCOM# are dedicated to fundamental topics of specific relevance to the joint research pursued in Track 1. These events usually last for a couple of days and consist of lectures covering basic and state-of-the art concepts, taught by NEWCOM# researchers and external experts. PhD students can thus benefit from the integrated expertise of the NEWCOM# consortium that complements the guidance provided by the direct PhD supervisor. Furthermore, the schools foster the exchange of scientific ideas and improve the networking of PhD students. The MAFFIN Winter Schools was the sixth seasonal school organized in the framework of NEWCOM#.

2.2 Key Facts

School Title: MAthematical Foundations of Future wIreless Networks (MAFFIN)

Chairs: Giusi Alfano (PoliTo), Guido Montorsi (PoliTo), Riccardo Zecchina (PoliTo)

Venue: Politecnico di Torino, Italy

Date: Nov. 19-21, 2014 (M25)

URL: http://www.euracon.org/index.php/2013-02-12-09-41-49/maffin2014

2.3 Speakers

Marco Chiani (CNIT/UniBo, Italy)
"The distribution of the eigenvalues for Wishart and Gaussian random matrices of finite dimensions, with application to wireless networks and multivariate analysis"

Eduard Jorswieck (Dresden University, Germany)
"Energy-Efficiency in 5G Wireless Networks via Fractional Programming Theory"

Angel Lozano (University Pompeu Fabra, Spain)
"Towards 5G Wireless Networks: A Research Perspective"

Ralf Müller (Erlangen University, Germany)
"Blind Pilot Decontamination"

Boaz Nadler (Weizmann Institute, Israel)
"On the largest eigenvalues and eigenvectors of signal+noise random matrices"

Roland Speicher (University of Saarland, Germany)
"Operator-valued free probability and block random matrices"

Giorgio Taricco (CNIT/PoliTo, Italy)
"Optimization of Linear Cooperative Spectrum Sensing for Cognitive Radio Networks"

Antonia Tulino (Bell Labs, USA)
"Wireless Caching"

	Wed Nov. 19	Thu Nov. 20	Fri Nov. 21
9:30 – 11:00	Boaz Nadler	Roland Speicher	Eduard Jorswieck
11:30 – 13:00	Boaz Nadler	Roland Speicher	Eduard Jorswieck
14:30 – 16:00	Marco Chiani	Ralf Müller	Angel Lozano
16:30 – 18:00	Giorgio Taricco	Ralf Müller	Antonia Tulino

Figure 2-1: Program of the MaFFiN Seasonal School.

2.4 Summary

The need for serving heterogeneous users and distributing even more heterogeneous contents in a timely manner in the 4G planning has already led to a significant increase of wireless networks and link model complexity. Indeed, this is even more evident in current efforts toward 5G design. The presence of an ever-increasing number of users and the nowadays assessed advantages coming from the (alternative and/or combined) deployment of a huge number of small cells and large number of base station antennas forced to resort to statistical mechanics methodologies for analysis and design of random wireless networks. Mathematical tools that are strictly related to this field are random matrix theory, free probability and combinatorics, whose most recent advancements were partly put forth by need of mathematical tools from the wireless community.

The school took place in the premises of Politecnico di Torino in Italy. The school counted about 25 attendees and comprised eight lectures, of which four were long lectures and four were short talks (see **Figure 2-1** for the detailed program). Three out of eight speakers came from NEWCOM# institutions (TUD, PoliTo, UniBo). The main focus of the school being on mathematical foundations of (current and) future wireless communication theory, the main talks were given by preeminent mathematicians and by leading researchers in the field of wireless communications. Boaz Nadler, leading researcher from Weizmann Institute (Israel), gave the opening talk, introducing to statistical detection and estimation theory most recent advancements and illustrating random-matrix-based test statistics derivation for problems of bright relevance in communications. Roland Speicher, recipient of ERC advanced grant NCDFP, gave a long talk on the operator-valued formulation of free probability theory and its possible application in time-dependent and non-stationary multiple-antenna systems design and analysis. Ralf Muller from Erlangen University shaped a picture of multi-bulk asymptotic random matrix spectra with application to analysis and design of multi-cell massive-MIMO systems. Eduard Jorswieck from TUD provided a tutorial introduction to fractional programming and other optimization tools aimed at determining energy-efficient resource allocation policies for several multi-cell, multi-hop wireless scenarios. Short talks were given by Marco Chiani from UniBo, jointly providing hints and results on spectrum-sensing and scheduling

algorithms, based on random matrix tools; by Giorgio Taricco from PoliTo on compressive sensing issues; by Antonia Tulino, with an excellent analysis of wireless caching; and by Angel Lozano, wrapping up the sessions with a detailed journey along the track to 5G.

