Short Visit Grant ⊠ **or** Exchange Visit Grant ☐

(please tick the relevant box)

Scientific Report

The scientific report (WORD or PDF file – maximum of eight A4 pages) should be submitted online <u>within one month of the event</u>. It will be published on the ESF website.

<u>*Proposal Title*</u>: Topological analysis of 3D images

<u>*Application Reference N°*</u>: 7151

1)   Purpose of the visit

The visit was scheduled to strength the existing collaboration with Prof. Noel O'connor and Dr. David Monaghan. We began to collaborate three years ago, with the outcome of a contribution to a conference [1], as well as an article publication [2], in which a topological evaluation of a 3D reconstruction process (called voxel carving) was carried out by means of an experimental use of persistent homology.

[1] Persistent Homology for 3D Reconstruction Evaluation, Antonio Gutiérrez, Maria-Jose Jimenez, David Monaghan and Noel E. O'Connor. In: 4th Int. Workshop on Computational Topology in Image Context, CTIC 2012, May 2012, Bertinoro, Italy. LNCS 7309, pp. 139–147, 2012.
[2] Topological evaluation of volume reconstructions by voxel carving, Antonio Gutierrez, Maria-Jose Jimenez ,David Monaghan, Noel E. O'Connor. Computer Vision and Image Understanding 121 (2014) 27–35.

2)   Description of the work carried out during the visit

We have exchanged background information, on one side, on previous works on which persistent homology has been used so far in shape retrieval an gait recognition and, on the other side, on papers developed in Prof. O'Connor's team regarding activity recognition.

We have convened that the use of persistent homology could provide interesting insight within the classification of movements of 3D reconstructions of sports players.

Dr. David Monaghan has been working to provide a suitable set of data as basis for experimentation. We have used them to design a first approach to solve the problem and some initial experiments have been carried out.

3)   Description of the main results obtained

Our aim now was to explore the use of persistent homology as a key tool for classification of the activity carried out by a 3d human model on a video sequence. We have restricted to video sequences of 3D reconstructions (obtained by voxel carving) of a tennis player and have fixed the goal of distinguishing forehand and backhand movements. Our first approach consist in taking, from each 3D frame, the projection of the volume on a certain plane of interest to construct an "action volume", as it is described in literature, which will be subject of persistent homology computation. We are still in process of experimentation with different functions so that the information obtained is as rich as possible.

4)   Future collaboration with host institution (if applicable)

We intend to maintain the current collaboration in future. We agreed that there are other contexts on which we could collaborate as, for example, activity recognition taking as input the squeleton provided by the kinect.

5)   *Projected publications / articles resulting or to result from the grant (ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant)*

We are in the process of writing a paper to be sent to a journal. Just now, we have in mind Pattern Recognition Letters.

6)   Other comments (if any)