Marie Curie Initial Training Network on Digital Cultural Heritage

Our Story 2013 – 2017

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Projecting our past to the future

"One never notices what has been done; one can only see what remains to be done."

Marie Skłodowska Curie (1867-1906)

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This booklet is dedicated to the memory of

Werner Weber (15.09.2014 †)

Ewald Quak (29.04.2015 †)
Chair of the Advisory Board

David Arnold (25.10.16 †)
Member of the Advisory Board

Marie Curie Initial Training Network for Digital Cultural Heritage

The project

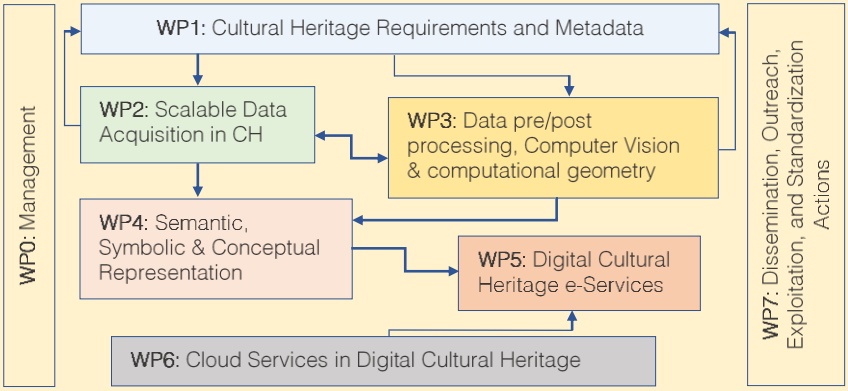
Initial Training Network for Digital Cultural Heritage

The “Initial Training Network for Digital Cultural Heritage: Projecting our Past to the Future” with acronym ITN-DCH, is the first and one of the largest Marie Curie fellowship projects in the area of the e-documentation / e-preservation and CH protection funded by the European Union under the FP7 PEOPLE research framework. The Project started on the 1st of October 2013 and its consortium comprising of 14 full partners and 10 associate members covering the entire spectrum of European CH actors, ranging from academia, research institutions, industry, museums, archives and libraries. The project aimed to train 20 fellows (16 ESR’s and 4 ER’s – 500 person months) in the area of CH digital documentation, preservation and protection in order to create them a strong academic profile and market oriented skills which will significantly contribute to their career prospects. The consortium and the fellows training programme is supported by a prestigious advisory board.

ITN-DCH aims -for the first time worldwide- to analyze, design, research, develop and validate an innovative multi-disciplinary and inter-sectorial research training framework that covers the entire lifecycle of digital CH research for a cost–effective preservation, documentation, protection and presentation of cultural heritage. CH is an integral element of Europe and vital for the creation of a common European identity and one of the greatest assets for steering Europe’s social, economic development and job creation. However, the current research training activities in CH are fragmented and mostly design to be of a single-discipline, failing to cover the whole lifecycle of Digital Cultural Heritage (DCH) research, which is by nature a multi-disciplinary and inter-sectorial research agenda.

ITN-DCH targets all aspects of CH ranging from tangible (books, newspapers, images, drawings, manuscripts, uniforms, maps, artefacts, archaeological sites, monuments) to intangible content (e.g., music, performing arts, folklore, theatrical performances) and their inter-relationships. The project aimed to boost the added value of CH assets by re-using them in real application environments (protection of CH, education, tourism industry, advertising, fashion, films, music, publishing, video games and TV) through research on (i) new personalized, interactive, mixed and augmented reality enabled e-services, (ii) new recommendations in data acquisition, (iii) new forms of representations (3D/4D) of both tangible /intangible assets and (iv) interoperable metadata forms that allow easy data exchange and archiving.

Work packages



WP1: Definition of a complete metadata interface able to represent the new forms of CH assets (4D/intangible) is proposed in order to allow interoperability and backward compatibility with existing specs used in CH libraries, such as EUROPEANA.

WP2: Promote a scalable capturing research by combining multi-view cameras, depth sensor and TOF cameras for generating high resolution 3D/4D point clouds, with textured data, under an affordable framework and focus on super-resolution approaches that increases capturing resolution through the incorporation of advanced signal processing tools and self-calibration /registration methods.

WP3: Automate modelling process regarding tangible and intangible content and in cases of complex background, moving objects and severe occlusions.

WP4: Research on inherently inter-related the way of expression, the style and emotional properties with tangible CH assets and on synchronization especially in cases where multiple moving objects are encountered in the digitization process.

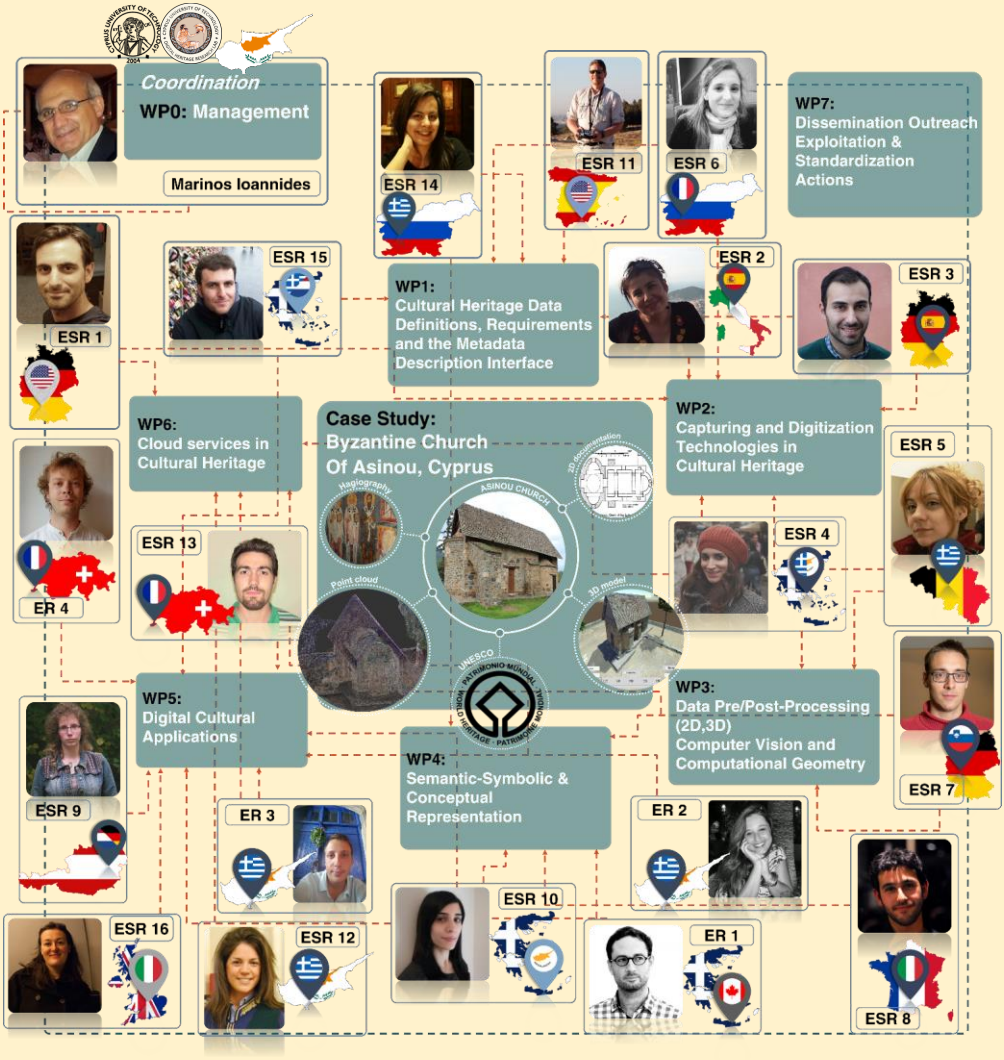
WP5: Incorporation of physical CH assets with virtual objects and additional knowledge coming from intangible information for perceptual and real-time rendering, human animation, storytelling, synchronization, incorporation of geo-information, virtual synthesis of all our senses environment.

WP6: Quality of Service (QoS) in cloud computing architectures and improve data acquisition using cloud computing services.

WP7: Dissemination, Outreach, Exploitation, and Standardization Actions: These activities are described in the Impact and Outreach Section.

Fellows

Research Training Overview



Chance

My Research Training Activity

Universität Stuttgart

ESR 1

Name: Chance Coughenour
Credentials: Master of Arts in Archaeology and Heritage
Start day: 01/06/2014
End day: 01/06/2016
Involved in WP: WP1, 2, 6
Hosting Institution: USTUTT

A. Summary of the Career Development Plan:

With a background in topographic surveying and archaeology, my plan is to incorporate and further develop these subjects at in the pursuit of a PhD in Geoinformatics at the Institute for Photogrammetry at the University of Stuttgart. The steps in order to support this career development plan have already begun through both my training at my hosting institution and project secondments. The process of organizing and applying remote sensing to cultural heritage is my prinicipal pursuit. I developed new ways in which tools such as photogrammetry and laser scanning can be used for the documentation of cultural heritage which will contribute not only to my career plan of working in academics in the future, specifically in computer applications to archaeology, but also in the ability to contribute to dissemination to the public in more interactive ways.

B. Core Research Training Activity:

The fundamental research training that I carried out is a combination of requirements for WP6: “Cloud Services in Digital Cultural Heritage” as well as developing new ways to apply remote sensing to cultural heritage while enriching this data with metadata which has only been touched on minimally in the past. Work Package 6 is directly concerned with a topic I have had much interest in previously, therefore its design and development, as an important part in the whole holistic workflow of the ITN-DCH project, is a topic I focused the core of my research. Semi-automated data organization and processing for photogrammetry and laser scanning in cultural heritage is a key component in how future projects will be able to succeed, not only in properly managing their data, but also to better utilize cloud computing technology in order to augment accessibility, processing, and dissemination for professionals and the public. Once the computation process is improved for cloud computing management and implementation, investigations in Digital Cultural Heritage will greatly be improved since the accessibility to proper computing resources remains a crucial component, both in cost and time. Thus, my intention was to greatly improve how remote sensing data is managed and processed more efficiently in Digital Cultural Heritage.