The imaginary path from univariate Gaussian variables to a 5G link setup was followed with enthousiasm by all students. Thanks to financial support from Compagnia di San Paolo, the main bank in the Piemont region (where Turin is located), two social events could be offered, the planned social dinner and also the attendance to Händel's Opera Lirica "Julius Caesar" in the Teatro Regio.

A survey conducted after the Winter School (see Table 2-1) revealed that the overwhelming majority of the attendees rated the quality of the event very high in most categories.

	rating						mean
Criterion	1	2	3	4	5	6	
How do you rate the technical program?		1			3	13	5,6
How do you rate the quality of the presentations?				1	2	14	5,8
How do you rate the quality of the poster session?			1	3	8	4	4,9
How do you rate the on-site catering?		4	2	3	3	4	4,1
How do you rate the social dinner?					3	13	5,8
How do you rate the local organization?					8	9	5,5

Table 2-1: Results of the survey conducted among the attendees of the MAFFIN Winter School in Torino.

3. WaveNAT School and EuWIn Training Session

3.1 Rationale

In addition to the seasonal schools, lab training sessions on actual experimental hardware platforms are held at the facilities of EuWIn in order to transfer experimental and implementation know-how relating to Track 2. The idea is to allow PhD students to gain hands-on experience on the various measurement and testbed platforms and thereby establish close ties between Tracks 1 and 2 of NEWCOM# with the goal of cross-fertilization between these two tracks. The training sessions capitalize on previous experience and know-how of the main players in teaching hardware and software implementation skills for various wireless communication platforms. With the goal of even tighter integration of Tracks 1 and 2, the WaveNAT event combined a seasonal school and lab sessions into a single event.

3.2 Key Facts

Title: Waveforms and Network Architectures for the IoT in 5G (WaveNAT)

Chairs: Raymond Knopp (Eurecom), Florian Kaltenberger (Eurecom), Roberto Verdone (CNIT/UniBo)

Venue: Eurecom, Sophia Antipolis (France)

Date: Sept. 14-16, 2015 (M35)

URL: http://www.euracon.org/index.php/2013-02-12-09-41-49/wavenat5

3.3 Speakers and Trainers

Roberto Verdone (CNIT/University of Bologna)
"Applications and Network Architectures for IoT"

David Lake (Cisco)
"Wireless architectures and MEC for the IoT"

Raymond Knopp (Eurecom)
"Modulation and coding for 5G"

Dragan Samardzija (Alcatel Lucent)
"5G Waveforms"

Stefania Sesia (Intel)
"5G IoT Terminal Challenges"

Andreas Festag and Dan Zhang (TU Dresden)
"Requirements on 5G Waveforms and GFDM"

Florian Kaltenberger (Eurecom)
"Lab session: Hands on Waveforms for MTC in 5G"

Chiara Buratti (University of Bologna)
"Lab session: Hands on Protocols for IoT Applications in 5G"

3.4 Summary

The school addressed the topic of how 5G will integrate Machine Type Communications (MTC) and the Internet of Things (IoT). The two main streams considered are related to the design of *5G waveforms for MTC*, and the *integration of IoT network architectures into the 5G Radio Access*. Attendees were exposed both to theoretical and experimental sessions.

The topics covered in the two lab sessions are described in more detail below:

"Set up a 5G network using your own USRP": OpenAirInterface is an open-source software that allows you to set up your own LTE network. In this lab session you will learn how to setup OpenAirInterface and how to do some basic experiments for 5G. You can even bring your own USRP and computer. In the experiment we studied the coexistence of a traditional 4G system with a 5G system using one of the new waveforms. We thus setup a 4G LTE eNB with at least one UE connected to it. The other participants used their USRPs to transmit and/or receive a signal using a new waveform, either UFMC or GFDM. The goal of the lab was to study the impact of the secondary system on the primary system in terms of throughput.

"Network Architectures for IoT within 5G"; The laboratory had two main objectives: one the hand to present a precise methodology to perform experimentation and to fairly compare different protocol solutions, and, on the other hand, to allow attendees to implement an example of application of such methodology. In particular, the laboratory activities focused on the setup of a real wireless network, where nodes have to send data to a final coordinator. Two different protocol stacks were compared: 1) A standard solution, based on Zigbee and using Many-to-One routing to establish and maintaining routes, and 2) A solution based on Software Defined Network approach, using a centralized network layer protocol, where routing policies are defined by an external controller that could be anywhere in the network.

