Network of Excellence

**NEWCOM#**

Network of Excellence in Wireless Communications#

**FP7 Contract Number: 318306**

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**WP3.5 – Development and valorization of human capital**

**D35.1**

Report on first-year mobility and awards

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This document contains information, which is proprietary to the NEWCOM# Consortium.
Abstract:
The purpose of this deliverable is to report achievements within NEWCOM# WP3.5 “Development and valorization of human capital” that is mainly: mobility grants and awards. In this year there were six grants of 1500EUR distributed. Young researchers spend at least 1 month on scientific visit in an external institution. In case of awards, 750EUR was granted to each of three recipients: Marco Di Renzo, Alessandro Guidotti, and Giovanni E. Corazza in case of Best Paper Award, Maria Gregori and Miquel Payaro in case of Young Researcher Award, Radio Networks research group (CNIT-UniBo), led by Roberto Verdone in case of Distinguished Researcher Award.

Keywords:
Mobility grants, awards, best paper award, young researcher award, distinguished researcher award.

Authors

IMPORTANT: The information in the following two tables will be directly used for the MPA (Monitoring Partner Activity) procedure. Upon finalisation of the deliverable, please, ensure it is accurate. Use multiple pages if needed. Besides, please, adhere to the following rules:

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- **Role:** Please, specify: Overall Editor / Section Editor / Contributor.

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Executive Summary

The purpose of this deliverable is to report on the achievements within Work Package 3.5 “Development and valorization of human capital” over the first year of the NoE duration. The goal was to allow for development of personal skills in research, while taking gender action to promote female researchers into account. There are two main tools used in this WP: mobility grants and awards.

The mobility grants are given to early-stage researchers willing to spend at least a month in a scientific visit in an external institution. There were 6 grants provided this year, each one of 1500EUR, to Melchiorre Danilo Abrignani (CNIT-Bologna) to work on “Self-configuration and Optimization of Hybrid LTE Femto-M2M Network for Smart City Applications” at CTTC, Riccardo Andreotti (CNIT-Pisa) to work on “Power allocation for green femto cells using game theory” at Supelec, Salvatore D’Oro (CNIT-Catania) to work on “Game Theoretic approach to timing channel communications in jamming scenarios” at CNRS-Paris Sud, Sophie Fosson (CNIT-Torino) to work on “Distributed sparse signal estimation: new models and solutions” at CTTC, Mohsen Rezaeekheirabadi (VUT) to work on “Interference management with imperfect CSIT” at Imperial College in London, and Vincenzo Zambianchi (CNIT-Bologna) to work on “Distributed field estimation via consensus techniques” at Supelec. Not all of them have finished their visit on the date of this deliverable writing, but for those who had activity the report is attached (Annexes B–E).

In the case of awards, three of them were distributed in the first year: Young Researcher Award (YRA), Best Paper Award (BPA), Distinguished Researcher Award (DRA). Each amounted for 750EUR paid directly by the Coordinator (CNIT). There were a relatively large number of applications, i.e., 15 for BPA, 5 for YRA, and 2 for DRA. In the cases of the BPA and YRA, the application process was limited to sending only NEWCOM# acknowledged paper to the project office. In the case of DRA, only one page description of researcher (or research team) achievements was needed. The awardees are Marco Di Renzo, Alessandro Guidotti, and Giovanni E. Corazza in case of BPA, Maria Gregori and Miquel Payaro in case of YRA and Radio Networks research group (CNIT-UniBo), led by Roberto Verdone in case of DRA.

Overall, both mobility grants and awards are assessed as successful. It is foreseen that the next run of these two tools is to be even more successful as the collaboration within NEWCOM# gets more mature and the number of joint papers rises.
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Glossary

BPA- Best Paper Award
DRA- Distinguished Researcher Award
YRA- Young Researcher Award
1. Introduction

This deliverable reports on achievements in Work Package 3.5 “Development and valorization of human capital” after the first year of NEWCOM#. This WP is providing a number of actions in order to develop personal skills in research. The two main instruments were mobility grants and awards. First, special grants went to PhD and early-stage researchers to spend some time on a scientific visit in a foreign institution, preferably one of NEWCOM# EuWin Labs. It helps them to gain some knowledge about their field of interest. It gives them some knowledge and skills obtained from different perspective of different research team. Additionally, new collaborations within the NoE should be achieved. On the other hand, awards are to be given to papers and other important achievements obtained within the NoE. It is an important means to recognize hard working researchers within the network and to publicize network achievements. Important were also gender actions in order to promote the participation of female researchers.

The focus of this deliverable is the mobility grants and awards granted in the first year of NEWCOM#. The first round is of high importance, as it allows for staring–up new connections among persons from different institutions. It is a means for cross-fertilization that provides new ideas to be developed within this NoE. Awards in the first year will promote the most active researchers that were able not only to start their collaboration within the NoE but also to publish their work.

In the next section, we will describe the steps taken in the first year regarding mobility grants. We explain the role of mobility grants, the process of application and reviewing, and we present the list of awarded persons and their research topics. In Section 3, first year of awards are summarized. Conclusions, with description of future steps to be taken, are presented in Section 4.
2. First year of mobility grants

2.1 Introduction to mobility grants

The aim of the mobility grants is to enhance face to face cooperation and to promote exchanges of researchers among different institutions, not only belonging to NEWCOM# institutions. The interested researchers were asked to provide an application form that was reviewed by the Evaluation Board. Each rewarded person is given 1500EUR for a research stay longing minimum one month. The rules for the first call for mobility grant were approved on Executive Board meeting on 14th January 2013. The call (described in Section 2.2) was opened on 31st January 2013 and was announced using, e.g., the NEWCOM# website [1], LinkedIn group [2], and a mailing list. It is also attached as Annex A. The application deadline was 15th March 2013. NEWCOM# project office received 7 applications, which were evaluated by a board consisting of:

- Pawel Kryszkiewicz (PUT)
- Miquel Payaro (CTTC)
- Davide Dardari (CNIT-UNIBO)
- Raymond Knopp (CNRS-EURACOM)
- Luis M. Correia (INOV).