One great aspect of this project were the secondments, where I had been given the opportunity to train with professionals from different areas of DCH and witnessed firsthand the ways in which the field is developing and what is still required. This was essential for my future career prospects and how my training and experience gained will place me in a strong position for future academic research.

Magda

My Research Training Activity

ESR 2
Name: Magdalena Ramos Calles
Credentials: Geodesic and Cartographic Engineer
Start day: 14/07/2014
End day: 13/07/2016
Involved in WP: WP2, 7
Hosting Institution: FBK

A. Summary of the Career Development Plan:

The research activity was focused on study and algorithm development oriented to a new methodology for data fusion and registration. To achieve this objective, short term objectives were also planned, such as state of the art study regarding data fusion, collaboration with existing fusion projects, mainly at the host institution but also into the ITN network, and training in specific areas.

B. Core Research Training Activity:

From the beginning, I was focused in gaining deep knowledge about all the digitalization methods, its pros and cons, the characteristics of raw data, and the algorithms used to derive useful information from each. Due to the wide range of data that can be fused, it is not an easy task to define a concrete research field, and a deep state of the art analysis has to be done before. I have had also the opportunity to collaborate with a colleague of department on a data fusion project, concretely calibration and registration of images coming from different bands of the spectrum, which I consider is of great importance for cultural heritage elements. I have actively participated in the 1st Summer school of the project, where I met the other ESRs and ERs and understood better the various partners of the project, establishing useful connections with several of them. There were several activities on a hands-on training in photogrammetry. In November 2014, I visited the church of Asinou in Cyprus. After the visit, I attended the Euromed2014 Conference, where I had the chance to meet and discuss with the project's advisors. In March 2015, I attended the 6th 3D-ARCH workshop where a poster presentation was given. At the same month, I participated in the 2nd project workshop hosted by 7Reasons in Carnuntum, close to Vienna, Austria. There, I could attend oral presentations, working jointly with other fellows, run digitization procedures on artifacts of the heritage site. At June 2015, together with all fellows and supervisors, I assisted to the Summer School in Rhodes. In December 2015, I attended the Cyprus workshop about "Standardization – Archiving – Harvesting: Existing Cultural Heritage metadata". In May 2016, I participated in the Genève workshop at CASA Conference. Also, together with my ITN-DCH colleagues, I have also been contributing in redacting several project deliverables. Regarding the training activity at my host institution, all the necessary equipment has been provided, as well as meetings with my supervisor in order him to review/ advise my research activity and the assistance to the internal lectures where my colleagues of department are presenting their work. Also, I had the opportunity to present to them the ITN-DCH project and my research topic. Additional training activities in which I participated at my host institution or country include: safety course, English public-speaking classes, and Italian and computer vision classes respectively.

Diego

My Research Training Activity

ArcTron 3D
Expertise in Three Dimensions

ESR 3

Name: Diego Bellido Castañeda
Credentials: Geomatic Engineer/ MSc Geodesy & Cartography Engineering
Start day: 01/02/2015
End day: 15/04/2017
Involved in WP: WP2, WP3, WP5, WP7
Hosting Institution: ArcTron3D

A. Summary of the Career Development Plan:

The main goal of the early stage researcher is the study of the current 3D high resolution techniques applicable to cultural heritage.
The long-term objectivities of the research are:
- to study 3D digitizing techniques applied in Cultural Heritage
- to build a solid network in the field of Cultural Heritage
- to apply the knowledge gained during the project into real case studies allowing the ESR to collect the data required for a consolidated research

In order to achieve these goals, a constant development of the research capabilities is required. One part of the training is provided by ArcTron3D, using the regular internal training courses, the integration in different study fields of ArcTron3D and the opportunity to have first-hand experience with different kind of newly developed technologies, etc. and the other one during the secondments. These have been and was chosen to fit the needs of the early stage researcher. Furthermore, ArcTron3D did encourage the early stage researcher to go to different conferences, meetings and fairs in his field of interest. Additionally, ArcTron3D had and will took the early stage researcher to different international fairs and congresses where the company presented itself.

B. Core Research Training Activity:

During the first part of the training at ArcTron3D, the fellow had learnt the different 3D digitizing techniques available at the hosting institution. To learn these techniques and to understand the methods from button up, ArcTron3D provided the ESR with different training studies in structured-light scanning, photogrammetry, surveying instruments and surveying techniques. These trainings studies had been evaluated by ArcTron3D experts. The researcher was involved in the planning, execution and completion of different CH projects at ArcTron3D (as a bystander) to understand the different phases of a CH digitalization project. All this training was required to gain knowledge for the different case studies of the ITN-DCH project, from the planning of data acquisition to the final products. The main focus of the research was on photogrammetry, laser scanning and light structured lighting methods in cultural heritage digitization for high resolution surveys. Based on the experience gained through the first part of the training, ESR3 developed his research focused on the case studies in order to produce results in combination with the different capacities of the fellows who were involved in the project. This growing body of experience gained during the first part of the training, allowed the ESR3 to have a better idea of his area of interest in combination with the company's most interest. According to this, the area of photogrammetry had been selected as a good field of study in different topics such as colorimetry processing and data integration with different sources.

Ellie

My Research Training Activity

ESR 4

Name: Elisavet Konstantina (Ellie) Stathopoulou
Credentials: Dipl. Eng. Rural & Surveying/ MSc Geodesy & Geoinformation
Start day: 01/05/2014
End day: 31/10/2016
Involved in WP: WP2, WP6
Hosting Institution: NTUA-PhotoLab

A. Summary of the Career Development Plan:

During the first weeks of the fellowship, a preliminary career development plan (CDP) was scheduled. Some short-term goals were set, such as gaining theoretical and practical experience in state of the art computer vision algorithms in order to define the specific scientific field she would focus on. Training needs were also defined like the possibility of additional secondments apart from the ones already stated, the attendance to conferences and workshops, the participation to teaching activities in NTUA etc. During the first two years in the project, the main research topics of ESR4 within the framework of ITN-DCH work packages (WP) are focusing in:

- 2D and 3D data capturing methods (low cost sensors, 3D scanning)
- 3D reconstruction algorithms (SfM –MVS)
- 3D model rendering
- Image processing algorithms

B. Core Research Training Activity:

Special attendance was given to her interdisciplinary training, through her secondments, visits and other ITN-DCH events. Her secondments were scheduled as such, in order to focus on integrating academia, research and industry experience. The fellow was involved in NTUA as a PhD student in the research area of photogrammetry, under the supervision of Prof. Andreas Georgopoulos and Dr. Anastasios Doulamis. ESR4 was mainly enrolled in WP2 and WP6, as NTUA is the co-leading institute. She undertook the coordination and completion of the first deliverable: D2.1, she actively participated in and co-organising together with ESR3: D2.2, D2.3, D2.4, D2.5. She has also contributed in WP3, by assisting ESR5 in writing D3.1a, D3.1.b, D3.2. Moreover, she has contributed in D1.1, D.1.2, in the framework of her interdisciplinary training. With the end of this project ESR4 has certainly exceeded her knowledge and improved her skills on the fields related with her PhD research (section A). At the same time, she has learnt new methods and technologies and has gained research and professional experience on these areas by collaborating with research institutes as well as with the private sector partners (secondments). The participation in various project workshops and meetings, as well as the collaboration with the other fellows have given her a general overview in various interdisciplinary scientific fields, apart from her main focus. Moreover, she was excited about improving her communicational skills by participating in secondments, conferences and workshops. Considering all the above, ITN-DCH has been for her a good foundation and networking experience for a future career, either in an academic setting or in industry.

Gina

My Research Training Activity

ESR 5

Name: Georgia Stavropoulou
Credentials: Surveying Engineer/ Photogrammetry/ MSc in GIS & Archaeology
Start day: 13/10/2014
End day: 12/10/2016
Involved in WP: WP3
Hosting Institution: KUL

A. Summary of the Career Development Plan:

Long Term Goals (a) PhD Degree in Computer Vision and its implementation to Cultural Heritage. (b) Develop a high quality and competitive professional profile. (c) Acquire a professional level of research skills and be able to carry the research to the public clearly and with scientific proof. (d) Publications in Computer Vision Journals & participation in peer-reviewed international conferences or other Digital Cultural Heritage related conferences.

Short Term Goals (a) Acquire teaching skills by participating in the educational team as a teaching assistant. (b) Participation in the upcoming ITN-DCH Workshops & Summer schools. (c) Improve technical skills on data collection by participating in the digitization process of cultural heritage objects using the Minidome by KUL.

B. Core Research Training Activity:

The central goal of my research was to explore how computer vision methods of 2D/3D shape retrieval, reconstruction and completion could be enriched and implemented to assist cultural heritage applications. As part of the Working Package 3, I had been working on feature extraction algorithms and more specifically their implementation on 2D data collected from the byzantine church of Asinou in Cyprus, one of the project's case studies. The long-term plan was to automatically find similar parts in different frescoes, and to use such similarities to fill out missing parts, due to cracks and other deteriorations. Additionally, I had also been working on a 3D dataset of small objects of archeological interest, exploring different 3D feature extraction algorithms with ultimate purpose to automatically match and retrieve similar objects. Apart from the skills that I acquired as a PhD student (section A), I believe that my participation in the ITN-DCH project had more long-term benefits on my future career. A big advantage is the collaboration with the rest of the fellows and the multi-disciplinary nature of the project. Through the continuous collaboration between us, not only we improved our communication and language skills but, more importantly, we learnt how to bridge the gap between any cultural, linguistic, or scientific background differences, aiming towards a common goal. Another important aspect regarding my future career was that through the project we were being introduced to a many different institutes, from both the academia and the industry and we were encouraged to form a very useful network and reflect on the all the different professional directions that we could follow in the future. Adding to this, the secondments to other partner institutes gave to the fellows a more global idea of the research in the field of digital cultural heritage and armed them with very useful tools for their future development.

