gipsa-lab

STAGE INTERNSHIP

MASTER 2

Date of Offer : 07/12/2020

A feasibility study on the effect of wi-fi hotspot signaling on human brain by means of electroencephalography

SUPERVISORS:

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PLACE OF INTERNSHIP:

Department Images-Signal, GIPSA-lab, in the campus of Grenoble.

DURATION OF INTERNSHIP:

The internship will start on February 2020 and will end on Juin 2020 (5 months).

CONTEXT:

This project aims at assessing the feasibility of a new experimental paradigm designed to study the effect of wi-fi hotspot signaling on the human brain by means of electroencephalography (EEG). It is possible thanks to the synergetic proficiency of the ViBS team on human EEG and of the Sigma-Phy team on applied electromagnetics. The project involves the use of experimental facilities available at the GIPSA-lab (the PERSEE and the MONT-BLANC platforms).

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SUBJET:

Wi-fi hotspots continuously emit electromagnetic waves within several bands around the 2.4Ghz carrier frequency (n protocol). More recent hotspots also use bands around the 5GHz and/or 6GHz (ac or ax protocols). Regardless whether data is transmitted or not and whether terminals are connected or not, wi-fi hotspots continuously emit short packets in

the form of pulsations of the carrier wave, named the 'beacon signal' or the wi-fi 'signaling'. These packets signal the availability to terminal searching a hotspot in order to establish a point to point wi-fi connection. In the overwhelming majority of hotspots, the beacon packets are sent at a 10 Hz frequency.

As seen by electroencephalography (EEG), the functional structures of the human neocortex at rest oscillates at frequencies in between 8 and 12 Hz. The average resting oscillation frequency of the posterior dominant rhythm (alpha) across individuals is 10 Hz and for most individual it is in the range 9-11 Hz. These oscillations are amplitude-modulated at lower frequencies and often comes as 'bursts".

RESEARCH TOPIC:

The question arises whether the wi-fi beacon signal may influence, linearly or non-linearly, the bio-electromagnetism of the neocortex. In fact, it is well known that electromagnetic radiation excites voltage-gated calcium-ion channels and this has immediate effects on the neurons; a linear effect would be observed if the hotspot beacon packets elicit evoked potentials and/or if the resting oscillation tends to synchronize to the hotspot beacon packets. Non-linear effects could be evidenced in the form of non-linear event-related potentials by analysis methods such as recurrence quantitative analysis. In order to study these effects, the hotspot beacon signal and the EEG of the subject submitted to the wi-fi radiation must be acquired and sampled synchronously with a high sampling rate.

EXPECTED WORK

The candidate will carry out pilot studies using a new experimental paradigm that is currently being developed at GIPSA-lab in order to acquire and sample synchronously the hotspot beacon signal and the EEG of the subject submitted to the wi-fi radiation. S/He will also evaluate linear and non-linear signal processing methods to study the possible effect of the hotspot beacon signal on the human brain.

MOTS CLEFS:

electroencephalography (EEG), electromagnetic waves, wi-fi, beacon signal, non-linear.

REMUNERATION:

The internship will be remunerated at 1/3 of SMIC.

REQUISITES:

The candidate should possess good knowledge on applied mathematics and electronics, with particular emphasis on digital signal processing and antennas. The candidate should also have experience with high-level programming language such as Julia, Python or Matlab.

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