MODULES & DEMO

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EUROPEAN RESEARCH INFRASTRUCTURE FOR HERITAGE SCIENCE

TRAINING CAMP 2024

Digital Heritage Camp: 3D Surveying Training in Sermoneta Castle and Ninfa Park

August 26 - September 7

SERMONETA
Latina, Lazio, Italy

organised by

CNR IDSU | Consiglio Nazionale delle Ricerche | Istituto di Scienze del Patrimonio Culturale | Consiglio Nazionale delle Ricerche | Istituto di Scienza e Tecnologie dell'Informazione "A. Faedo"

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MUDULES

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MODULE 1 | Topography, CNR ISPC

The lectures will focus mainly on theoretical basics and practical activities related to the use of Global Navigation Satellite Systems (GNSS), with emphasis on reference systems and instrumental use in differential mode. The most common territorial surveying and data processing activities for the visualization of digital terrain models (DTMs) and applications within GIS platforms (QGIS) will also be addressed. Additionally, it will cover essential aspects of terrestrial surveying, incorporating techniques using total stations for supporting laser scanning and photogrammetry.

MODULE 2 | Photogrammetry, FBK & CNR ISPC

This module covers fundamental principles to advanced techniques. Participants will learn how to generate precise 3D models from images, leveraging Structure from Motion (SFM) algorithms. Through practical exercises and hands-on projects, students will develop proficiency in various aspects of photogrammetry, including basic concepts, panoramic photogrammetry, and AI-driven applications:

Basics - This section introduces the fundamental principles and workflows of photogrammetry, covering topics such as camera calibration, image acquisition techniques, and the generation of point clouds and meshes.

Panoramic Photogrammetry: this section will delve into panoramic photogrammetry, exploring techniques for creating immersive 360-degree panoramas, stitching panoramic images, and discovering applications in fields like virtual immersive experiences.

AI and Photogrammetry: The final section focuses on the intersection of artificial intelligence and photogrammetry. Participants will explore AI-driven feature detection and matching, dense reconstruction using deep learning techniques.

MODULE 3 | TLS (Terrestrial Laser Scanner) survey, UNISA

The aim is to deepen knowledge of the TLS survey methodologies used to document archaeological objects, architectural structures and cultural sites. The module also aims at the practical analysis and critical evaluation of reality-based 3D surveying for the metric documentation, conservation, restoration and valorization of cultural heritage.

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MODULE 4 | Close Range Scanning, CNR ISPC

For the measurement of artifacts, given their smaller size and transportability, sensors with a lower measurement threshold are preferred, also with a modest range, with submillimetric precision, which are also characterized by limited working windows, i.e. structured light scanners. This module familiarizes students with this type of technology.

MODULE 5 | CloudCompare, FBK

This module focuses on utilizing CloudCompare software for point cloud manipulation. Participants will learn the fundamentals of point cloud processing and filtering, editing, and advanced visualization, and analysis using CloudCompare's features.

MODULE 6 | MeshLab, CNR ISTI

This module will explore some of the most powerful MeshLab features. Participants will delve into mesh processing and editing techniques, learning to refine, manipulate, and optimize 3D meshes. Advanced features for texture enhancement and geometry and visualization will also be covered.

MODULE 7 | Passive and active technologies integration, CNR ISPC

The wide variety of solutions for the acquisition, management and integration of three-dimensional survey data, both open source and proprietary, offers a panorama of techniques and tools whose choice depends on numerous factors, in particular the objects or contexts to be surveyed and the conditions of use in the field. However, a single tool and software is almost never sufficient to meet the descriptive and analytical requirements of a larger project. In fact, there is an increasing need to integrate data from multiple scanning tools and methods into a single project. This module will offer and discuss different ways to manage and integrate multi-sensor 3D data.

MODULE 8 - Data publication, CNR-ISPC + CNR-ISTI

In this module, students will explore Aton and 3DHOP, open-source frameworks developed by CNR ISpc and ISTI and designed for crafting interactive web presentations of high-resolution 3D models. Participants will gain insight into the fundamental principles behind web-based 3D visualization. Through hands-on exercises, students will experience the frameworks Aton and 3DHOP to showcase complex 3D models on the web.

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DEMO

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DEMO 1 | Drone, CNR ISPC

The demo will delve into the potential of drones featuring LiDAR and multispectral technologies. A live aerial demonstration will show high-precision 3D mapping and spectral insights beyond the visible spectrum, revealing archaeological evidence and hidden structure. The experts will demonstrate possible applications in heritage preservation, site documentation, and landscape analysis.

DEMO 2 | SLAM, CNR ISPC

The demonstration will illustrate SLAM (Simultaneous Localisation and Mapping) in the context of historic building digitisation. This technology represents a dynamic way of acquiring spatial information, centred on the predefinition of acquisition paths capable of producing centimetre-precise clouds, which can be implemented through integration with other technologies. The demonstration activity will illustrate a standard procedure applied to the sites proposed by the training camp; moreover, the scientists involved will show the potentialities and criticalities of the methods and tools, also through the presentation of activities carried out in some ISPC research projects.

DEMO 3 | GuPho, FBK

The demo will explore the GuPho system from FBK, ARM-based, low-cost and lightweight stereo vision mobile mapping system based on a Visual Simultaneous Localization And Mapping (V-SLAM) algorithm. The demonstration will show the effectiveness of the prototype in mapping large and intricate scenarios, enabling motion blur prevention, robust camera exposure control and achieving accurate 3D results.

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