Anaïs

My Research Training Activity

ESR 6

Name: Anaïs Guillem
Credentials: Architect, Archaeologist
Start day: 01/06/2014
End day: 30/07/2016
Involved in WP: WP1, WP2, WP3, WP4, WP7
Hosting Institution: UL

A. Summary of the Career Development Plan:

The topic of this fellowship deals with large-scale spatio-temporal reconstruction. More specifically, it aims at developing effective and efficient methods for data collection, processing, and modeling for the purposes of understanding and following the processes of building evolution, taking into account material properties and typical patterns of decay. My position focused on tangible heritage and more precisely on built heritage, i.e.:

- the study of the most current approaches to the collection, formalisation, presentation and storage of built heritage data
- the study and analysis of 3D models of built heritage in relation to semantics and ontology
- the investigation of the possibility of the enrichment of 3D models with semantics as a support for simulations of such use cases as seismic and structural analysis, evacuation scenarios and/or fire events, testing

particularly for the ability of such models to: (a) facilitate built heritage maintenance strategies and procedures, (b) predict mid and long-term behavior of buildings, taking into account their particular uncertainty

B. Core Research Training Activity:

The core research training activities of my fellowship focused on the domain of reconstruction, its tools and techniques. The home institution is the Chair for testing of Materials and Structures, in the Faculty of Civil and Geodetic Engineering, University of Ljubljana. Over the past years, the team has been involved in a series of projects in cultural heritage including Histcape, Perpetuate, Eu-Chic, and Climate for Culture. The team focused on building documentation issues, putting emphasis on the questions of decay, the diagnostics of structures and the decision-making process. As an architect, the position offered me a unique opportunity to enlarge my knowledge in the field of engineering, in particular seismic and structural analysis. With regards to the broader horizon of the CH field, I became a member of the Slovene chapter of ICOMOS and attended a course on heritology offered by Jelka Pirkovic and Verena Perko, two leading experts in museum activities, archaeology and exhibition outreach in the University of Ljubljana. Additionally, I attended Slovene language courses in order to acquire basic knowledge of the language and to communicate in everyday life. Part of the training that the ITN-DCH project provides, is engaging fellows in research management activities. The work carried out in researching and writing the different work packages and deliverables forms the basis of the state-of-the art in our research work. The exercise of writing the deliverables motivated collaborative initiatives between the fellows, encouraging to auto-organize our tasks and to deploy the latest in project management and publication tools.

Matevž

My Research Training Activity

Fraunhofer

ESR 7

Name: Matevž Domajnko
Credentials: Univ. Dipl. Eng. University Diploma in Geodesy and Geoinformatics
Start day: 01/09/2014
End day: 31/08/2017
Involved in WP: WP1, WP2, WP3, WP4, WP5, WP6, WP7
Hosting Institution: Fraunhofer IGD

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 focusing 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:

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. Matevz had the opportunity to learn how to use both, the Laser scanning technology and the Photogrammetric capture setup and has now been introduced to 3D reconstruction software as well as 3D modelers (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.

Nicola

My Research Training Activity

ESR 8
Name: Nicola Carboni
Credentials: BA Cultural Heritage - International MA Digital Library Learning
Start day: 01/06/2014
End day: 31/05/2017
Involved in WP: WP1, WP4
Hosting Institution: CNRS

A. Summary of the Career Development Plan:

With the purpose of investigating the contextual information regarding an artefact, and how the environment shape its function within a community, the fellow started his research from the definition, analysis and documentation of the nature of the intangible heritage activities as well as the scope of the ICH List and the role of the work inscribed in such inventory. The investigation takes in account the role of the various entities in such activity, and how their interaction in a time and space originate not only the phenomenon, but also its material and conceptual significance for a certain group of actors. Following the above analysis, the fellow explored the concept of intangible/tangible heritage from a documentation perspective, investigating the theoretical framework developed within the various branches of the cultural heritage studies and providing a clear perspective, as well as an alignment, of the various approaches and requirements. The focus provided highlights the prospect of developing a conceptual foundation that would cover the documentation of the tangible and intangible elements of a cultural object. The theoretical assumptions were then analyzed from an ontological perspective, and tested using CIDOC-CRM, developing a series of representative mappings, including information about the material, spatial and symbolic elements of a scene in a narrative cycle painted in the narthex of a byzantine church in Cyprus. The result is a formalisation of a set of requirements and a documentation paradigm which help record the tangible and intangible elements of a heritage asset.

B. Core Research Training Activity:

The fellow is currently working on the harmonization of semiotic, philosophy and art-history for resolving the sign-relation and sign-system issues, presenting the diverse research's directions that have been followed in the past years. The result of this work is an extension of CIDOC-CRM to support propositions about visual items. The goal of this newly created model is to record the diverse identities and the sign relations present in visual items and to put them in relations with an interpretation, as well as to maximise the clustering process through automation. ITN-DCH allowed the fellow to discover different ways of looking at cultural heritage as well as to cooperate with some of the most influential researcher in the field. The collaboration within such great group of people, coming from several different disciplines, helped him develop new type of analysis, giving him a chance to better examine his theories and achievement in a challenging but very responsive environment.

Marleen

My Research Training Activity

ESR 9

Name: Marleen De Kramer
Credentials: BSc in Architecture, MSc in Heritage Science
Start day: 01/09/2014
End day: 28/02/2017
Involved in WP: WP3, WP5, WP7
Hosting Institution: 7Reasons

A. Summary of the Career Development Plan:

The MSCA fellowship in ITN-DCH has greatly helped my research career, allowing me to consolidate my diverse previous interests and experience into a cohesive approach. Due to the amazing mentoring, especially by Michael Klein of 7Reasons, I learned to use industry standard software and hardware tools. Working in a multidisciplinary group was both challenging and stimulating, as it allowed each researcher to take the lead on certain aspects, but each was a necessary and equal part of the whole effort.

Travelling to secondments, conferences, and workshops not only allowed me to see how cultural heritage is viewed and explored in different parts of Europe, but also brought me into close contact with experts in the field and allowed for plenty of networking. Presenting at these conferences allowed us to hone our public speaking skills and contribute to the state of the art, while hosting and organising allowed us to see how a successful conference is managed.

B. Core Research Training Activity:

This project provided not only research experience and theoretical knowledge, but concrete training with a variety of relevant tools and techniques. The main areas I seeked to improve were:

Technical expertise: This included relevant software packages for 3D and 4D visualization and animation, dissemination/ publishing to different media as well as selecting, using, and designing for the required hardware/ input and output devices. I also learnt the basics of computer programming.

Research skills: I learnt how to quickly gain the necessary background knowledge for attempting a visualization, and how to work with experts in different fields to transfer their knowledge to my projects. This also includes best practice for communication with interdisciplinary teams through documentation/ annotation of reconstruction and visualization process to show the decision-making process and scientific.

Communication skills: Besides learning to present information graphically and practicing my writing and presentation skills in scientific papers and presentations at conferences, I will be working with end-users, interdisciplinary groups, experts, and non-experts, and in international groups with varying degrees of language proficiency. At an industrial partner, this also means client relations and integrating the end-user into the process.

Margarita

My Research Training Activity

ESR 10

Name: Margarita Papaefthymiou
Credentials: BSc in Computer Science/ MSc in Computer Games and Interactive Technologies
Start day: 01/02/2015
End day: 31/07/2017
Involved in WP: WP4, WP5
Hosting Institution: FORTH-CVRL

A. Summary of the Career Development Plan:

The main aims of the Early Stage Researcher are to work on Interactive mixed reality environments and investigate novel AR character simulation techniques. Specifically, the long-term objectives of the research are: (1) Vision based user gesture tracking and activity recognition. (2) Geometric and Illumination registration for dynamic scenes in AR. (3) Context-Aware Adaptive Rendering System for User-Centric Pervasive Computing Environments.

For these goals to be attained further research activity and training is needed on the part of the researcher. The researcher is attending several courses provided by University of Crete such as Computer Graphics, Interactive Computer Graphics, Advanced Computer Vision, Advanced HCI etc. Furthermore, the researcher is trained and have the opportunity to collaborate with other fellows during the secondments in other institutions like CUT, UNIGE, UW and CERTH.

B. Core Research Training Activity:

By the active participation in the ITN-DCH project the research skills, communication skills as well as the strength of writing skills of the ESR benefited enormously. The opportunity to make research in many fields of Computer Graphics, for example real time rendering and animations, gave the ability to the ESR to gain precious research experience and inspiration for further work and researching in these interesting topics. During the ITN-DCH the fellow has engaged in research and development, according to the career development plan for mobile augmented reality applications. One part of the research focused on global illumination in real-time. The fellow engaged in research in Precomputed Radiance Transfer (PRT) techniques and methods. By using PRT techniques the virtual objects of the AR scenes are illuminated realistically, based on HDR-captured environment light. The fellow extended the PRT algorithm by proposing a new method for representing Spherical Harmonics (SH) with Conformal Geometric Algebra (CGA) entities and rotating SH by rotating CGA entities. The proposed algorithm, enables SH rotation slightly faster than rotation matrices, provides a unique visual representation and intuition regarding their rotation, in stark contrast to usual rotation matrices and provides and better performance in memory usage. The fellow also, conducted research in animation interpolation for skinned characters. CGA has been used as the mathematical background for character animation control and particularly for animation blending and GPU-based geometric skinning. The employ of CGA has allowed better visual results and better performance (computation time and memory usage) in comparison to using other techniques like Linear Algebra.

Matthew

My Research Training Activity

UNIVERSIDAD DE MURCIA

ESR 11

Name: Matthew Luke Vicent
Credentials: BA Theology, Biblical Languages, MA Anthropological Archaeology, Post-graduate Certificate GIS
Start day: 15/06/2014
End day: 15/06/2016
Involved in WP: WP1, WP5, WP7
Hosting Institution: UMU

A. Summary of the Career Development Plan:

The fellow trained at the highest level of research competencies and deepened knowledge across all disciplines of the e-documentation and e-preservation of CH. By the end of the project, he had acquired strong market and research skills bridging the gap between academia, industry and humanities common in the field of CH. The primary training objective was to strengthen scientific and technological excellence, to conduct and support novel CH research within the innovative framework of topics defined by the network. Hence, the primary focus of ESR's research was the management and integration of the data requirements from the various facets of cultural heritage. With these requirements in mind, he further investigated cost-effective solutions to implement the necessary data-recording, publishing, curation, and management of the metadata for cultural heritage. In part, this required a specific study on the implementation of metadata for intangible heritage recording, and interfaces to bring this about. Finally, he also dealt with the integration of mixed-reality and augmented reality environments and the integration of these data into such environments.