The evaluation process (described in details in Section 2.3) was concluded with a virtual meeting on 11th April 2013. Afterwards, on 15th April 2013 the results of the first year NEWCOM# mobility grant winners were announced.

2.2 Rules and application process

Before the call was open, two important documents were prepared: guidelines and an application form. In the guidelines, the purpose of the mobility grant is mentioned (“The aim of the mobility grants is to enhance face to face cooperative research and to promote exchanges of researchers among different institutions.”). The awarded persons should be young researchers coming preferably from a NEWCOM# beneficiary of associated partner, but persons from externals institutions are not excluded. Each person should visit a host for at least 1 month to get the 1500EUR grant. The amount allocated in the NEWCOM# budget in the first year allowed for 6 grants. The document clarifies also the method of payment and how the expenses should be reported to Project Office. Payment was done this year directly to winners account by the project coordinator CNIT. After the research visit (within 60 days), the winner is expected to provide a short activity report as well as a certificate (a form available at NEWCOM# website [3]) confirmed by the host. The criteria used during evaluation process are as follows:

- Relevance to the objectives of NEWCOM# (links to WPs).
- Feasibility and clarity of the objectives.
- Integration:
  - added value to already existing liaisons;
  - new collaborations;
  - “Cross-fertilization” (the person who moves should have complementary knowledge with respect to the one of the hosting institution in any case helpful for the research)
  - Quality of applicant’s CV;
  - Proposals coming from NEWCOM# Institutions will be favoured
  - Preference will go to female researchers ceteris paribus.

There was also information on the appointment of the Evaluation Board by the Executive Board, and on the procedure in case of conflict of interests.

At the end of the call, there were 7 applications collected:
• Melchiorre Danilo Abrignani (CNIT-Bologna) – PhD student
  Hosting institution: CTTC
  Subject: Self-configuration and Optimization of Hybrid LTE Femto-M2M Network for Smart City Applications
  Visit duration: 1 month
• Riccardo Andreotti (CNIT-Pisa) - Young researcher
  Hosting institution: Alcatel-Lucent Chair on Flexible Radio – Supelec
  Subject: Power allocation for green femto cells using game theory
  Visit duration: 1 month
• Salvatore D’Oro (CNIT-Catania) - PhD student
  Hosting institution: CNRS- Paris Sud
  Subject: Game Theoretic approach to timing channel communications in jamming scenarios.
  Visit duration: 1 month
• Sophie Fosson (CNIT-Torino) - Young researcher
  Hosting institution: CTTC
  Subject: Distributed sparse signal estimation: new models and solutions
  Visit duration: 1 month
• Francesco Malandrino (CNIT-Torino) – Young researcher
  Hosting institution: UOULU
  Subject: Approximate Optimization techniques for cognitive radio
  Visit duration: 1 month
• Mohsen Rezaeekheirabadi (VUT) - PhD student
  Hosting institution: SUPELEC
  Subject: A deterministic equivalent approach to the optimization of non-convex information-theoretic measures
  Visit duration: 1 month
• Vincenzo Zambianchi (CNIT-Bologna) - PhD student
  Hosting institution: SUPELEC
  Subject: Distributed field estimation via consensus techniques
  Visit duration: 6 months

All applicants come from NEWCOM# institutions. Among them, 4 are PhD students, while 3 are young researchers within 4 years from the degree (shown in Figure 2-1). One of all is a woman. As for the relevance to NEWCOM# objectives, all applications were connected to WP1.1 (1), WP1.2 (4) or WP1.3 (4); however, 2 applicants are also going to work within Track 2 (WP2.2), as visualized in Figure 2-2. It is also interesting the statistics of the applicants’ origin (Figure 2-3) and hosting institutions (Figure 2-4).

Figure 2-1: Percentage of applicants belonging to certain research seniority groups.
2.3 Evaluation process and results

All members of the Evaluation Board were to evaluate each application based on the criteria presented above. For simplicity and coherence, a review form was prepared. All reviews were collected by WP3.5 leader and summarized. A discussion and decision was made by the Evaluation Board during a virtual meeting on 11th April 2013. Although all applications present interesting problems from the scientific viewpoint, and the researchers have valuable achievements (respective to the scientific seniority) justifying the high-quality of future publications, the number of mobility grants was limited to a maximum of six.

The Evaluation Board agreed to give 6 mobility grants, rejecting the one provided by Francesco Malandrino, as a bit weaker than others. The general vision of combining
knowledge of cognitive radio technology at UOULU and mathematical tools for optimization under uncertainty at CNIT-Torino is interesting and has great potential for future research. However, the applicant should have some knowledge on cognitive radio technology before the short scientific visit. There should be at least a defined scenario to be investigated or value to be optimized, e.g., power. At this, very first, stage of collaboration valuable time may be wasted for some basic literature studies, scenarios definition, etc. The applicant seniority in research and significant publications history suggests that these basic steps can easily be achieved by, e.g., self-study or virtual calls.

