

ESR 7

Name: Matevž Domajnko

Your credentials:

Univ. Dipl. Eng.

University Diploma in Geodesy and Geoinformatics

Start day: 01/09/201

End day: 01/09/2017

Involved in WP:

WP1, WP2, WP3, WP4, WP5, WP6, WP7

Hosting Institution:

Fraunhofer IGD



My Research Training Activity in ITN-DCH

A. Summary of the Career Development Plan:

Main focus of ESR7 work is in the 3D reconstruction domain within CultLab3D, in particular technologies to speed up 3D photogrammetric reconstruction from still images or videos. In parallel he will be introduced to other digitization technologies such as Laser, structured light digitization and time of flight sensors to ultimately be able to develop, manage and master a variety of different digitization technologies and fuse results into consolidated virtual models.

The goal is to develop and apply 3D reconstruction techniques to a variety of cultural heritage artefacts requiring several different digitization approaches while focussing predominantly on the scientific development of massively parallel photogrammetric reconstruction. For multi-view-stereo (MVS) reconstructions, suitable subsets of images need to automatically be selected and eventually masked to decrease reconstruction time and reduce the possibility of erroneous matching of feature points.

To speed up the 3D reconstruction process research will be done on parallel processing mechanisms as well as algorithms running on multiple-cores or GPUs ranging from parallelizing algorithms to run on a single multi-core machine up to an HPC cluster.

In addition ESR7 fellow will be introduced to the capturing and processing of optical material properties, allowing to capture and mimic the appearance of an artefact based on BRDFs or SVBRDFs.



B. Core Research Training Activity:

After recruitment of ESR7, Matevz Domajnko, a series of training activities have already taken place, some within the ITN-DCH project as for example summer-schools and ongoing exchange with other partners and fellows and some in the depth of digitization of cultural heritage.

The first training activity for Matevz was digitization of the Pergamon Altar at the Pergamon Museum in Berlin, the most visited German museum. Competence Center for Cultural Heritage Digitization scanned the overall room where the Pergamon Altar is located and in particular the 113m Gigantomachy Fries depicting a battle between the Giants and the Olympians. The whole room was scanned using Laserscanning technique with 1-2 mm of accuracy. For the Fries a photogrammetric approach was chosen in order to achieve accuracy of 500µm.

Matevz had the opportunity to learn how to use both, the Laserscanning technology and the Photogrammetric capture setup and has now been introduced to 3D reconstruction software as well as 3D modellers (Agisoft Photoscan and Meshlab).

Nevertheless, core research training activity for Matevz is digitization process at the CultLab3D pipeline - the worldwide first, fast and economic 3D mass digitization pipeline. In the beginning of November 2014 Matevz had a chance to do tests with the CultArc3D – first station of the 3D scanning system. In this way he was confronted with challenges in mass digitalization, classification and archiving of museum inventory.

Since the goal is to develop massively parallel 3D reconstruction algorithms for CultLab3D, he is doing research on how to make use of all available information to speed up this process such as the fact that camera positions in the automated digitization pipeline are known.

C. Secondments:

Planned secondments for 2015 for ESR 7 fellow:

1. ArcTron 3D: one month (from 15/05/2015 to 10/07/2015)
2. USTUTT: for two weeks (from 07/09.2015 to 18/09/2015)

D. Dissemination & Outreach:

Dissemination and Outreach activities of the fellow during the first stage of the project.

- Working meeting @ Digitale Rekonstruktion, Darmstadt, November 2014
- Exhibition @ Autodesk University 2014, Las Vegas, December 2014

Upcoming Dissemination:

- Oral presentation @ SEAHA Conference, London, July 2015

E. **Added Value** to ESR7 Future Research Career:

ESR position within ITN-DCH has already broadened horizon of ESR7 fellow by providing the opportunity to interact with Cultural Heritage Digitization professionals, allowing to develop a more integrated view across a range of disciplines.

Fellow will gain knowledge in the field of computer vision and image processing, in particular 3D reconstruction based on photogrammetric approaches, 3D/4D-reconstruction techniques using Photometric Stereo and Multi-view Stereo and other photogrammetric methods. Fellow will improve his implementation skills, such as programming skills in C++, as well as experiences with cross-platform build systems such as cmake.

Furthermore, communication skills, scientific writing and proficiency in English will be significantly improved.