The program of the school (including oral and lab sessions) is shown in Figure 3.1 The oral presentations were given by NEWCOM# members (Roberto Verdone, CNIT/UniBO; Raymond Knopp, Eurecom; Andreas Festag/Dan Zhang, TU Dresden) and by industry representatives from CISCO, Alcatel-Lucent, and Intel. The two lab sessions were dedicated to the design of waveforms for Machine Type Communications in 5G and their impact over legacy systems, using the OpenAirInterface testbed of Eurecom, and the comparison among network protocols and architectures for IoT, based on the FLEXTOP testbed available at CNIT/UniBo.

The school had seventeen attendees. The list of names, with their affiliations, is reported in Table 3.1 As is evident, though the number of attendees from the NEWCOM# community was rather small (which may be explained by the project being about to end), the school was successful in attracting participants from industry, thus confirming the relevance of the topic addressed. From the administrative viewpoint, the school was managed by EurACoN. All information is available on the EurACoN webpage http://www.euracon.org/index.php/2013-02-12-09-41-49/wavenat5. The local organisation was ensured by Florian Kaltenberger from. A picture of the event is shown in Figure 3.2.

	Monday, Sept 14	Tuesday, Sept 15	Wednesday, Sept 16
welcome			
instructor	**Roberto Verdone (Univ. of Bologna)**	**Raymond Knopp (Eurecom)**	**Chiara Buratti (Univ. of Bologna)**
time	9h30 - 10h30	9h30 - 10h30	9h30 - 11h00
topic	*Applications and Network Architectures for the IoT*	*Modulation and coding for 5G - Part 2*	*Lab session: Hands on Protocols for IoT Applications in 5G*
break	30 min	30 min	30 min
instructor	**David Lake (Cisco)**	**Andreas Festag and Dan Zhang (T.U. Dresden)**	**Chiara Buratti (Univ. of Bologna)**
time	11h00 - 12h30	11h00 - 12h30	11h30 - 13h30
topic	*Wireless architectures and MEC for the IoT*	*Requirements on 5G Waveforms and GFDM*	*Lab session: Hands on Protocols for IoT Applications in 5G*
lunch	1 h 30	1 h	1 h
instructor	**Raymond Knopp (Eurecom)**	**Florian Kaltenberger (Eurecom)**	**Stefania Sesia (Intel)**
time	14h00 - 15h30	13h30 - 15h30	14h30 - 16h00
topic	*Modulation and coding for 5G*	*Lab session: Hands on Waveforms for MTC in 5G*	*5G IoT Terminal Challenges*
break	30 min	30 min	30 min
instructor	**Dragan Samardzija (Alcatel Lucent)**	**Florian Kaltenberger (Eurecom)**	
time	16h00 - 17h30	16h00 - 18h00	
topic	*5G Waveforms*	*Lab session: Hands on Waveforms for MTC in 5G*	
close			

Figure 3-1: Program of the WaveNAT5 Summer School and EuWIn Training Session.

First name	Last name	AFFILIATION
Kun	Chen Hu	Universidad Carlos III de Madrid
James	Birchall	University of Bristol
alireza	shams shafigh	CWC-university of oulu
Mohamed	Kamoun	Huawei
Loïg	Godard	Huawei
Raquel	Guerreiro Machado	Huawei
Eric	Simon	University of Lille1
Hamidreza	Khaleghi	b<>com
Jianqiang	Yang	Huawei Technologies France
Yoann	Roth	CEA
Iker	Sobron	University of the Basque Country (UPV/EHU)
Maria	Christopoulou	IASA-Wireless Systems Group
Francois	Taburet	Alcatel Lucent BellLabs France
Bruno	Mongazon	Alcatel-Lucent Bell Labs
Xiwen	Yiang	Eurecom
Kalyana	Gopala	Eurecom
Elena	Lukashova	Eurecom

Table 3-1: List of WaveNAT5 attendees with affiliation.

Figure 3-2: A talk during the WaveNAT5 Summer School.