Results were announced by using the NEWCOM# webpage [3], LinkedIn group [2] and a mailing list.

As of the time of finalizing this deliverable, not all winners returned from the research visit and sent a report. However, the reports currently available are attached to the Deliverable (Annexes B-F).

### 2.4 A change in the results

After the announcement of the results on 15th April 2013, a problem with the research visit of Mohsen Rezaeekheirabadi to SUPELEC raised. The hosting institution was not able to host Mohsen (SUPELEC statement send to Project Office on 14th June 2013). In order not to penalize the winner for a situation beyond his control, the Evaluation Board decided to allow Mohsen to change his research plan. Mohsen visit is to Imperial College in London to work on “Interference management with imperfect CSIT” over the period of 1 month. It was accepted by the Evaluation Board on 7th June 2013.

The final list of persons awarded is:

- Melchiorre Danilo Abrignani (CNIT-Bologna) – PhD student  
  Hosting institution: CTTC  
  Subject: Self-configuration and Optimization of Hybrid LTE Femto-M2M Network for Smart City Applications  
  Visit duration: 1 month

- Riccardo Andreotti (CNIT-Pisa) - Young researcher  
  Hosting institution: Alcatel-Lucent Chair on Flexible Radio – Supelec  
  Subject: Power allocation for green femto cells using game theory  
  Visit duration: 1 month

- Salvatore D’Oro (CNIT-Catania) - PhD student  
  Hosting institution: CNRS- Paris Sud  
  Subject: Game Theoretic approach to timing channel communications in jamming scenarios.  
  Visit duration: 1 month

- Sophie Fosson (CNIT-Torino) - Young researcher  
  Hosting institution: CTTC  
  Subject: Distributed sparse signal estimation: new models and solutions  
  Visit duration: 1 month

- Mohsen Rezaeekheirabadi (VUT) - PhD student  
  Hosting institution: Imperial College in London  
  Subject: Interference management with imperfect CSIT  
  Visit duration: 1 month

- Vincenzo Zambianchi (CNIT-Bologna) - PhD student  
  Hosting institution: SUPELEC  
  Subject: Distributed field estimation via consensus techniques  
  Visit duration: 6 months
3. First year of awards

3.1 Introduction to awards

There are three kinds of awards to be granted each year in order to promote excellence in research within NEWCOM#:

- The NEWCOM# Best Paper Award (BPA)
- The NEWCOM# Young Researcher Award (YRA)
- The NEWCOM# Distinguished Researcher Award (DRA).

All of them will be assigned during the annual NEWCOM# conference that will be collocated in the first year with EuCNC – European Conference on Networks and Communications in June 2014. All applications will be evaluated by an Award Committee appointed by the Executive Board. It is chaired by NEWCOM# Scientific Director, i.e., Marco Luise (CNIT). In the case of the NEWCOM# Distinguished Researcher award the other members are:

- Andreas Polydoros
- Hanna Bogucka
- Luis M. Correia

The choice was made as a result of the discussion between Marco Luise and Carles Anton-Haro. The key factor behind choosing these committee members was their distinguishing research achievements as well as them being well known and recognized within the network. It is important as applicants for this award can be proposed by themselves, by other researcher or by the Committee itself. The Committee can be proactive and propose names themselves (also asking WP leaders).

The Award committee for The NEWCOM# Best Paper Award and the NEWCOM# Young Researcher award consist of:

- Muriel Médard (MIT)
- Petar M. Djuric (Stony Brook University; NY)
- Bjorn Ottersten (University of Luxembourg).

It has been decided to nominate an external commission, as it allows the increasing of the fairness of the final decision. In the case of these awards, it is not important to be involved within NEWCOM# as only the scientific level of the papers is assessed. The committee was also chosen by Marco Luise and Carles Anton-Haro, under the criteria of well-known and distinguished persons in the research field.

3.2 Rules and application process:

3.2.1 General Considerations

The rules of the awards have been published on the NEWCOM# webpage [4] and via a mailing list. The call was open from 6th September to 30th September 2013. Although Mobility Grants were available not only to NEWCOM# researchers, the awards are limited to researchers working and publishing papers within the NoE. All papers proposed for the award should have acknowledgement to the NEWCOM# project. There are three types of awards:

- Best Paper Award (BPA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers;
- Young Researcher Award (YRA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers. The first author must be under 30 years of age.
• Distinguished Research Award (DRA) to a (group of) researcher(s) belonging to NEWCOM# that has achieved special results in research or dissemination resulting of his/her/their activity in the project and during project’s lifetime.

Each winner will be awarded with 750 EUR paid by the project coordinator – CNIT. The main criteria for choosing winners are:

• Contribution to the advancement to the field of Wireless Communications;
• Relevance to the objectives of NEWCOM# (links to WPs);
• General quality, originality of research, contributions, subject matter, clarity and style of presentation;
• Priority: papers co-authored by researchers belonging to more than one NEWCOM# partner will be given special consideration in the evaluation process.
• Ceteris Paribus, preference will be given to female researchers.

The gender action, covered by the last criteria, is promised in the Description of Work to cover the DRA, though it has been decided to extend it to other awards too.