B. Core Research Training Activity:

ITN-DCH has been the most valuable addition in the fellow's formation as a cultural heritage professional. Fellows were given access to heritage professionals at many different levels to engage with as part of their own professional development. This means that they had the opportunity to learn from people from a diverse set of backgrounds, and thanks to the mobility, it was like they were studying at 14 different universities rather than just one. In addition to the professionals, the ESR11 fellow also had the opportunity to engage with stakeholders of cultural heritage. One such event was the conversation with Interpol during EuroMed, in November 2014. This was a rare moment to learn how they deal with looted antiquities and a very clear chance to learn how fellows, as heritage professionals, can best provide them with the needed material to identify and recover looted heritage. Furthermore, the project's advisors were happy to work with the fellows as individuals, providing constructive criticism of the fellows' work and trajectory as a project, and research. While such a traineeship can be intense, the benefit far outweighs that of any other project the fellow could be in at this point in time. He felt like he had been exposed to more information and material during the project, than the entire time when he was engaged in his MA at UC San Diego, California.

Vasiliki

My Research Training Activity

ESR 12

Name: Vasiliki Nikolakopoulou
Credentials: BSc in Mathematics/ MSc in Design of Interactive and Industrial Products & Systems
Start day: 01/02/2016
End day: 31/08/2017
Involved in WP: WP1, WP4, WP5, WP6, WP7
Hosting Institution: CUT - DHRLab

A. Summary of the Career Development Plan:

As a Mathetimacian, with further specification in Informatics and Education, and having a professional background as an e-course developer for the University of Athens' e-Learning Platform, my research is mainly focused on the creative reuse of digital CH artefacts taking into account the respective semantic signatures. In conjunction with exploration of innovative methodologies for harvesting multimedia 3D/4D data sets, my case studies have been concentrated on their experimental implementation and evaluation in educational environments. During the first months of the fellowship, a literature review was conducted on the state of the art metadata schemas and standards as well as lessons learnt from their implementation in digital libraries, archives, museums, repositories and relevant cloud and social media services. Practical experience and additional knowledge, has been, and continues to be, added through secondments, hands on training activities on the field, attendance and organization of scientific conferences, workshops and dissemination and outreach activities.

B. Core Research Training Activity:

Core Research Training is being carried through theoretical and practical, hands on experience in related academic and industrial sectors. The theoretical study and approach has already resulted to a book chapter on Springer, as well as seven conference papers relevant to e-documentation of Monuments and Education, a poster presentation, numerous research reports and contributions to project's Deliverables.

Moreover, the training I am receiving from Digital Heritage Research Lab, in combination with ITN-DCH, is crucial to my future career. Aside from the knowledge gained in terms of semantic representation, knowledge engineering, archaeological and architectural documentation, 2D/3D digitization and 3D modeling technologies, the fellowship provides research presentations, public outreach and networking with researchers from other disciplines. The extensive attendances and active participations at conferences, workshops and summer school, have provided me with a broader view of the DCH domain and helped me understand my work as a researcher in a multidisciplinary field and the approaches that I have to develop concerning my research in connection with other professionals. In addition, the project's concept has entirely changed my scientific perspectives. The connection and communication with the other fellows, supervisors and institutions have enlarged my research context by fulfilling it with new research paths and ideas. My exposure to other researchers' work have helped me to develop my English language, presentation and communication skills and transcended my national point-of-view concerning my research, to an International and European one.

Simon

My Research Training Activity

UNIVERSITÉ DE GENÈVE MIRALab

ESR 13
Name: Simon Sénécal
Credentials: Physics Engineer/ MSc in Art & Science
Start day: 02/06/2014
End day: 31/01/2017
Involved in WP: WP1, WP4, WP5, WP7
Hosting Institution: MIRALab

A. Summary of the Career Development Plan:

The Ph.D. research project, Real-time human avatar interaction, was about to investigate new ways to interact with a virtual avatar in real time, using motion sensing. The main goal was to develop a new model of interaction based on animation technics and physics law. The research steps were:

- Development of a real-time positional tracking system
- Development of an interactive model physics-based dedicated to avatars
- Optimizing the model to match natural smoothness reaction
- Development of an emotion recognition system based on body analysis
- Updating the recognition system to reach real-time analysis

During the first year, I learned different methods related to the fields of computer graphics and got sufficient knowledge and practice to start writing publications and develop my own interactive system.

B. Core Research Training Activity:

A complete training has been given to the ESR in the fields of motion capture, 3D modelling, and other technics and resources related to the virtual human's research: (a) Motion capture: ESR13 has been trained on digitizing motion of people. For example, dancing or making a particular action. In the context of ITN-DCH, we used this technical and the knowledge of MIRALab to record a ceremony of a priest, which can be considered part of intangible heritage. (b) 3D Semantically enriched modelling: We had different technics to build 3D objects. One of them was to use photogrammetry to reconstruct a person from a bunch of photos. Another way was to use Constructive Geometry to make volumes from scratch. (c) Motion synthesis and editing: Once the data was acquired we needed to edit the motion and/ or animation to have good final rendering. For that purpose, we often used different blending or re-targeting technics. (d) Real-time programming: As for interactive applications, we needed to program the scripts in the way to have best visual feedback. A training was also given concerning real-time programming and perceptual rendering.

Overall, being part of a huge European research project such as ITN-DCH was very good for making new connections with partners across Europe but also other young researchers. It may lead to collaborative work and common publications. The mandatory internships were also very important as they brought to all of us interdisciplinary techniques from various fields and a global view of research.

Nikoletta

Univerza *v Ljubljani*

My Research Training Activity

ESR 14

Name: Nikoletta Skordaki
Credentials: MSc in Chemical Engineer
Start day: 08/06/2014
End day: 08/07/2016
Involved in WP: WP1, WP2, WP4, WP5, WP7
Hosting Institution: UL FGG

A. Summary of the Career Development Plan:

The title of the fellow's participation in the project was 'Environmental factors in digital cultural heritage'. The fellow focused her research on how the environment affects the built Cultural Heritage as well as the examination of the decay processes of both building materials and structure, a work, which enhanced her scientific background as a chemical engineer specialized in building materials characterization and decay diagnosis. Moreover, she gained more knowledge and research experience regarding the comprehension of the impact of the long term environmental factors in Cultural Heritage and of the decay processes and therefore how they could contribute to the decision making for the most suitable and compatible conservation and/or restoration of cultural assets. During the 25 months of her participation in ITN-DCH project the fellow was also introduced to the digital documentation both in situ and in the lab and its application to several monuments and immovable assets.

Nikoletta Skordaki broadened her knowledge and gained new IT skills regarding digitized techniques and visualization tools and she was also introduced to new non-destructive techniques (3D Optical Microscope and Infrared Thermography). Her interaction with the other fellows, ITN-DCH partners and significant researchers and scientists from the field of digitization and protection of Cultural Heritage contributed to the better understanding of different approaches, that academic, private and research institutions around Europe have and of the digital documentation in a multi-disciplinary level. All these helped Nikoletta Skordaki to become a better and more mature researcher and scientist and to have a broader conception about the approaching, documentation and protection of cultural assets.

B. Core Research Training Activity:

The fellow is mainly focused on the study of the 8 following categories regarding the long-term environmental factors, which can influence the built CH, based on the EU-Chic Project: A1. Bio-attack, A2. Climate conditions fluctuations, A3. Aeolic impact, A4: Water (atmospheric, ground), A5: Solar radiation, A6: Particle matter and aerosols, A7: Long term loading, A8: Geological conditions (including local particularities). Moreover, the fellow concentrated on the study of the most common building materials in Cultural Heritage, such as wood, masonry and iron cast. Nikoletta was also trained in the application of the DIGITAL MICROSCOPE KH – 3000 and of the Infrared thermo-camera for the investigation of the materials and cultural assets' surface and their decay mapping. Last but not least, during her fellowship, she learnt to apply a plethora of techniques for the digitization and 3D modelling of movable and immovable cultural assets.

Manolis

My Research Training Activity

ESR 15

Name: Alexakis Emmanouil (Manolis)
Credentials: Applied Physicist and Engineering in Sustainable Energy Technology
Start day: 01/07/2014
End day: 31/08/2016
Involved in WP: WP1, WP2, WP4, WP5
Hosting Institution: NTUA-LMSE

A. Summary of the Career Development Plan:

In a short-term base, I am involved in the Research Activities of my laboratory, acquiring the needed experience – information and developing the foundation that will support my research activity and eventually will give me the opportunity to expand the existed Research Framework with the creation of new knowledge. The objectives of my work are mainly focused on: (1) Development of Innovative methodologies for computer aided cultural heritage preservation and protection (2) Documentation of monuments including all the necessary information about materials, structural mechanics, historical records, storytelling: enrichment of metadata.

The mentioned, even from the first months of my elaboration with the project, had started to be realized; publications and oral presentations in Conferences and Workshops, Secondments, Seminars attendance etc. having as a result: (1) Disseminate my research work and give access to a broad and multidisciplinary scientists' network and (2) Acquire new Research Skills and Technical Expertise through training in specific new scientific areas. In a long-term base, following the described research pattern, my expectation was my work to result in a PhD degree.

B. Core Research Training Activity:

Laboratory of Material Science and Engineering, in the School of Chemical Engineering where I conducted my Research, provided me the means (instruments, data etc.) and the knowledge (methodology and scientific approach etc.) to acquire a complete and thorough training in the following: (1) Non-Destructive Testing Diagnostic Methodology Monuments' Materials Decay, (2) Knowledge Base Database Enrichment with data concerning: Structural Materials Types, Types of Decay, Consolidation Materials, (3) Three Dimensional (3D) Representation of the Monuments (Macro level) and the Materials Decay (Microlevel). As a multidisciplinary and intersectorial research and training programme, ITN-DCH managed to bring together fourteen leading European partners in a transnational network, providing me not only networking opportunities but also potential future cooperation in the academic or/ and the industrial sectors in the fields of Digital Heritage Documentation and Protection. Training activities included in the ITN-DCH framework (e.g. Secondments) provided the ideal circumstances for acquiring supplementary (but needed) knowledge for the completion of my work and created the potential of novel research fields that participants could lead. Last but not least, all mentioned activities accounting the participation in International Conferences and the visits to the case studies of the project resulted in improving communication and scientific skills, very important for a successful Future Research Career.