4. Third Emerging Topics Workshop

4.1 Rationale

NEWCOM# organizes once per year a workshop dedicated to emerging topics in wireless communications which possibly also touch on other disciplines (mathematics, physics, life sciences, etc.). In contrast to seasonal schools, the focus of Emerging Topic Workshops (ETWs) is on recent developments and open problems that are specifically suited as potential topics for PhD theses. These events are a meeting point for interaction with the industry with the specific aim of harmonizing the interests of young NEWCOM# researchers and the practical needs of the European industry in wireless (and neighbouring) businesses. The structure of ETWs is a combination of expert talks and student presentations. Invited speakers, who typically are internationally recognized top experts from within and outside NEWCOM#, give expert talks. The student presentations are supposed to further stimulate the discussion and help with the identification of PhD thesis topics.

4.2 Key Facts

Title: Advances in Coding and Information Theory

Chairs: Jossy Sayir (UCAM)

Venue: University of Cambridge, UK

Date: June 25-26, 2015 (M32)

URL: https://www-sigproc.eng.cam.ac.uk/Main/NsharpETW

4.3 Speakers

A list of speakers at the 3rd ETW is provided below. For the titles of the talks that have been given, please see the program reproduced below.

Jossy Sayir, University of Cambridge (UK)
Jing Guo, University of Cambridge (UK)
Claudio Weidmann, CNRS/ENSEA Cergy (France)
Ingmar Land, Huawei Labs, Paris (France)
Michael Lentmaier, Lund University (Sweden)
Najeeb ul Hassan, TU Dresden (Germany)
Sebastian Cammerer & Stephan ten Brink, TU Stuttgart (Germany)
Georg Böcherer, TU Munich (Germany)
Guido Montorsi, Politecnico di Torino (Italy)
Ramji Venkataramanan, University of Cambridge (UK)
Alexandre Graell i Amat, Chalmers University (Sweden)
Erdal Arıkan, Bilkent University (Turkey)
Bernhard Geiger, TU Munich (Germany)
Abdellatif Zaidi, CNRS/Université de Marne-la-Vallée (France)

Tobias Koch, University Carlo III Madrid (Spain)

Alfonso Martinez, Universitat Pompeu Fabra, Barcelona (Spain)

4.4 Summary

There were 32 participants at this workshop and 17 presentations. About half of the participants came from abroad and half from the UK. The participants were overwhelmingly from academia with the exception of a noted strong interest from Huawei who sent two delegates. The workshop was organised by UCAM and the topics covered related mostly to Task 1.1.3 of NEWCOM#.

Thursday June 25

Time	Speaker	Talk Title
14:00 - 14:30	Jossy Sayir, University of Cambridge	Mixed linear / non-linear codes for frame synchronization
14:30 - 15:00	Jing Guo, University of Cambridge	Polarization for arbitrary alphabet sizes
15:00 - 15:30	Claudio Weidmann, CNRS/ENSEA Cergy, France	Hamming-space Voronoi cells of convolutional codes (with an application)
15:30 - 16:00	COFFEE BREAK	
16:00 - 16:30	Ingmar Land, Huawei Labs, Paris	Distributed caching in hetnets
16:30 - 17:00	Iryna Andriyanovna, CNRS/ENSEA Cergy, France (represented by Alex Graell)	Repair Scheduling in Wireless Distributed Storage with D2D Communication

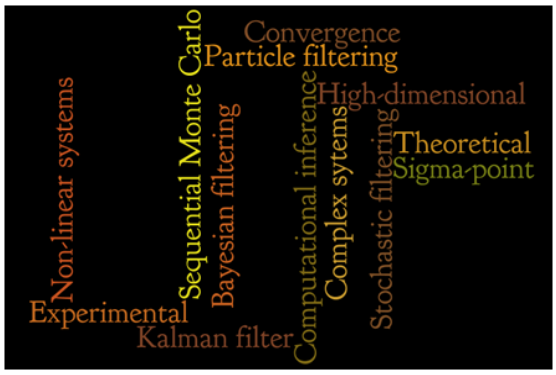
Friday, 26 June:

Time	Speaker	Talk title
09:00 - 09:30	Michael Lentmaier, Lund University	Threshold Saturation for Spatially Coupled Turbo-like Codes
09:30 - 10:00	Najeeb ul Hassan, TU Dresden	Protograph Design for Spatially Coupled Codes over the Block-Fading Channel
10:00 - 10:30	Sebastian Cammerer & Stephan ten Brink, TU Stuttgart	Triggering wavelike-convergence in tail-biting SC-LDPC codes
10:30 - 11:00	Georg Böcherer, TU Munich	Bandwidth Efficient and Rate-Matched Low-Density Parity-Check Coded Modulation
11:30 - 12:00	Guido Montorsi, Politecnico di Torino	Analog Digital Belief Propagation (ADBP) and multistage decoding with a hard decoding stage
12:00 - 12:30	Ramji Venkataramanan, University of Cambridge	Capacity-achieving codes for the AWGN channel via approximate message passing decoding
12:30 - 13:00	Alexandre Graell i Amat, Chalmers University	All-to-all broadcast coded slotted ALOHA for V2V communications