3.2.2 Best Paper Award

The application process is quite simple. Researchers are asked to send PDF versions of their papers to the Project Office. At the end of the application period (30th September 2013), there were 15 applications collected:

• B. Lorenzo, S. Glisic (Dept. Communications Engineering University of Oulu, Finland); L. Galluccio (CNIT Research Unit at DIEEI University of Catania, Italy); Y. Fang (Dept. Electrical and Computer Engineering University of Florida, USA), “Adaptive Infection Recovery Schemes for Multicast Delay Tolerant Networks”, IEEE Globecom 2013
• A. Laya, L. Alonso (Department of Signal Theory and Communications, Universitat Polite`cnica de Catalunya (UPC), Spain), J. Alonso-Zarate (Centre Tecnolo`gic de Telecomunicacions de Catalunya (CTTC), Spain), “Is the Random Access Channel of LTE and LTE-A Suitable for M2M Communications? A Survey of Alternatives”, accepted for publication on September 2013 in IEEE Communications Surveys and Tutorials, Special Issue on Machine-to-Machine Technologies & Architectures.
• N. ul Hassan, G. P. Fettweis (Vodafone Chair Mobile Communications Systems, TUD, Germany), A. E. Pusane (Dept. of Electrical and Electronics Engineering, Bogazici University, Turkey), M. Lentmaier (Dept. of Electrical and Information Technology, ULUND, Sweden), D. J. Costello, Jr. (Dept. of Electrical Engineering, University of Notre Dame, USA), “Non-Uniform Windowed Decoding Schedules for Spatially Coupled Codes”, IEEE Globecom 2013
• C. Fernández-Prades, J. Arribas, P. Closas (CTTC, Spain), “Turning a Television into a GNSS Receiver”, ION GNSS+ 2013

Most of the papers were published in well recognized journals (more than 60%), while the other 40% are international communications conferences. These data are depicted in Figure 3-1.

![Figure 3-1: Percentage of papers published in journals/ presented on conferences.](image)

### 3.2.3 Young Researcher Award

The researchers are asked to send PDF versions of their papers to the Project Office. At the end of application period (30th September 2013) there were 5 applications collected:
• N. ul Hassan (age: 28, PhD student at TU Dresden), G. P. Fettweis (Vodafone Chair Mobile Communications Systems, TUD, Germany), A. E. Pusane (Dept. of Electrical and Electronics Engineering, Bogazici University, Turkey), M. Lentmaier (Dept. of Electrical and Information Technology, ULUND, Sweden), D. J. Costello, Jr. (Dept. of Electrical Engineering, University of Notre Dame, USA), “Non-Uniform Windowed Decoding Schedules for Spatially Coupled Codes”, IEEE Globecom 2013
• P. Kryszkiewicz (age: 27, PhD student at Poznan University of Technology), H. Bogucka, (PUT, Poland), “Out-of-Band Power Reduction in NC-OFDM with
Optimized Cancellation Carriers Selection”, accepted on July 2013 for publication in IEEE Communications Letters

- C. Vitiello (age: 27, PhD student at Uni Pisa), S. Pfletschinger (CTTC), M. Luise (Uni Pisa), “Decoding Options for Trellis Codes in the Two-Way Relay Channel”, IEEE 14th Workshop on Signal Processing Advances in Wireless Communications (SPAWC) 2013

All of them fulfilled the requirements stated in the call. It is important to mention that all applicants represent different institutions (TU Dresden, PUT, SUPELEC, CTTC, Uni Pisa), 75% of them being still Ph.D. students (Figure 3-2). Similarly, 75% of them are men (Figure 3-3), which reflects the overall situation in the communications research environment.

![Figure 3-2: Scientific status of young researchers applying for YRA.](image1)

![Figure 3-3: Gender of young researchers applying for YRA.](image2)

### 3.2.4 Distinguished Researcher Award

The applicants should provide 1 page description of their achievements within the NoE with CV attached. For this award there were two applications:

- For the Alcatel-Lucent Chair on Flexible Radio (SUPELEC); Led by: Merouane Debbah
- For the Radio Networks research group (CNIT-UniBo); Led by Roberto Verdone.
3.3 Evaluation process and results

The winners of all awards have been announced on 25th October 2013. The winners are:

- **Best Paper Award**

  Comment from Award Committee:
  *In this paper, the authors introduce an analytical methodology for evaluation of average rates of downlink heterogeneous cellular networks based on moment generating functions. The methodology provides a tractable and numerically efficient framework that is applicable to general fading distributions.*

- **Young Researcher Award**

  Comment from Award Committee:
  *In this paper, the authors provide results for a design of a transmitter that maximizes the mutual information along N channel uses by studying jointly the nature of the energy harvesting process at the transmitter and arbitrary distributions of the input symbols.*

- **Distinguished Researcher Award**
  Radio Networks research group (CNIT-UniBo); Led by Roberto Verdone

  Comment from Award Committee:
  *The jury for the Distinguished Research Award examined the two applications under the criterion of whether a researcher or a group of researches belonging to NEWCOM# has achieved special results in research or dissemination resulting of his/her(their) activity in the project and during project’s lifetime.*

  *It was found that the application from Roberto Verdone’s group has indeed contributed to increase NEWCOM#’s joint collaboration, excellence and visibility, via the work done in setting up EuWIN’s lab and related activities. The jury decided to grant the award to this group.*
4. Conclusions

In the first year of NEWCOM#, 6 mobility grants and 3 awards were distributed. The applications and evaluation process worked swiftly. The number of applications was only 7 in case of mobility grants. These numbers are expected to rise in the next project year, as the cooperation between partners gets more mature. The awards were launched a few months later, the number of applicants being significant (15 for the BPA, 5 for YRA, 2 for DRA), justifying the above hypothesis. The number of papers and their origin (best international journals and conferences) shows a good development of researchers’ skills and coherence between topics investigated within the NoE and worldwide trends. All these facts suggest that next year awards and mobility grants calls should also be successful. Only minor changes in the procedures are needed, e.g. not to have situations like with Mohsen Rezaeeekheirabadi mobility grant.

