



ABCDE



Scientific Report

First name / Family name

Arash Maskooki

Nationality

Iranian

Name of the *Host Organisation*

Inria

First Name / family name
of the *Scientific Coordinator*

Nathalie Mitton

Period of the fellowship

01/01/2014 to 31/12/2014



I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

During my fellowship, I focused on optimizing the spectrum efficiency of the cognitive radio network. The electromagnetic spectrum is a scarce natural resource and has already been allocated by governments for specific applications. However, the emergence of smart computing devices with bandwidth demanding technologies and applications as well as the increasing number of wireless device users has rendered legacy spectrum allocation inefficient. A promising approach to improve spectrum efficiency is cognitive radio. The main objective of cognitive radios is to access the allocated band when and where it is not used by its primary user. Nevertheless, choosing the best channel at the right time to sense and transmit is a non-trivial problem.

I modelled the channel exploration-exploitation dilemma in a cognitive radio context as a multi-arm bandit problem and applied common multi-arm bandit techniques including, upper confidence bound and ϵ -greedy methods on the channel measurement data. In addition, I developed a learning algorithm based on Thomson sampling where I modelled each channel observation as a Bernoulli trial with channel availability rate as the Bernoulli parameter and used Beta distribution as the prior. Using Bayesian learning, I showed that Thomson sampling method converges to the best channel faster and more efficient comparing to the other methods. In a more realistic scenario, I relaxed the stationary channel assumption and developed an infinite hidden Markov model for the channel availability rate. I combined this model with ϵ -greedy algorithm to dynamically track changes in the availability rate of the channel and switch to the best available channel. Through MATLAB simulations, I showed that the proposed method could outperform the algorithms using conventional multi-arm bandit learning techniques.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

A. Maskooki, G. Sabatino, and N. Mitton, "Analysis and performance evaluation of the next generation wireless networks", *Modeling and Simulation of Computer Networks and Systems: Methodologies and Applications*, Springer 2014.

V. Loscri, A. Maskooki, N. Mitton, and A. M. Vegni, "Wireless Cognitive Networks Technologies and Protocols", *Modeling and Simulation of Computer Networks and Systems: Methodologies and Applications*, Springer 2014.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

ABCDE Seminar IV, 23-24 October 2014, CNR Pisa, Italy



IV – RESEARCH EXCHANGE PROGRAMME (REP)

During my research exchange programme, I visited Mobile Communications Research Group (GRCM) at Universitat Politècnica de Catalunya (UPC) in Barcelona. There I presented my research for the team members and they presented their research work briefly. We had several discussions and they demonstrated the system they had developed to transmit video using cognitive radio.