Rossella

My Research Training Activity

ESR 16

Name: Rossella Suma
Credentials: BSc and MSc in Computer Engineering, Master of Music – Piano Performance
Start day: 01/10/2014
End day: 31/05/2016
Involved in WP: WP5, WP7
Hosting Institution: UW

A. Summary of the Career Development Plan:

My contribution as ESR16 within The University of Warwick to this end has been the creation of detailed authentic relighting of Asinou site using HDR imaging environment map. One of the main outcome of my research has been the publication of two works, in collaboration with NTUA and KU Leuven, that explore the applicability of HDR tone-mapped images to photogrammetric techniques. Another noticeable demonstration of the collaboration with the other fellows from the project (CNRS, NTUA, LU, FORTH, ARCTRON, USTUTT, Fraunhofer, FBK and 7Reasons) is the publication of a proposed methodology for the documentation in the Digital Heritage pipeline during each and every stage. This methodology enables the collaboration and effective documentation and communication among people of different backgrounds and the use and reuse of digitized heritage resources.

B. Core Research Training Activity:

My primary training objective has been to strengthen my scientific and technological excellence, to conduct and support novel cultural heritage research within the innovative framework of topics defined by the ITC-DCH network. During my training, I have acquired deep knowledge of HDR techniques and familiarised with Warwick's HDR low-cost video system. To learn these techniques and to understand the methods, Warwick University has provided me with different training studies in HDR imaging, environment map capture techniques, and global illumination algorithms. As part of my training I have been a visiting researcher in several institutions. This has enabled me to understand deeply the different aspects of the CH pipeline and how important it is to acquire and polish cross disciplinary skills as a researcher.

The ITN-DCH project has allowed me to improve my research skills; has given me the possibility to work side by side with people from one of the finest and more active group in computer graphics and HDR imaging in the world. Moreover, through this project I had the opportunity to work and build relationships with people from different background, learning about new technologies and all the different methods used in each one of the steps of the CH pipeline. In October 2015, I started my PhD at Warwick University within the Visualisation Group. In addition, being responsible for the dissemination and outreaching of the project and the ITN-DCH Newsletter, it has constantly pushed to improve my communication skills in a research environment and polishing my knowledge of English on a daily basis.

George

My Research Training Activity

ER 1

Name: George Bruseker
Credentials: Philosopher/ PhD in Philosophy National and Kapodistrian University of Athens
Start day: 01/01/2015
End day: 31/03/2016
Involved in WP: WP1, WP4
Hosting Institution: FORTH-ISL

A. Summary of the Career Development Plan:

The Marie Curie action ITN-DCH comes at an exciting moment in the progress of applying complex ICT solutions at a wide level in cultural heritage. Advanced techniques in data capture allow for the elaboration of ever more sophisticated 3D and 4D representations of cultural heritage objects. The burgeoning mass of data generated over the past decades presents a great challenge for data integration through semantics. Meanwhile, the growing field of argumentation representation presents important new possibilities in terms of recording, interrogating and understanding knowledge provenance.

My training at FORTH and in the ITN-DCH offered a formation in conceptual modeling and knowledge engineering with applications in cultural heritage and in observation based science knowledge management more generally. Moreover, I received ample hands-on experience in employing and deploying CIDOC-CRM for the integration of heterogenous CH datasets. I was supported to carry out original research with regards to the semantic representation of 3D models of CH. My research became especially focused on the accurate representation and documentation of architectural and archaeological data for supporting research on built cultural heritage.

B. Core Research Training Activity:

My training was carried out through instruction and practical experience at my home institution of FORTH, as well as through secondment activities with network partners and participation in conferences. At FORTH, I received high-level training in knowledge engineering and CIDOC-CRM. On-going supervision and mentorship were provided by Dr. Martin Doerr and Maria Theodoridou in the theory and practical execution of semantics and formal ontology. Secondments with three ITN DCH network partners helped me build experience and connections with scholars and professionals working on archaeology argumentation, 3D modeling, and heritage conservation.

Extensive participation in conferences and workshops to network with other researchers and to present research results augmented my training and experience.

The training I received from Forth and ITN-DCH was invaluable to my career. Aside from the knowledge gained in terms of semantic representation, knowledge engineering, archaeological argumentation and 3D modeling technologies, the fellowship provided intensive training in article writing, research presentation and public outreach. It also provides invaluable networking opportunities for discovering new research paths and partnerships. Presently, I work on the Parthenos project and am employed by ICS-FORTH.

Eirini

My Research Training Activity

ER 2

Name: Eirini Papageorgiou
Credentials: Dipl. Architect Engineer/ MSc in Monuments' Restoration/ Educator
Start day: 04/05/2016
End day: 03/05/2017
Involved in WP: WP2, WP3, WP4, WP5, WP6, WP7
Hosting Institution: CUT - DHRLab

A. Summary of the Career Development Plan:

As an architect engineer with specialization in Monuments' Restoration I have been occupied in managing Cultural Heritage (CH) on various scales using different approaches. This pre-existing knowledge has facilitated the further study of the concept of "monument" as expression of tangible CH up to the scale of Cultural Landscapes, the evolution of its definition through time (declarations, charters, forms, key-concepts, philosophical theories, internationally recognized values, management etc.), as well as the aspect of holistic approach throughout the lifecycle of a CH asset. The transition from 3D models to BIM and HBIM has also been studied.

Moreover, research on Digital Libraries has been carried out (history, evolution, state-of-the-art, international best practices, ways to overcome language obstacles and achieve intersectoral understanding etc.) as well as their possibilities, challenges, risks and limitations (Europeana included). In conjunction with the aforementioned, an extended study of a substantial number of relevant EU-funded research projects has been conducted regarding: repositories, tools, vocabularies and thesauruses used, interoperability, the combination of the information with text and/or geometry and/or image, the user experience as well as their objectives, added value, challenges and future work. Additionally, research has been carried out on 3D standards, User Interfaces, Virtual CH, Multimedia e-encyclopedias, Dissemination and Standardization, while the guidelines provided by CLARIN-ERIC, ESFRI, JPICH ERA and IPR have been explored as well.

B. Core Research Training Activity:

My training included the participation in the data acquisition phase during the documentation of Saint Neophytos Enkleistriotis monastery in Cyprus as well as in conferences (CASA 2016, CGI'16, EuroMed2016), the parallel to them ITN-DCH summer schools and meetings in Switzerland, Greece and Cyprus, as well as workshops in Cyprus (ICOMOS-CY, RSCy2017). The conducted extended literature review has resulted to a book chapter and five conference papers, all published by Springer, one paper and two articles under publication and a number of research reports as well as contributions to ITN-DCH deliverables. Part of my training was also the organisation of a big scientific conference (EuroMed2016) as core-member of the local organizing committee, the review of scientific papers as member of the International Scientific Committee and the chairing of conference sessions. I have also contributed to the organisation of the ITN-DCH Final Conference and actively participated in dissemination and outreach activities such as European Researcher's Night 2016 in Cyprus, paper presentation in EuroMed2016 conference and social excursion to the Asinou church along with the presentation of the ITN-DCH results.

George

My Research Training Activity

ER 3

Name: Georgios Leventis
Credentials: MSc in Cultural Informatics
Start day: 16/05/2016
End day: 15/8/2017
Involved in WP: WP1, WP4, WP5, WP6, WP7
Hosting Institution: CUT - DHRLab

A. Summary of the Career Development Plan:

During my first days as a Marie Curie Fellow, a preliminary Career Development Plan (CDP) has been scheduled in cooperation with my supervisor, where the goals of my planned research along with its outreach/dissemination activities were set. The conducted literature review on applied machine learning techniques in current applications of Cultural Heritage domain regarding the summarization, classification and identification of cultural assets, acted as a driving shaft in shaping the next steps that were needed to be followed. With these requirements in mind, I further examine how different machine learning & deep learning techniques (unsupervised, semi-supervised, supervised) perform in the processing of 3D/4D digital cultural assets that are stored in various digital libraries and repositories. As the classification parameter is considered to be an important factor for these assets, I will study the efforts that are currently being made, aspiring to find new ways of classifying properly the relevant cultural content throughout the time periods. However, in order to achieve the desired scientific results as well as to be deemed successful, the use of certain tasks and methodologies (such as the review and evaluation of current methodologies in Europeana, the creation of deep learning architectures, the 4-dimensional (X, Y, Z, Time) multimedia summarization) is strongly required.

B. Core Research Training Activity:

My training is being carried out at my host institution (CUT) through balanced theory and practice in concepts related to a monument and its meaning to peoples' daily life as well as how latest technological advances in Artificial Intelligence (A.I) may contribute significantly in the multidisciplinary domain of Cultural Heritage. The undertaken core research training activity will be strongly enhanced through the participation in forthcoming secondment activities, where further experience will be gained by collaborating with other fellows and partners within ITN-DCH network. Furthermore, as an ER3 with solid background in Neural Networks, my research responsibilities are mainly focused on applying Machine Learning methods in the Cultural domain. Since Deep Learning is considered to be a powerful branch of Machine Learning that is based on a set of algorithms which attempt to model high levels abstractions of data, my training also includes the study and the experimentation with such architectures. In the wider context of my research activity, many publications have already been written, which further contribute in the dissemination of the knowledge acquired to distinguished conferences and scientific books.

Louis

My Research Training Activity

UNIVERSITÉ DE GENÈVE MIRALab

ER 4

Name: Louis Cuel
Credentials: Doctor in Applied Mathematics
Start day: 01/01/2015
End day: 31/03/2016
Involved in WP: WP5
Hosting Institution: MIRALab

A. Summary of the Career Development Plan:

During my PhD, my main research topic was the development of robust methods to estimate normals and curvatures on unorganized point clouds and meshes approximating surfaces. This work can be applied in many frameworks such as 3D visualization, 3D reconstruction or 3D mapping. The knowledge of the underlying geometry of a 3D point cloud allows to develop complex, efficient and accurate computer graphics algorithms. My goal is now to develop applications in the frameworks of “cloth digitization and simulation” and “virtual interaction”. These applications will be useful to reach realistic 3D environments since immersive interactive environments are immature and need more technical research.

B. Core Research Training Activity:

During the 15 months in Project ITN-DCH, I improved my knowledge of different research topics:

- Motion Capture: One of the specialties of the partner MIRALab is the motion capture. We were working on a virtual 3D scene including a Christian ceremony in Asinou church in Cyprus. An upcoming secondment in common to both ER4 and ESR13 were in the Cyprus University of Technology partner during the month of June 2015, in order for us to acquire intangible data.