There were also 3 awards granted. The number of applications in case of Best Paper Award was 15. In case of the Young Researcher Award and Distinguished Researcher Award these numbers were 5 and 2 applicants, respectively. The total number of 22 applications is quite satisfying. Moreover, It is foreseen that more applications will appear next year as the number joint papers within Newcom# increases. The quality of papers was high, that is confirmed by the journals/conferences they were published/presented at. The popularity of the awards, confirms it is a good way for promoting personal skills in research and joint work within the NoE.
5. References


Annex A- Call for mobility grants

MOBILITY GRANTS

Call for applications and guidelines – First year

Opening of the call: 31st January 2013

Project acronym: NEWCOM#
Type of contract: NETWORK OF EXCELLENCE.
Contract No: 318306
Project URL: http://www.newcom-project.eu/
GENERAL ASPECTS

Purpose
The aim of the mobility grants is to enhance face to face cooperative research and to promote exchanges of researchers among different institutions.

Participants
Young researchers (typically early stage researchers) preferably from N# beneficiaries or associate partners, not excluding external institutions.

Duration
The duration of the research stay is not fixed, as long as it is within NEWCOM# duration. A minimum duration of 1 month is envisaged. Shorter research stays are not covered by the grant.

Budget
The total budget allocated for each grant is € 1,500,00.

Number of grants
The maximum number of grants to be issued in year 1 is six.

Claim and Proof
The grant will be directly paid to the winner by the coordinator CNIT. Within 60 days from the end of the stay the researcher will send to the project Office a short activity report as well as a certification by the hosting institution with starting and ending date of the stay.

EVALUATION OF PROPOSALS

Criteria
- Relevance to the objectives of NEWCOM# (links to WPs).
- Feasibility and clarity of the objectives.
- Integration:
  - added value to already existing liaisons;
  - new collaborations;
  - “Cross-fertilization” (The person who moves should have complementary knowledge with respect to the one of the hosting institution in any case helpful for the research)
- Quality of applicant’s CV;
- Proposals coming from N# Institutions will be favored
- Preference will go to female researchers ceteris paribus.

Procedure
Each project will be evaluated by the Mobility Panel to be appointed by the Executive Board. In case of conflicts of interest, the corresponding member(s) of the Panel will be replaced by a person chosen by the Executive Board.

Supporting Documentation
Application Form and Applicant’s CV

SCHEDULE

The applicants should send the Proposals to the Newcom# Office
project_office@newcom-project.eu
Deadline for submitting the proposals: 15th March 2013
Notification of the ranking: 15th April 2013.

APPLICATION FORM

The application form can be found at: http://www.newcom-project.eu under the ‘Mobility’ section.
Annex B- Report of Sophie Fosson

MOBILITY GRANT

Report

Guest name: Sophie Fosson
Guest Institution: CNIT – Politecnico di Torino, Italy

Host name: Carles Antón-Haro, Javier Matamoros
Host institution: Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Castelldefels (Barcelona), Spain

Title of research: Distributed sparse signal estimation: new models and solutions

Starting date: June 15, 2013
Ending date: July 14, 2013

1. Motivations

The research topic of this Mobility Grant has been the distributed estimation of sparse signals over sensor networks. This is one of the topics of the JRA entitled “Energy-efficient data collection and estimation in wireless sensor networks” (Partners: CNIT Torino, CNIT Bologna, CNRS/UPS, CTTC, PUT; WP 1.2.3 and 1.3.1), in the context of which the collaboration between CTTC and CNIT-Politecnico di Torino has started.

Sensor networks have attracted the attention of several scientific communities. Sensors are smart devices able to acquire and process data, and to communicate with other sensors, e.g., via wireless channels. Typically, their capabilities in terms of storage, computation and communication are limited but, by leveraging on network structure, significant computations can be efficiently performed if compared with a single powerful processor. Moreover, the deployment of sensors allows to perform monitoring and localization tasks over larger geographical areas, which could not be tackled by a unique data collector.

The aim of Mobility Grant was to focus on the problem of the estimation of sparse, correlated signals with a wireless sensor network. Recently, the compressed sensing theory has provided the tools to estimate sparse signals acquired via linear compression. In the last few years, compressed sensing has been generalized to decentralized scenarios, in which acquisition is performed by a sensor network. Data gathering is thus distributed, but in general the signal recovery operations are deferred to a fusion center, which receives and collects all the measurements taken by the sensors and implements the reconstruction algorithms.

For many purposes, this may be a drawback: transmission to a fusion center can be costly, not energy efficient and not robust. Moreover, for privacy reasons, sensors might prefer to not send all their information. For this motivation, the study of in-network reconstruction techniques is very important, which allows the sensors to reconstruct themselves the signals, leveraging on local cooperation with the other sensors.
At CNIT – Politecnico di Torino, on the one hand, an extensive research work has been performed on this topic. Specifically, a class of iterative algorithms has been proposed for this purpose, which combines gradient descent methods, hard and soft thresholding algorithms and consensus techniques. These algorithms have proved to work in the case when all the sensors measure the same sparse signal. In particular, the convergence has been proved when the constrained communication among sensors can be modeled as a regular graph, and the performance have been shown to be satisfactory through a consistent number of Monte Carlo numerical simulations.

