Seminars Report

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1 Introduction

The main purpose of this Thesis is to explore the applicability of Reinforcement Learning into the Spatial Reuse problem in Wireless Networks. Due to the variability in terms of user activity suffered at the kind of scenarios we aim to mostly focus (residential buildings, shopping malls, stadiums, trains, etc.), real-time mechanisms turn out to be necessary to dynamically configure devices so as to adjust parameters such as the frequency channel, the transmit power or the sensitivity threshold. To provide a reliable and flexible solution, we focus on Reinforcement Learning, so that wireless networks are empowered to act autonomously according to their requirements and possibilities.

2 Career development

In order to be active in the research community, we have created the following profiles:

- Website: `https://www.upf.edu/web/fwilhelmi`
- Scholar: `https://scholar.google.es/citations?user=4EHXj4UAAAAJ&hl=ca&citsig=AMstHGShG4ofYlHpMmt1o34BA0qt08UFxQ`
- Orcid: `http://orcid.org/0000-0003-3936-535X`

For a proper career development, we attempt to generate valuable and rigorous work in order to publish in relevant journals (e.g. Computer Networks[1], IEEE Intelligent Systems[2], etc.). Furthermore, working with other researchers is fundamental to constantly improve and gain knowledge. Finally, another important aspect for a proper career development in research, is to be an active reviewer. Hence, during the first year we have participated in some reviews, and even acting as TPC in the 2nd Workshop on Data Science for Internet of Things.[3]

[1] `https://www.journals.elsevier.com/computer-networks/`
[2] `http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?reload=true&punumber=9670`
[3] `https://ds-iot.org/`

3 General reproducibility aspects

To properly share the generated knowledge, and with the aim of making reproducible the production derived from our research activity, we have created a Github account for the Wireless Networking Research Group.[4]. Furthermore, in relation to the research compendium provided under the MdM excellence unit, we have established a set of guidelines for reproducibility:

- Publish the papers in arXiv for openness.
- Publish the code in Github. Furthermore, we follow the Clean Architecture, so that our code can be completely understood by a third party.
- Publish the experiments in Github together with the code.
- Attach *readme* files. In many occasions, it is required to provide some guidelines about how to run the code, as well as the accepted input parameters. In addition, it is worth to share other features of the simulation, such as the type of scenario used (including path-loss models, type of devices, traffic model, etc.).

As an example, for the conference publication submitted to PIMRC [1], we provided the source code used for simulations, specifying the concrete commit for the provided results. In addition, the code was prepared in a such way that simulations can be easily executed to reproduce similar results[5] to the ones shown in the publication.

4 Data Management

The majority of the data I will use during the thesis will be generated by us through programs and real testbeds. However, we expect some real data from FON, which may include some requirements regarding confidentiality that must be considered when the agreement is finished. We expect to manage huge amounts of data. Thus, in the high performance computing (HPC) cluster, I will order and labeled data properly not only to facilitate the collaboration with group members, but also the work of the administrators. Similarly I continuously use both the personal and groups GitHub account. In there, we are aimed to properly comment every piece of code and support material. Also, we use the issues functionality for tracking the updates on the different projects, asking for help, proposing new approaches, etc.

5 Ethical issues

Most of the activities planned for this Thesis involve using analytical models and simulated data related to wireless communications. Therefore, personal data is not expected to be manipulated. However, as the WNRG is getting involved into a collaboration with FON[6], there is some data to be used that may indirectly tell something about someone. In this case, the enterprise is the entity that collected the data, so we are only being requested to firm confidentiality agreements and to act responsibly.