- 3D digitization and processing: MIRALab is specialized in the digitization of 3D objects. We proposed an application that allows to protect and promote ancient costumes. In collaboration with our partner “Dachverband Tanz Deutschland” in Berlin, we were developing a 3D viewer that allows the visualization of real clothes in contextual scenes. A secondment was also planned in July in order to reach these objectives.

- Interaction and Tracking: We were developing a program that allows an interaction between a user and a character in real time. This work was useful to model scene in the church of Asinou (case study 1) where a real user can interact with a 3D virtual character from the church. We worked on recognizing gestures and the presence of people.

My Postdoc position allowed me to continue my career in the academic field of computer vision or computer graphics. Both areas required theoretical and applied skills that I learnt there. I also improved my skills related with the research expertise as report and academic papers writing. Group work and knowledge sharing were also very present expertise in ITN-DCH team. This helped me, especially considering to follow a career in companies.

Case Studies

Asinou

1.

In 1985, Asinou church was declared a UNESCO World Cultural Heritage monument belonging to the Troodos Painted Churches group, in which various trends of Byzantine and post-Byzantine monumental art have been preserved, created from the 11th to the 19th century. The church of Asinou is visited by 30,000 tourists per year, and many Cypriot babies are still baptised there. Accessibility through well-graded roads, the picturesque setting in the foothills of the Troodos mountain and of course, the colourful interior of the monument make Our Lady of Asinou one of the top sightseeing destinations in Cyprus.

VISIT
http://case-study1.itn-dch.net/
and download the android mobile app

photo: courtesy of ITN-DCH

Case Studies

Carnuntum

2.

Carnuntum has been considered among the most important cities of the Roman province Pannonia. Built as a stronghold against the Barbaricum on the other side of the Danube Limes, it was also a crossover point of the Amber Road and occupied a major strategic, political and economic role. Archaeologically, it is significant not only because of its historical importance, but because much of the site was never built on after the Roman occupation, meaning that much of the town's structure remains intact under today's fields and meadows. As a site, this extensive could never be fully excavated - and the utility and wisdom of excavating everything remains debatable - it offers a perfect opportunity to use and compare non-invasive methods of data acquisition such as geophysical prospection.

VISIT
http://www.itn-dch.eu/index.php/case-studies/carnuntum/

photo: courtesy of ITN-DCH

Case Studies

Donaustauf

3.

East of Regensburg (southern Germany), the township of Donaustauf is situated. The small city is dominated by the ruins of the castle Donaustauf. The castle sits on a hilltop, approximately 100m above the Danube. It is the oldest castle mentioned in documents within the area of Regensburg. The structure of the castle ruins, which requires the use of several acquisition techniques, as well as its historical importance make the site an ideal site for training. Due to that, Donaustauf castle has been chosen as a case study. Already acquired datasets were used within the project, as a state of the art dataset and compared to the newly gathered data by the ITN-DCH fellows. Donaustauf castle has been chosen as a case study. Already acquired datasets were used within the project, as a state of the art dataset and compared to the

VISIT
http://www.itn-dch.eu/index.php/case-studies/donaustauf/
http://www.arctron.de/en/gallery/galerie_archiv/2014/walhalla/

photo: courtesy of ITN-DCH

Case Studies

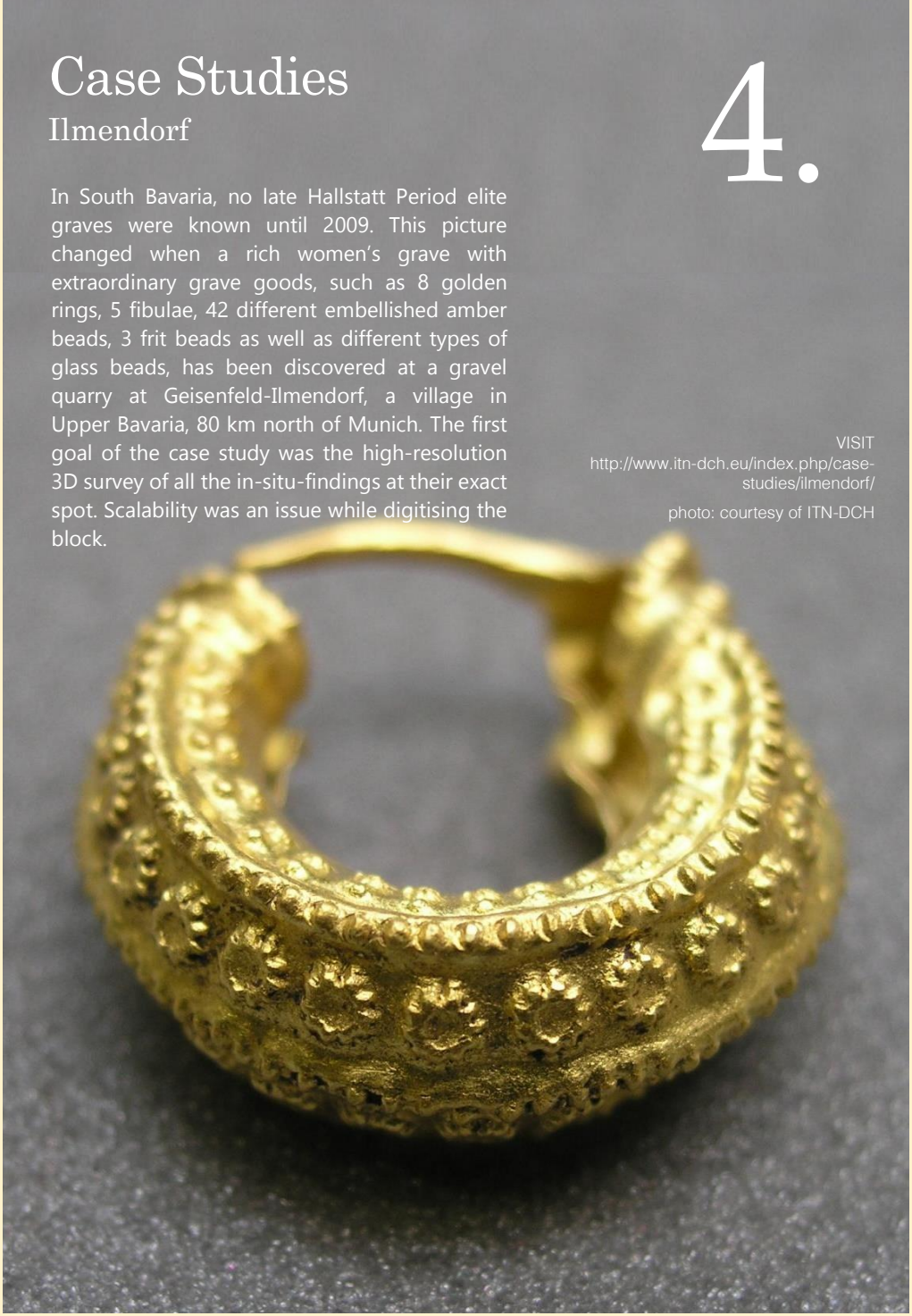
Ilmendorf

4.

In South Bavaria, no late Hallstatt Period elite graves were known until 2009. This picture changed when a rich women's grave with extraordinary grave goods, such as 8 golden rings, 5 fibulae, 42 different embellished amber beads, 3 frit beads as well as different types of glass beads, has been discovered at a gravel quarry at Geisenfeld-Ilmendorf, a village in Upper Bavaria, 80 km north of Munich. The first goal of the case study was the high-resolution 3D survey of all the in-situ-findings at their exact spot. Scalability was an issue while digitising the block.

VISIT
http://www.itn-dch.eu/index.php/case-studies/ilmendorf/

photo: courtesy of ITN-DCH



Project Coordinator

Biography

Coordinator

Name: Marinos Ioannides
Credentials: Computer Science, 3D Reconstruction, Professor at the Electrical Engineering, Computer Engineering and Informatics, Lab Director
Start day: 01/10/2013
End day: 31/09/2017
Involved in WP: WP0 & all WPs
Institution: CUT - DHRLab

Dr. Marinos Ioannides is since the 1st of January 2013 the chair of the newly established and unique Digital Heritage lab of the Cyprus University of Technology (CUT) in Limassol. The lab is the fastest growing research group on the island and has been awarded a number of EU projects within its three years debut (total budget for CUT: 2.95 MEuro). Previously, he worked at the Computer Department of the Higher Technical Institute in Nicosia (1994-2011). After receiving his MSc in Computer Science at the University of Stuttgart, Germany where his thesis was undertaken at the Hewlett Packard European Headquarters in the area of safety and security of Multiuser and Multitasking Database and Digital Library systems, he received a fellowship from the University of Stuttgart in the faculty of Mechanical Engineering where he participated in 42 European Community projects as well as in 12 research projects funded by the German Research Foundation, the German Federal Ministry for Research and the Federal State of Baden Württemberg with a budget of more than 22 Million DM). For his PhD, he specialized in 3D Reconstruction from Digitized Data in different Computer Integrated Manufacturing Applications (CIM). His research team has been massively supported by IBM Europe with the most efficient hardware and software from 1988-1994. The final version of his 3D-Reconstruction engine was developed in cooperation with IBM Germany and is available and running in more than 142 research centers around the world. IBM Germany has promoted and presented his results in several conferences and exhibitions in the EU (such as the biggest ICT exhibition in the world -CEBIT 1993 and CEBIT 1994).As one of the first non-European young researchers to be financially supported for his achievements by the European Commission, Marinos has received in 1994 the prestigious EU KIT SurfMod award for his work on 3D reconstruction in the areas of Archaeology, Medicine and Engineering (the EU KIT Prize has been awarded only 36 times worldwide from the EC DG RTD). In 2010 he was awarded from the Spanish and European Association of Virtual Archeology the prestigious Tartessos prize for his achievements in the area of 3D-documentation in Cultural Heritage. Ioannides has been invited as a Keynote Speaker in more than 72 conferences/events in the area of Digital Cultural Heritage in the last 13 years. Ioannides is the Chair of the Bi-annual conference on Digital Heritage with more than 500 participants from all over the world. The EuroMed proceedings belong to the bestselling e-books of Springer-Nature Publisher with more than 650.000 sold copies since November 2006. Dr. Ioannides was a member of the Cypriot committee negotiating the accession of Cyprus to the EU and was one of the responsible professionals for the chapters on research and education (1999-2002). Ioannides is since 2007 an active member of the EU Digital Library Europeana Network as well as representing Cyprus in the European Union Group of Experts on Digital Heritage and Europeana.