On the other hand, the problem of the estimation of different sparse signals has been proposed by CTTC and is the subject of the JRA. An iterative distributed algorithm, which extends those proposed by CNIT – Politecnico di Torino, is being introduced, and its properties have to be studied analytically and via simulation. The proposed model envisages sparse signals that are different, but have the same support. The key idea is to reconstruct them by exploiting consensus techniques, applied on the support and not on the values of the signals. The algorithm proposed by CTTC is decentralized and does not require any fusion center.

As we are going to explain in next section, the aim of the Mobility Grant was to develop the proposed models and algorithms.

2. Objectives

Regarding the setting described in the previous section, the main issues we aimed to tackle during the Mobility Grant were:

1. Model: are there necessary assumptions on the signals, for example in terms of correlation?
2. Feasibility and the performance of the algorithm: is the algorithm really implementable in sensor networks? Is it sufficiently low complex?
3. Convergence and performance of the algorithm: can we prove the convergence of the algorithm? Can we theoretically analyze its performance?

3. Technical results

During the Mobility Grant, we have tackled the three issues introduced in Section 2 and obtained the following results.

1. Model: we have decided to concentrate on signals with equal support, according to the model JSM2 of compressed sensing. This choice, in fact, is the more interesting one for the applications, as proved by the very recent literature devoted to this.

2. We have proved via numerical simulations that the algorithm proposed by CTTC is feasible, but we introduced many variations to it in order to improve its performance and to settle it in a more precise theoretically context. Namely, the current version of the algorithm can be derived in terms of minimization of a suitable functional. This improvement has been possible thanks to the previous work done at CNIT – Politecnico on iterative Thresholding methods by Sophie Fosson. The performance are comparable to those of other algorithms developed for the same problem.
3. The convergence of the proposed algorithm has been analytically proved, using Lyapunov arguments. Specifically, the algorithm has been proved to decrease a given functional, which is sufficient to show that the support estimation stabilizes. For what concerns the performance, some analytical observations have been done, but much work has to be done.

4. Collaboration results

This Mobility Grant has greatly facilitated the collaboration between CNIT-Politecnico di Torino and CTTC, speeding up and improving the joint work.

The collaboration between CTTC and CNIT – Politecnico di Torino started in the context of Newcom# for the JRA “Energy-efficient data collection and estimation in wireless sensor networks” (Partners: CNIT Torino, CNIT Bologna, CNRS/UPS, CTTC, PUT). This JRA, which was officially presented in the Track 1 meeting in Paris, is a cross-WP activity which spans workpackages WP 1.2 (Opportunistic and Cooperative Communications) and WP 1.3 (Energy- and Bandwidth-Efficient Communications and Networking). Specifically, it addresses tasks T1.2.3 (Cooperative Sensing) and T1.3.1 (Techniques for Power Efficient Communications).

In this JRA, a number of possible joint problems have been identified and now have to be evaluated in terms of their scientific interest and feasibility. Among them, the problem described in the previous sections seems to be very promising. One motivation of this Mobility Grant was to work on these topics, to strengthen the collaboration among Newcom# partners and leading to a stronger JRA with a very high potential to produce top-level scientific results.

5. Outputs

The results obtained during the Mobility Grant month have been collected in a paper, that will be submitted to a conference, probably ICASSP 2014. For more technical details, we attach a draft of this paper.

6. Activities

In this section, we report the main activities done by the guest Sophie Fosson with the hosts Carles Antón-Haro and Javier Matamoros, which lead to the produce the described outputs.

In addition to these main activities, everyday meeting were held by Sophie Fosson and Javier Matamoros to develop the algorithms, to discuss the partial results of numerical simulations and the mathematical technical details of the proposed procedures, and to examine the literature.

All the activities have been done at CTTC.

Meetings

• Meeting 1: June 17, 9:30 a.m., 1 hour

Attendees: Sophie Fosson, Carles Antón-Haro, Javier Matamoros
Items: discussion on the model, definition of the problem to study

• Meeting 2: June 19, 12 noon, 1 hour

Attendees: Sophie Fosson, Carles Antón-Haro, Javier Matamoros

Items: discussion on the model and on possible variations to the algorithm proposed by CTTC, examination of the literature on the problem

• Meeting 3: June 26, 12 noon, 1 hour

Attendees: Sophie Fosson, Carles Antón-Haro, Javier Matamoros

Items: definition of the algorithm, discussion on its analytical convergence

• Meeting 4: June 28, 2.00 p.m., 1 hour

Attendees: Sophie Fosson, Carles Antón-Haro, Javier Matamoros

Items: discussion on the convergence of the algorithm and on the first numerical results

• Meeting 5: July 3, 2.00 p.m., 2 hours

Attendees: Sophie Fosson, Javier Matamoros

Items: discussion on the mathematical details of the proposed algorithms, analysis of other possible algorithms

• Meeting 6: July 10, 3.00 p.m., 2 hours

Attendees: Sophie Fosson, Carles Antón-Haro, Javier Matamoros

Items: discussion on numerical results and on possible improvements, definition of the structure of a paper containing our results

Seminar

• July 10, 12 noon, 1 hour

Technical seminar: “Compressed Sensing over Distributed Systems” held by Sophie Fosson (the slides are attached)

7. Attachments

1. Draft of the paper that will be probably submitted to the ICASSP conference 2014.

2. Slides of the technical seminar held by Sophie Fosson at CTTC.

Torino, August 20, 2013

Sophie Fosson
MOBILITY GRANTS
Activity Report

Researcher: Salvatore D'Oro (CNIT-Catania)- PhD student
Hosting institution: CNRS - Paris Sud
Subject: Game Theoretic approach to timing channel communications in jamming scenarios.
Visit duration: 1 month (1-30 September 2013)

Salvatore D'Oro (CNIT - Catania) has spent one month (1-30 September 2013) as a visiting researcher at CNRS – Paris Sud under the advisiorship of Fabio Martignon and Lin Chen (CNRS – Paris Sud).