Time	Speaker	Talk title
14:00 - 14:30	Erdal Arıkan, Bilkent University, Turkey	Polar Coding for Applications
14:30 - 15:00	Bernhard Geiger, TU Munich	The Fractality of Polar and Reed-Muller Codes
15:00 - 15:30	Abdellatif Zaidi, CNRS/Université de Marne-la-Vallée, France	Two-Terminal Interactive Source Coding for Function Computation with Remote Sources
16:00 - 16:30	Tobias Koch, University Carlo III Madrid	Fundamental limits of short-packet wireless communications
16:30 - 17:00	Alfonso Martinez, Universitat Pompeu Fabra, Barcelona	Additive Energy Channels

5. FASF Summer School

5.1 Rationale



The Summer School on Foundations and Advances in Stochastic Filtering 2015 was successfully held in Castelldefels, Barcelona, Spain, in the week of 22-26 June 2015, co-organized by Pau Closas (CTTC) and Joaquín Míguez (UC3M). The aim of the School was to provide PhD students, postdoctoral researchers, and young scientists with the unique opportunity to meet and learn from leading experts the most advanced signal processing techniques in the field of stochastic filtering. Both theoretical background and practical hints were provided by the lecturers.

Additionally, a round table on open problems in stochastic filtering was conducted in the afternoon of June 24th, open to all participants. Also, the participants were invited as well to present their current research topics in the form of a poster. To that aim, we organized a poster session during the afternoons of June 23rd and 25th, where the participants had the opportunity to present and discuss their own research with the lecturers and the rest of FASF attendees. The program included a social event, held in the evening of June 23rd and included in the registration fees.

Besides Newcom#, the FASF Summer School was jointly sponsored by the IEEE Signal Processing Society and the EURASIP.

5.2 Key Facts

Title: Foundations and Advances in Stochastic Filtering

Chairs: Pau Closas (CTTC) and Joaquín Míguez (UC3M)

Venue: Castelldefels, Spain

Date: June 22-26, 2015 (M32)

URL: http://fasf2015.cttc.cat/

5.3 Speakers

All the attendees enjoyed the 5-day program, during which 6 professors and researchers provided lectures covering both foundations and advances in various fields of stochastic filtering. The final programme can be consulted in **Errore. L'origine riferimento non è stata trovata.** Figure 5-1. The list of speakers (in alphabetical order) and titles were:

- **Petar M. Djurić** (Stony Brook University, USA, N# associate partner), with the Introductory Course and Course #2 on Particle filtering in high dimensional spaces
- **Jordi Vilà-Valls** & **Carles Fernández-Prades** (CTTC, Spain), with Course #3 on Bayesian Filtering in the Gaussian Context
- **Kari Heine** (Univesity College London, UK), with Course #4 on Analysing the convergence of particle filters: introduction to techniques and main results
- **Omiros Papaspiliopoulos** (ICREA/Universitat Pompeu Fabra, Spain), with Course #5 on SMC methods for parameter estimation: IBIS, pMCMC, SMC^2 and computational challenges
- **Thomas Schön** (Uppsala University, Sweden), with Course #1 on Nonlinear system identification using sequential Monte Carlo.