Partners

Academia

Cyprus University of Technology

Cyprus University of Technology
Department of Electrical Engineering and Information Technology - DHRLab

Coordination & Management

Location: Limassol, Cyprus

Supervisor:
Dr. Marinos Ioannides

The **Digital Heritage Research Lab** (DHRLab) was established in 2013 at the **Department of Electrical Engineering and Information Technology** of the **Cyprus University of Technology**. The lab is devoted to research on the digitisation, archiving, and promotion of cultural heritage, tangible and intangible remains of our cultural past. The research scientists and doctoral students employed at the lab engage in collaborate research with national and international institutions to explore the latest technological advances in the field, their efficacy and usefulness in bring cultural heritage information to end-users, obstacles and prospects for further development. At a European level the lab collaborates with a network of over 150 partners from the academic, research and industrial sectors working towards the development of new tools and applications.

DHRLab is a prototype of cooperation and has rapidly achieved world-spectrum collaboration research programs. The lab has created a unique and wide research network and agenda with great potential for future activities. The input of the lab is significant, since it promotes and supports an advanced scientific basis. Since 2013 the DHRLab participated in the EU-FP7 & H2020 projects with a total budget of 3 MEuro for the Lab.

The research focuses on four thematic areas: recording, access, management, and conservation of cultural heritage assets.

- Research collaborations on the use and impact of digitisation in the field of preservation of cultural heritage and the memory of the past.
- Methods for the digitisation of cultural heritage such as system development, large-scale databases, virtual representations, 3D e-presentations, etc.
- Digitisation of audio-visual records.
- Semantic enrichment of artefacts, metadata encoding, reasoning, and inference.
- Operation of interactive technologies that allow user interaction with the content.
- Development of new applications and mash-ups over existing knowledge and data sets.
- Hosting of new research programs.
- Organising activities, events, seminars, and conferences to discuss new fundamental research capabilities.
- Use and reuse of digitised collections.

(www.digitalheritagelab.eu)
(www.cut.ac.cy)

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Follow us on Twitter: twitter.com/dheritagelab

Partners

Academia

University of Geneva

Founded in 1989 and headed by Professor Nadia Magnenat-Thalmann, **MIRALab** teams up around 20 researchers coming from as many different fields as Computer Science, Mathematics, Medicine, Telecommunications, Architecture, Fashion Design, Cognitive Science, Haptics, Augmented Reality, etc. This truly interdisciplinary group works in the field of Computer Graphics, Computer Animation and Virtual Worlds. The group works under the aegis of the Centre Universitaire Informatique (CUI), University of Geneva in Switzerland.

UNIVERSITÉ DE GENÈVE

MIRALab

University of Geneva
MIRALab

Location: Genève, Switzerland

Supervisor:
Prof. Nadia Magnenat-Thalmann

MIRALab not only participates in numerous European and National projects but the team also produces displays for museums, galleries and has also worked for and with private companies. The group has generated over 450 papers and 40 books and has received many prizes and awards in different fields. Prof. Nadia Magnenat-Thalmann has directed more than a dozen of PhD thesis. Former PhDs have become Professors in renown institutes such as the Indian Institute of Technology, the University of Zaghreb, the University of Utrecht, the University of Ottawa, Kaist in Korea, for example, or are working in renown companies like Electronic Arts and PDI/ Dreamworks in California, Samsung in Korea, IBM in Switzerland or BUF Compagnie in France, to mention just a few.

(http://www.unige.ch/international/en/)
(www.miralab.ch)

Supervisor

Nadia Magnenat Thalmann is the Founder and Director of the MIRALab, an interdisciplinary lab in Human Computer Animation, University of Geneva, Switzerland. She is also Director of the Institute for Media Innovation in NTU, Singapore. Her research domains are Social Robots, mixed realities and medical simulation. In Singapore, she has developed the robot Nadine alike of herself that is able to speak, recognize people and gestures, express mood and emotions, and remember actions. All over her career, she has received several artistic and scientific Awards, among them the 2012 Humboldt Research Award, and two Doctor honoris Causa (from University of Hanover in Germany and from the University of Ottawa in Canada). She is Editor-in-Chief of the Journal the Visual Computer (Springer-Verlag) and is a Member of the Swiss Academy of Engineering Sciences.

Partners

Academia

National Technical University of Athens

Choosing "Prometheus bringing the fire from the gods to the mankind", as its symbol, NTUA never loses sight of the real human needs and dimensions. Its final concerns are quality of life and protection of democratic rights and achievements. It integrates its mission by adopting the timeless valuable social role of the traditional Universities.

The **Laboratory of Photogrammetry (PhotoLab)**, of the **School of Surveying Engineering**, focuses on three main areas:

(a) Photogrammetry, image processing and computer vision applied on cadastral, mapping and cultural heritage applications

(b) Cameras, laser scanners, UAS, low-cost sensors

(c) Summer schools on 2D and 3D data acquisition and processing (d) Software developing

(www.survey.ntua.gr)

National Technical University of Athens

School of Surveying Engineering - PhotoLab

Location: Athens, Greece

Supervisor: Prof.Andreas Georgopoulos

Supervisor

Andreas Georgopoulos was born in Alexandria (Egypt). He is a Professor at National Technical University of Athens, and Director of the Laboratory of Photogrammetry. Education, Scientific & Professional Activities: 1966-1972, German School of Athens, 1972-1976 Rural & Surveying Eng., NTU of Athens, and 1976-1977 Diploma and Master of Science (MSc) in Photogrammetry from University of London (University College London). In 1981, he receives his Doctor of Philosophy (PhD) in Photogrammetry from University of London (University College London). As of December 1999, he becomes a Full Professor at the Laboratory of Photogrammetry of NTUA. Between 2002 – 2006, Prof. Georgopoulos was the Head of the School of Rural & Surveying Eng. of NTUA, and between 2005-2013 he was an associate member of CIPA Executive board. Since 2013 he is the president of CIPA. Between 2006 – 2010, he was Vice-President of NTUA Research Committee, and from 2010 until 2011, he was a Visiting Professor at The Cyprus Institute, Nicosia.

Partners

Academia

National Technical University of Athens

School of Chemical Engineering – LMSE

Location: Athens, Greece

Supervisors:
Prof. Antonia Moropoulou

National Technical University of Athens

The **Laboratory of Materials Science and Engineering (LMSE)**, of the **School of Chemical Engineering**, has six main areas of research focus:

(a) The use of sustainable materials and construction technologies aiming to increase the lifetime of infrastructure and monuments (b) The impact assessment of environmental loads on structures (c) The implementation of integrated diagnosis of the decay of building materials using high measuring techniques (d) The planning of interventions for the protection of monuments using compatible materials and techniques (e)The application of quality control of building materials and works for sustainable construction (f) The strategic planning for the protection of cultural heritage and integrated environmental management for the protection of monuments using GIS The development of expert systems providing scientific support on decision making on management of monuments and historic buildings, using intervention necessity indices and risk thresholds.

(www.chemeng.ntua.gr/the_materials_science_and_engineering_lab)

Supervisor

Antonia Moropoulou is currently Professor at the National Technical University of Athens, Greece and Vice President of the Technical Chamber of Greece. She is a Chemical Engineer, PhD, Full Professor at the Section of Materials Science and Engineering of the School of Chemical Engineering. She was elected as Contracted Professor in IUAV University of Venice (1993), Visiting Professor at Princeton University (1995-1996) and has served as Vice Rector of Academic Affairs of NTUA (2010-2014). She is a world class expert in building materials and the preservation of monuments that comprise the World's Cultural Heritage (Hagia Sophia in Istanbul, Medieval City of Rhodes, Holy Sepulchre in Jerusalem, et al.) scientific coordinator of more than 80 National, European and International research competitive programs and author of 1 book, 2 monographies, 16 chapters in books and more than 450 scientific publications. In 2012, she was awarded the 'YPATIA' Award by the 'Association of Hellenic Women Scientists'. Prof. Moropoulou was the Principal Investigator of the newly finished documentation and restoration project of the Aedicula of the Holy Sepulchre in Jerusalem.

Partners

Academia

Universität Stuttgart

University of Stuttgart

Institute for Photogrammetry (ifp)

Location: Stuttgart, Germany

Supervisor: Prof. Dieter Fritsch

University of Stuttgart

The University of Stuttgart is one of the leading technically oriented universities in Germany with global significance. It sees itself as a center of university-based, non-university, and industrial research. Furthermore, it takes a role as a guarantor of research-based teaching, focused on quality and holism.

With its focus on the engineering and natural sciences in balanced interaction with the humanities, social sciences and economics, the University of Stuttgart is one of Germany's most successful research universities and a member of the elite TU9 - German Institutes of Technology Association. Its status as outstanding research university and the broad spectrum of subjects studied today positions it as an internationally recognized and future-oriented place for science and research.

The **Institute for Photogrammetry** is focused on three main areas with their sub-main activities:

Teaching, Further Education L^3: Geodesy & Geoinformatics, GEOENGINE, Infrastructure Planning, WAREM, Aerospace Engineering

Research & Development (R&D): Photogrammetry, CV Photogrammetric, Image Processing, Geoinformatics, Signal Processing

Technology Transfer: The Photogrammetric Week Series (biennially), SW Development, Consultancy, Workshops

(www.uni-stuttgart.de/)
(www.ifp.uni-stuttgart.de/)

Supervisor

Prof. **Dieter Fritsch** is the head of the Institute for Photogrammetry at the Universität Stuttgart since 1992. He has served six years as Rector of the Universität Stuttgart and is the academic Co-Founder of The German University in Cairo (GUC), Egypt. Prof. Fritsch published three hundred articles on topics of GIS, Photogrammetry, LIDAR and Remote Sensing. He has served on steering committees in both academia and industry and is a much asked for keynote speaker on academic as well as political events. Prof. Fritsch hosts the Photogrammetric Week, a bi-annual conference, which regularly attracts 500 international participants from science and industry.