[4] `https://github.com/orgs/wn-upf/dashboard`

[5] Results may slightly vary due to the randomness added to the proposed scenario

[6] `www.fon.com`

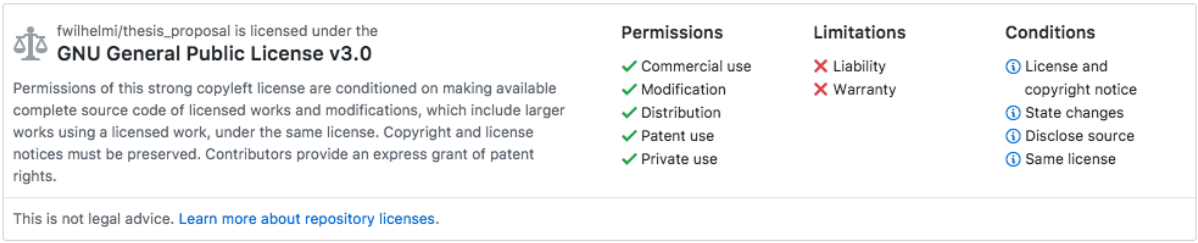

Figure 1: GNU License

6 Intellectual Property

As a general rule, the research knowledge generated is aimed to be completely open, so that it can be freely used by other researchers. For that purpose, the contents generated in each project are published in Github under the GNU license (see Figure 1), which provides a large range of permissions in exchange for using the same license. However, there are some other cases in which knowledge cannot be freely shared, so a more restrictive licensing must be applied to the generated research output. This is the case the collaboration with FON, which requires setting the scene before making any publication.

7 Computing needs

To the proper development of the experimental part of some of the ongoing projects involved in the Thesis, it is required a strong computational power. A really useful available tool is the (HPC)[7], which is composed by 15 nodes that provide high-performance calculation support to the DTIC community. In order to make use of the HPC, we have spiked on running advanced jobs in parallel. Some of our latest results ([1]) have been obtained from HPC executions with the Matlab parallel toolbox. In addition, to bring the usage of the HPC to the WNRG, we have created specific instructive material[8] to fulfil the needs of the group. Thus, HPC is introduced so that it can be rapidly used for the practical purposes of the Wireless Networking Research Group.

8 Scientific and general disseminations

The main activity performed so far regarding scientific dissemination is the participation on the 5th EITIC Doctoral Workshop[9], which was held at UPF the last March, 5th 2017. In this event, we presented [2], an introduction to the wireless networks coexistence issues and the techniques that we aim to study along the Thesis to solve them. The poster was prepared in order to be simple, readable and eye-catching, so that a diverse audience can comprehend the problem and get interested on it.

[7] http://hpc.dtic.upf.edu/

[8] Material available in https://drive.google.com/file/d/0BzOhuzdX0br5b3pWMEFUZ3JDVUk/view?usp=sharing.

[9] https://www.upf.edu/web/etic_doctoral_workshop

In parallel to the main research activity, we have also participated in the following dissemination activities:

- Teaching staff in "Descobrint l'Internet de les Coses a travs d'Arduino": introductory course about the Internet of Things (IoT) through Arduino. Held at UPF (Campus Junior) from 10th to 14th July, 2017.
- Jury member in the "XI Award to Research Project in Applied Engineering and Mathematics"[10].

Both activities aim to disseminate Engineering to teenagers in order to help them determine their academic career.

9 Gender

Regarding the unfortunate gender imbalance that also reaches the scientific field, it is very important to be conscious of the problem and act in consequence to favour equality. For that, the most obvious act that we are able to do in research is to cite papers indiscriminately of the authors gender, which seems very natural but for many people is not. To the matter of our Thesis, we find several women researchers that stand out, which work is not only worth to be mentioned, but a must:

- Cristina Cano[11]
- Konstantina Papagiannaki[12]
- Christina Thorpe[13]
- Setareh Maghsudi[14]

References

[1] Francesc Wilhelmi, Boris Bellalta, Cristina Cano, and Anders Jonsson. Implications of decentralized Q-learning resource allocation in wireless networks. *arXiv preprint arXiv:1705.10508*, 2017.

[2] Francesc Wilhelmi, Boris Bellalta, Cristina Cano, and Anders Jonsson. Improving spatial reuse in high-density wireless networks through learning. *5th EITIC Doctoral Workshop*, 2017.

[10] https://www.upf.edu/en/web/etic/research_project_award
[11] https://scholar.google.es/citations?user=3fpyaLkAAAAJ&hl=es
[12] https://scholar.google.es/citations?user=xuVXDXkAAAAJ&hl=ca
[13] https://scholar.google.es/citations?user=Wed8UJwAAAAJ&hl=es
[14] http://dblp.uni-trier.de/pers/hd/m/Maghsudi:Setareh