According to the subject of the Mobility Grant, “Game Theoretic approach to timing channel communications in jamming scenarios”, research activities addressed security issues in opportunistic networks and were strictly related to those performed in JRA2 (Task 1.2.2).

The addressed scenario consists on an opportunistic wireless network in which several legitimate nodes are communicating while a jamming attack is ongoing. As opportunistic wireless networks are assumed to be energy constrained, it has been assumed that the attacker is a reactive jammer, that is, the jammer attacks the network only when a transmission activity is detected on the monitored channels. This kind of attack is extremely efficient as the jammer does not waste its energy by jamming silence between packets which usually do not convey any information.

Since the assumption of a reactive jammer is feasible and realistic in several energy constrained wireless scenarios, it is also meaningful to assume that opportunistic nodes exploit covert timing channel communications to covertly transmit their data.

In fact, as in timing channel communications data is encoded in silences between events, e.g. silence between a packet and the next one, it has been proven that it is possible to transmit information even if a reactive jamming attack is ongoing.

Thus, it is possible to analyze interaction between the jammer and network users by exploiting the game theoretic framework. In fact, this scenario models a competition between several players as the jammer has to trade-off between jamming effectiveness and energy efficiency by properly tuning the transmission power and the jamming pulse duration, while network users have to choose a proper average silence period duration in order to maximize their own achievable capacity.

Nash and Stackelberg have been studied and equilibrium points have been characterized in two different scenarios, two-person and N-person game. In the two-person game it is assumed that there are a Jammer (J) and a transmitter (T) transmitting on a single channel, while in the N-person game we have a jammer (J) and N-1 transmitters on m wireless channels.

Existence and uniqueness of Nash and Stackelberg equilibria have been proven and conditions on the existence of interior equilibria have been proposed.

Furthermore, insightful results have been obtained showing how, if the transmitter plays as a leader, it is possible to force the jammer in stopping its jamming activity by choosing large average silence period duration.

A shared journal version draft has been defined in which major results are proposed and illustrated.
Annex D- Report of Melchiorre Danilo Abrignani

MOBILITY GRANTS

Report of visit

Guest name: Abrignani Melchiorre Danilo

Guest institution: Radio Networks, DEI@University of Bologna and CNIT

Host name: Lorenza Giupponi, PhD

Host institution: Centre Tecnològic de Telecomunicacions de Catalunya

Title of research: Self-configuration and Optimization of a Hybrid LTE Femto - M2M Network for Smart City Applications

The visit was performed in the period 01.09.2013 to 01.10.2013. The main scope of the visit was to work on the joint research activity between CNIT/UniBo and CTTC. The JRA is on “Self-configuration and Optimization of a Hybrid LTE Femto - M2M Network for Smart City Applications” and it is in the framework of WP1.3. The main idea of the JRA is to optimize the use of the LTE network in a smart city scenario with a large presence of machine type communication (MTC) devices. The JRA was started in May 2013, hence a first part of the work was done before the visit started, the results of this preliminary work were included in the Deliverable 1.3.1. The initial idea to use a LTE network simulator was confirmed during that preliminary work. The LTE network simulator chosen is LENA, a simulator ns-3 based developed from CTTC. During the visit a deep study of the simulator was possible and several issues from the implementation point of view were solved. It was consolidated part of the preliminary work, a first set of traffic patterns for MTC device was developed and integrated in the simulator. Then the scenario was deeply analyzed and it was decided to focus on the scheduler of the LTE small cells trying to define a new scheduler algorithm that being aware of the different kinds of traffic could correctly and efficiently scheduling the user request. It was chosen to focus on an uplink scheduler. In literature a mathematical framework that can be used as starting point to deploy the algorithm, was identified. Test code was produced to understand limits and requirements of the algorithm from the implementation viewpoint. Finally the implementation of the first version of the algorithm was started and a roadmap to continue the JRA were traced. It is planned that a first technical paper should be prepared, with results stemming out of the activity, in Jan/Feb 2014, to be submitted for publication.
Annex E- Report of Mohsen Rezaee

Report of the research stay at Imperial College London

Researcher: Mohsen Rezaee (VUT)- PhD student

Hosting institution: Imperial College London

Subject: Interference management with imperfect channel state information at the transmitter (CSIT)

Visit duration: 1 month (4/09/03/10/2013)

We started to look into interference management when CSIT imperfection is introduced by delay. Delay is a major source of CSIT degradation in wireless networks as the wireless channel is changing over time and the CSIT which is used to design the transmit signal might be obsolete. Therefore we always rely on an estimate of the true channel which is imperfect. In the case that the channel is not changing very fast, one can optimally exploit the correlation of the channel over time and design the transmit signal based on the best estimate of the channel. However when the delay is larger than the coherence time of the channel, it is not possible to exploit the old channels to have an estimation of the current channel. However the old channels are also shown to be useful even though they are completely independent of the current state of the channel. This gain is achieved by precoding over successive time slots using interference alignment.

