# Short Term Scientific Mission Report
## Cost Action IC09303

**Visiting researcher (beneficiary):** Katarina Gavrić
**Host**: Nico Van de Weghe, Faculty of Sciences, Ghent University
**Period**: from November 1st to November 23rd
**Place**: Ghent, Belgium

## Purpose of STSM

Main objective of the visit for a visiting researcher was to familiarize herself with current research being conducted by the host group in the area of extracting patterns of movement, understanding human spatio-temporal behavior and dynamics using Bluetooth tracking data, but also to compare several aspects of data sets (Bluetooth and Flickr), in order to examine if the Flickr data can be used as a alternative to proprietary mobile-phone-use related data. Also, host group gained insight into methods and tools used by the visiting scientist's group for meta-data representation and visualization, which provided new perspective of some of their existing data, enabling for some new knowledge to be extracted.

In specific, objectives set for this visit were:

- Share knowledge of the techniques employed in our research with the host group in the Ghent University.
- Get to know and learn the intelligence gathering algorithms and tools that the host group has developed and is using.
- Compare several aspects of available data sets (Bluetooth and Flickr), in order to examine if the Flickr data can be used as a alternative to proprietary mobile-phone-use related data.
- Discuss future collaborations and outline an joint research paper based on the analysis of tracks present in community-contribute multimedia data and Bluetooth tracking data.

These objectives were largely achieved during the visit, and some additional ones were defined and will be actively pursued in the future. The research conducted during this visit also expanded towards the development of new methods for user-dynamics analysis that combine geo-visualization techniques with image and video content-discovery techniques.

## Description of the work carried out during the STSM

First five days of the visit were spent on introduction to techniques and methods used by both research groups, as well on introduction to data sets which was used for various analysis later on. Prof. Nico Van de Weghe and Mathias Versichele of the Faculty of Sciences explained in-depth the algorithms their group used to analyze the data based on tracking of users obtained from the Bluetooth service. During this period, I gave an insight about the methods employed by the FTS group to crawl the Flickr for meta-data that is subjected to different spatial and temporal analysis in order to discover patterns in movement and geographical concentration of its users; we had a discussion afterwards on how approaches of our groups could be combined to discover new knowledge in existing data and how Bluetooth and Flickr data could be combined.

Next two days, I was working on pre-processing of Bluetooth and Flickr data in order to eliminate entries that had invalid time and spatial attributes, users with only one geo-referenced tag, as well as duplicate entries uploaded by the same user at the same geographical location.

The rest of the period was reserved for conducting experiments that included:

- Clustering and Visualizing the Flickr data and detecting interesting patterns (FTS approach).
- Visualizing the Bluetooth data in order to compare it with results obtained with Flickr data.
- Extracting movement patterns of Bluetooth and Flickr users for a selected region (Ghent) and selected period (Ghent Light festival).
- Comparing Bluetooth and Flickr users' movement patterns for a selected region.

## Description of the main results obtained

This short visit enabled both teams to gain insight into the research being conducted by the other team, which was one of the main goals of the mission. This lead to deeper understanding of differences between the users of services each team was focusing on (Flickr and Bluetooth respectively), and identification of ways to somehow merge the FC and FTS approach in order to extract even more knowledge from existing data. Preliminary experimentation showed some promising results, and several common research strands have been identified, followed by outlining a few goals that will be actively pursued by both groups during the next few months. Still, there is a work to be done in order to get the results which will confirm that Bluetooth and Flickr data are indeed comparable.

## Future collaboration with host institution

As described above, several common research areas have been identified, and even some short-term goals have been set. In addition to these, a few other topics have been discussed that are indirectly related to the ongoing joint research (for example, characteristic frame extraction from Bluetooth data that might be used later on to classify and geographically assign geo-referenced Flickr, based on other data sets collected for the city of Ghent) and which show a good potential for expansion of this research and laying foundation for some new ones.

## Foreseen publications/articles resulting or to result from the STSM

Several conferences and journals have been considered for publication of papers that ought to emerge as a result of the joint research efforts of the FS and FTS groups. Still, there is work to be done in order to get nice publication which will be significant for the scientific community.