

COST-STSM-TD1301- 20737 Scientific Report

STSM Topic: Breast cancer classification & set-up of CEMI-SUSTC & industrial visit

STSM Applicant: Raquel Cruz da Conceição (Instituto de Biofísica e Engenharia Biomedica, Faculdade de Ciências, Universidade de Lisboa, Portugal)

Host: Professor Yifan Chen (South University of Science and Technology of China (SUSTC), Shenzhen, China)

Period: 23/08/2014-29/08/2014

(i) Abstract

The applicant followed Professor Chen's work on classification of breast cancer using microwave signals very closely, as this was one of the main topics for her PhD thesis which was titled "The Development of Ultra Wideband Scanning Techniques for Detection and Classification of Breast Cancer".

While the applicant first started testing her classification algorithms on tumour models that had been created using Gaussian Random Spheres (following some work published by Davis *et al*, 2008). Professor Chen developed a 2D modelling method for benign and malignant breast tumours by extending a method to determine tumour boundaries in X-Ray mammograms on polygonal approximation by Rangayyan *et al*, 1997. Also, we have used different approaches for classifying these tumour models.

Professor Yifan Chen and I have been collaborating on the completion of a book chapter called "Lesion Classification". The work in this chapter falls in the milestones proposed for WG1 in the MoU, in particular "- Classification/extraction of non-image information from microwave signals". During this STSM, the applicant will be discussing and advancing the completion of this book chapter (to be released in a Springer Brief next year).

Moreover, Professor Yifan Chen and his group have started preparing their laboratory for their own microwave imaging prototype. Also, they have recently attracted significant commercialisation interest for their prototype and it will be important to further discuss potential endeavours for the Action in terms of its transition from experimental to clinical trials and commercial products.

(ii) Purpose of the STSM

The purpose of this STSM was to visit Professor Yifan Chen, one of the Action's IPC members and his colleagues and researchers at SUSTC, to both advance on some on-going joint work (a book chapter) and also to discuss future venues for collaboration. Also, Professor Yifan Chen organised a visit to a medical company (ET Medical) with whom they have recently started collaborating. Finally, during the STSM, the applicant became first exposed to the SUSTC facilities where their Centre of Excellence in Microwave Imaging (CEMI) will be operating.

(iii) Description of the work carried out during the STSM

During this STSM the following work was completed.

Day 1: Presentation of the applicant to the host: the SUSTC and the staff at the Department of Electrical and Electronic Engineering. The applicant also visited the laboratories where the Centre of Excellence in Microwave Imaging (CEMI) in SUSTC will be running. The applicant made a presentation about the COST Action and also her research work, on the same day as a presentation from professor Shiina from Chiba University in Japan. This was followed by a technical discussion of the presented work, in particular some suggestions were given on how to model tumour phantoms (to be tested in Microwave Imaging prototypes) and to further classify tumour phantoms *via* complex resonances (similarly to methods studied by Professor Yifan Chen and Doctor Fan Yang)

Day 2: Visit to a Shenzhen based medical company called ET-Medical. The company made a presentation on several of their equipment, namely: Ultrasound equipment (specialized for liver diagnosis), Hyperthermia chambers, radiotherapy equipment and also some small equipment for veterinary use. Also during this day, the applicant discussed some steps that have to be completed towards a book chapter (called "Lesion Classification" to be included in a Springer brief related to the work in the Action) that she has been working on with Professor Yifan Chen.

Day 3: The full day was dedicated to working on the chapter “Lesion Classification”.

Day 4: During this day, the applicant had a long discussions with Doctor Fan Yang (Professor Yifan Chen’s post-doctoral researcher). During this talk, Doctor Fan Yang presented most of the work that he completed at the University of Technology in Sydney towards his PhD, which is extremely related to what the applicant did during her PhD. The applicant also spent part of the day reading material from Doctor Fan Yang’s PhD thesis so that future collaboration could be discussed.

Day 5: The full day was dedicated to working on the chapter “Lesion Classification”.

(iv) Description of the main results obtained

Due to the short length of this STSM, most of the results are expected to be completed in the period after the STSM. Work has been completed towards the writing of the chapter “Lesion classification” to be part of a Springer Brief next year. Also, future directions of collaborative work have been discussed. These are further described in sections (v) and (vi).

(v) Future collaboration with host institution (if applicable)

This STSM allowed to establish the initial starting point for future collaboration with the host institution. Both the applicant and researchers at SUSTC have completed research towards the classification of breast cancer using different classification methods: the applicant has analysed the radar target signature of tumours to classify tumours in terms of their size and shape while the host researchers have used the complex natural resonance of lesions to further classify them. The applicant provided some signals recorded at the National University of Ireland in Galway (in collaboration with Doctor Martin O’Halloran and two students from the applicant’s institution) to Doctor Fan Yang so that he can apply his classification algorithms and compare results to those obtained by the applicant.

Also, Doctor Fan Yang has developed an antenna during his PhD that would suitable for a project that the applicant recently applied funding for (together with the Instituto de Telecomunicações in Lisbon, Portugal) related to the imaging of the underarm for lymph node detection. Further collaboration is anticipated with SUSTC if the applicant is successful in being funded for this project (MSCA-IF submitted in September 2014).

(vi) Foreseen publications/articles resulting or to result from the STSM (if applicable)

The chapter “Lesion classification” is scheduled for completion early in 2015. A publication (possibly to a conference) may be considered, comparing the two classification approaches developed by the applicant and the host.

(vii) Confirmation of the host of the successful execution of the STSM

We confirm that Raquel Conceição from Instituto de Biofísica e Engenharia Biomedica, Faculdade de Ciências, Universidade de Lisboa, Portugal worked in our laboratories at South University of Science and Technology of China (SUSTC), Shenzhen, China, from 23/08/2014 to 29/08/2014.

The visit has been successful and the results are described in this report, which I confirm.

Professor Yifan Chen

Handwritten signature of Professor Yifan Chen in black ink.

(viii) Other comments (if any)

No further comments