We started by looking into the degrees of freedom (DOF) gain achieved by this smart precoding in the 2-user MIMO interference channel. In this area there exist several papers and the DOF region is characterized however the achievable schemes are complicated and different for every configuration of the antennas.

In this research collaboration we tried to come up with a general and simple and intuitive scheme which encompasses all the achievable schemes presented for the 2-user MIMO interference channel. The collaboration is ongoing remotely and we have got some insights on this problem. The goal is to finally use this simple scheme and generalize it for asymmetric cases (where the nodes have different amounts of CSIT) and also we are going to extend the result to the case where the channels are not completely outdated where one can also exploit the channel correlation.
Annex F- Report of Riccardo Andreotti

Report of the research stay

Researcher: Riccardo Andreotti

Hosting institution: Alcatel Lucent Chair in Flexible Radio, Supélec, France

Visit duration: From 21/09/2013 to 20/10/2013

Subject: Power allocation for green femto cells using game theory

The topic of the scientific visit concerns the development of a novel distributed resource allocation algorithm in an interference channel scenario based on limited information feedback. In particular, the majority of the effort has been put in the definition of the operating scenario, the analysis of the main open issues of the problem and the definition of the distributed algorithm. The scenario consists of several pairs transmitter-receiver which communicate over the same frequency band at the same time, causing thus harmful interference to each other. Each transmitter sends at its receiver packets made of a certain number of symbols (either uncoded QAM or random Gaussian coding is considered) employing a certain power level. We assume that the transmitter has no information neither on the channel state nor its statistical distribution. The only assumption about the channel is that it remains constant over several packet transmissions, i.e., block fading channel. The receiver attempts to decode the received packet and then feedbacks to the transmitter a positive (ACK) or negative acknowledgment (NACK) if it was able to successfully decode or not the packet, respectively. The decoding probability depends, obviously, on the power and coding rate chosen, the channel over the link and the interference caused by the other pairs transmitter-receiver. The objective of each transmitter is, at each transmission instant, to allocate the power and choose the coding rate only accounting for the information coming from the ACK/NACK feedbacks received so far, as well as for the history of the chosen coding rates and power levels at the previous transmissions. This problem can be formalized as a non-cooperative game where the players are the pairs transmitter-receiver, the strategies are the feasible set of power and coding rate and the objective function is instead related to the estimate of the channel-to-interference-plus-noise (CINR) of each link. In fact, the proposed solution can be summarized as follows. At every transmission attempt, each transmitter tries to estimate the CNIR over its link, through an estimator based on the ACK/NACK feedback and on the expected error probability. Then, the coding rate and the power are allocated in order to maximize the Fisher information, which minimizes the variance of the CINR estimator. Preliminary results obtained by simulation for 2 pairs transmitter-receiver show that the proposed algorithm converges to the desired solution: the power and coding rate converge to a constant value and the CINR of each link is well estimated at each transmitter.
Annex G- Call for awards

Seventh Framework Programme

1ST BEST PAPER, YOUNG RESEARCHER and DISTINGUISHED RESEARCHER AWARDS

Call for submissions

Opening/Closure of the call: September 06/September 30, 2013
Project acronym: NEWCOM#
Type of contract: NETWORK OF EXCELLENCE
Contract No: 318306
Project URL: http://www.newcom-project.eu/
### GENERAL ASPECTS

**Purpose**
The aim of the awards is to encourage (especially, young) researchers to publish their research work and to promote a healthy competition among researchers and institutions.

**Participants**
The papers must have originated from NEWCOM# researchers and contain the acknowledgement of NEWCOM# support.

**Budget**
The budget allocated to each award is 750 euro.

Three awards will be issued during the first year of NEWCOM#:

- 1st Best Paper Award (BPA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers;
- 1st Young Researcher Award (YRA): to the best paper already published or accepted for publication by the submission deadline, and authored by NEWCOM# researchers. The first author must be under 30 years of age.
- 1st Distinguished Research Award (DRA) to a (group of) researcher(s) belonging to NEWCOM# that has achieved special results in research or dissemination resulting of his/her (their) activity in the project and during project’s lifetime.

**Prize-giving**
The prize will be issued to the winner by the coordinator (CNIT)

### EVALUATION OF PAPERS

**Criteria**

- Contribution to the advancement to the field of Wireless Communications;
- Relevance to the objectives of NEWCOM# (links to WPs);
- General quality, originality of research, contributions, subject matter, clarity and style of presentation;
- Priority: papers co-authored by researchers belonging to more than one NEWCOM# partner will be given special consideration in the evaluation process.
- Ceteris Paribus, preference will be given to female researchers

**Procedure**

Two Committees will evaluate the submissions:

- Each paper will be evaluated by the BPA Committee, formed by external distinguished experts.
- The Distinguished Research Award will be evaluated by a committee of distinguished NEWCOM# researchers.

Both Committees will be chaired, without voting privilege, by the NoE Scientific Director.

**Schedule and Documentation**

For the BPA and YRA awards, the applicants must send a PDF version of their paper(s) to the NEWCOM# Office at project.office@newcom-project.eu by the submission deadline indicated below. For the DRA award, instead, the applicants must provide a short document (max. 1 page) describing the achievements as a result of his/her (their) involvement in the project plus CV(s).

Submission deadline: September 30, 2013

Notification of the ranking: October 15, 2013.

Award materially presented to winners during the 1st NEWCOM# Annual Event.

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AWARDS – Call for submission – Page 2 of 2
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