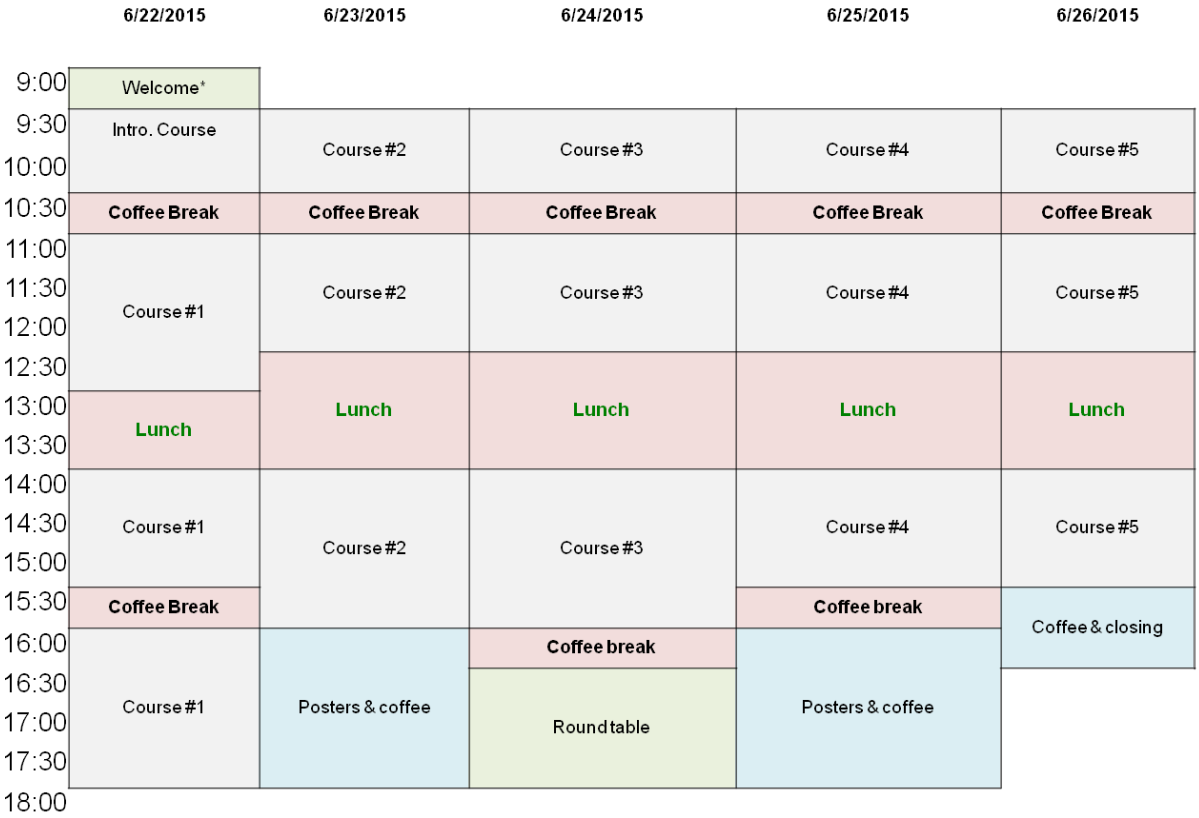


Figure 5-1: Program of the FASF 2015 Summer School.

5.4 Summary

The Summer School was an enormous success, gathering 37 attendees. PhD students and young researchers, from around the globe participated in the Summer School. They came from Australia, Belgium, Brazil, France, Germany, Italy, Netherlands, Spain, Turkey, and UK. FASF had 27 students and 10 non-student attendees.

Some picture of various moments during FASF2015 are herein provided:

Poster Session

Lectures

Lectures

Social event

6. Conclusions

During the last 12 months of NEWCOM#, there has been continuing commitment and participation in several education and training activities. Specifically, there have been the following events:

- Winter School on “Mathematical Foundations of Future Wireless Networks”
- Joint Summer School and Training Session on “Waveforms and Network Architectures for the IoT in 5G”.
- Summer School on “Foundations and Advances in Stochastic Filtering”.
- Emerging Topic Workhop on “Advances in Coding and Information Theory”

All events were highly successful in terms of quality of the technical program, even though the number of attendees declined slightly towards the end of the project. Whenever feedback was provided by the participants, it was overwhelmingly positive. All events were also used to integrate relevant industry into NEWCOM# activities. Specifically, representatives from Huawei, Cisco, Alcatel-Lucent, Bell Labs, and Intel were among the speakers and attendees. Besides, some associate partners (e.g., Stony Brook University) actively contributed to those schools as lecturers. Much of the success of the above events can be attributed to the fact that administrative aspects have been taken care of in a professional manner by EurACoN, thereby allowing the NEWCOM# researchers to focus on the organization of the technical program.
With a total of 9 Seasonal Schools, 3 EuWIn Training Sessions, and 3 Emerging Topics Workshops organized by the NEWCOM# community in various countries and venues, all WP3.2 milestones have been achieved (in excess, actually) and the Training and Education activities can be considered a major success of the NEWCOM# initiative.

Comments and suggestions for the improvement of this document are most welcome and should be sent to:

project_office@newcom-project.eu

http://www.newcom-project.eu