Partners

Academia

Univerza v Ljubljani

University of Ljubljana

Faculty of Civil and Geodetic Engineering

Location: Ljubljana, Slovenia

Supervisor: Prof. Roko Zarnic

University of Ljubljana

The University of Ljubljana implements and promotes basic, applied and developmental research and is pursuing excellence and the highest quality as well as the highest ethical criteria in all scientific fields and art. In these areas of national identity, the University of Ljubljana specifically develops and promotes Slovenian scientific and professional terminology. Based on its own, Slovenian, and foreign research, the University of Ljubljana (UL) educates critical thinking top scientists, artists and professionals qualified for leading sustainable development, taking into account the tradition of the European Enlightenment and Humanism and with regard to human rights. Special attention is dedicated to developing talents.

The **Faculty of Civil and Geodetic Engineering** is divided in eight scientific areas: geodesy, municipal economics and spatial planning, materials and structures, construction management, traffic and traffic constructions, hydraulic engineering, construction IT and basic subjects.

(www.en.fgg.uni-lj.si)

Supervisor

Roko Žarnić is a Professor of building materials at University of Ljubljana, Faculty for Civil and Geodetic Engineering, since 1993. His research background is mainly focused on earthquake engineering. He joined the University from the position of director general of Slovenian National Institute for Research in Materials and Structures (ZRMK), where he started his career in 1974. From 2010 to 2012 he was on duty of Minister of Environment and Spatial Planning of Republic Slovenia, and Chairman of Slovenian Association of Earthquake Engineering in 2003-2007. He was a principal investigator and coordinator in number of international projects, member of Managing Committees, currently Supervisor of the ongoing EU FP7 project Marie Curie ITN-DCH, H2020 Project INCEPTION and two ongoing COST Actions. He has published over 400 papers and reports, and since 2013 he is an individual expert.

Partners

Academia

University of Leuven

University of Leuven

Department of Electronic Engineering - Center for Processing Speech and Images

Location: Leuven, Belgium

Supervisor:
Prof. Luc Van Gool

The University of Leuven was founded at the center of the historic town of Leuven in 1425, making it Belgium's first university. After being closed in 1797 during the Napoleonic period, the Catholic University of Leuven was "re-founded" in 1834, and is frequently, but controversially, identified as a continuation of the older institution. It is considered the oldest Catholic university still in existence.

The **Center for Processing Speech and Images**, of the **Department of Electronic Engineering**, is focusing in three subgroups: MIC, VISICS, SPEECH. It performs demand-driven research in the field of image and audio processing. This research approach offers the opportunity to respond to social and economic trends. Methodologically, the research belongs to the domains of computational science and machine learning. During the previous decades computers became more powerful and the amount of sensorial data increased. Modeling and exploiting this large amount of data (data science) is one of the current challenges and opportunities.

(www.esat.kuleuven.be/psi)

Supervisor

Luc Van Gool is both a full professor at Katholieke Universiteit Leuven (Belgium) and at the Eidgenössische Technische Hochschule (ETH) Zürich (Switzerland). He has worked on a broad variety of computer vision topics. His experience includes texture analysis and synthesis, 2D and 3D object and object class recognition, multi-view and structured light 3D reconstruction, visual robot navigation, tracking and motion analysis, and gesture and emotion interpretation. Several prizes testify to the international appreciation for his work: David Marr prize (best paper award) at ICCV98 and U.V. Helava Award, one of the most prestigious ISPRS awards in 2012. He was also awarded an ERC Advanced Grant in 2011 for his project VarCity. Luc Van Gool is initiator and editor-in-chief of Foundations and Trends in Computer Graphics and Vision, associate editor for IEEE T-PAMI and IJCV. He was PC member and Area Chair for many major vision conferences, served as Program Chair of the Int. Conf. on Computer Vision (ICCV) 2005 in Beijing, and as General Chair for ICCV 2011 and the European Conf. on Computer Vision (ECCV) 2014. In '98 he co-founded the spin-off company Eyetronics (Belgium, US, Canada), specialised in 3D modelling. His h-index is 71, with a total of 21730 citations, according to scholar google.

Partners

Academia

UNIVERSIDAD DE MURCIA

University of Murcia

digitalMED – Centre for Studies in Virtual

Archaeology

Location: Murcia, Spain

Supervisors:
Prof. Mariano Flores Gutierrez
Prof. Alfredo Grande
Victor M. Lopez-Menchero Bendicho

University of Murcia

The University of Murcia is a public institution of Higher Education which pursues academic and scientific excellence through an international influence. Its main activities are focused on research, training and cooperation projects, exchange programs, bilingual education and the promotion of double-degrees. Even though, its origin dates back to the 13th century; its establishment dates from 1915.

The University hosts more than 31.000 students, around 1.000 of them international. It offers: 56 undergraduate programs, 78 master degrees, 29 doctoral programs, 44 Summer Courses and 337 research groups. It is devoted to providing higher education to the public, and among its main objectives are the creation, development and research into science, technology and culture through study and research and the transmission of such knowledge through education.

The **digitalMED – Centre for Studies in Virtual**, is focusing on exploration of new applications of Virtual Archaeology: 3D Printing, 3D Modelling, Virtual Museums, Immersive environments, Metadata applications to Virtual Archaeology

(www.um.es)

Supervisor

Mariano Flores Gutierrez was born in Murcia in 1965, he is a Doctor of Fine Arts by the University of Murcia and Professor at the Department of Information Technology and Systems. He is also Deputy Dean of Quality and European Convergence of the Faculty of Fine Arts of the same University. His teaching and research work are linked to technology transfer to the business field. He pursues the balance throughout his professional career between the academic and the scientific advice to entities of diverse nature, both public and private. From his beginnings, he directs his activity to the generation of computer image, the new discipline that began to beat in Spanish society in the mid-eighties as was computer animation. He has participated in many audiovisual-related projects and Director of documentary short films.

Partners

Academia

University of Warwick

WMG - Visualisation Group

Location: Warwick, England

Supervisor: Prof. Alan Chalmers

University of Warwick

The University of Warwick is a leading university, somewhere forward-looking and ambitious, where the starting point is always 'anything is possible'. It is one of the UK's leading research universities and the quality and impact of its research is reflected in its rankings. It also performed strongly in the Government's Research Excellence Framework (REF) 2014.

The Visualisation team, led by Professor Alan Chalmers, is working to create "Real Virtuality": high fidelity virtual environments which provide the same perceptual response from viewers as if they were actually present, or "there" in the real scene being portrayed (also known as there-reality). A human's perception of the real world is more than just what we see, and thus real virtuality may need to include visual, aural, smell, touch and even taste, to achieve the appropriate level of perceptual realism. Real virtuality has applications in many fields. In particular, cultural heritage: Computer reconstructions of heritage sites provide us with a means of visualising past environments, allowing us a glimpse of the past that might otherwise be difficult to appreciate. However, it is essential that these reconstructions incorporate all the physical evidence for a site, otherwise there is a very real danger of misrepresenting the past.

(www2.warwick.ac.uk/)
(www2.warwick.ac.uk/fac/sci/wmg/research/visualisation/)

Supervisor

Alan Chalmers is a Professor of Visualisation at the International Digital Laboratory, WMG, University of Warwick, UK. He has an MSc with distinction from Rhodes University, 1985 and a PhD from University of Bristol, 1991. He has published over 200 papers in journals and international conferences on high-fidelity graphics, multi-sensory perception, High Dynamic Range (HDR) imaging, virtual archaeology and parallel rendering. He is Honorary President of Afrigraph and a former Vice President of ACM SIGGRAPH. Together with SpheronVR, a high-precision German camera company, he was instrumental in the development of the world's first HDR video camera, which was completed in July 2009. He is the Founder and a Director of the spin-out company goHDR Ltd., which aims to be the leader in the software which enables HDR technology. Chalmers' research goal is "Real Virtuality", obtaining physically-based, multi-sensory, high-fidelity virtual environments at interactive rates through a combination of parallel processing and human perception techniques.

Partners

Research

FORTH

FORTH is one of the largest research centers of Greece. It functions under the supervision of the General Secretariat for Research and Technology (GSRT) of the Ministry of Culture, Education and Religious Affairs. It is ranked as the topmost Research Center in Greece. FORTH has become one of the top European research centers, thanks to its high impact research results and its valuable socioeconomic contributions.

The **Computational Vision and Robotics Laboratory (CVRL)** was established in 1985. The groups' activities emphasize research and development in the areas of computer vision, computer graphics and autonomous mobile robots with "intelligent" behaviour. More specifically, the research efforts are directed towards visual perception of static and dynamic characteristics of the 3-D world (depth, shape, color, motion), object tracking, robot navigation, behaviour modelling and real-time graphics. Additionally, the group is interested in the exploitation of machine learning techniques in robotic applications. In this context, reinforcement learning and genetic algorithms are used to enable a robot to improve its skills and acquire new ones. Another research topic is related to the study of parallel implementations of the developed algorithms. Such issues are critical towards developing autonomous robots that are able to exhibit specific behaviors in real time. Finally, issues related with image and video communication are also investigated. In addition to the research work outlined above, CVRL also aims at applying the methods, technologies, and tools it develops in domains such as industrial automation, the support of people with special needs, space monitoring and security, home automation, virtual heritage, augmented reality etc.

(www.ics.forth.gr/cvrl)

Supervisor

Prof. **George Papagiannakis** is a computer scientist specialized in computer graphics and virtual & augmented reality. He obtained his PhD (Hons) in Computer Science at the University of Geneva in Switzerland in 2006, his M.Sc. (Hons) in Advanced Computing at the University of Bristol in UK and his B.Eng. (Hons) in Computer Systems Engineering, at the University of Manchester, UK. Since 2011 he is assistant professor at the Computer Science department of the University of Crete, Greece and Research Fellow at the Computer Vision and Robotics Laboratory in the Institute of Computer Science of the Foundation for Research and Technology Hellas, Heraklion, Greece. Prior to this post, he had worked as a senior researcher and research assistant at MIRALab, University of Geneva with Prof. Nadia Magnenat-Thalmann. He has also been employed as consultant and lead computer graphics programmer in the industrial computer graphics simulation sector.

Partners

Research

FORTH

FORTH – ISL

Centre for Cultural Informatics (CCI)

Location: Heraklion, Crete

Supervisor:
Dr. Martin Doerr

The **Information System department (ISL)** addresses the challenges of ontology engineering and discourse analysis through a specialised unit, the **Centre for Cultural Informatics (CCI)**, which is currently the most extensive facility of ISL in terms of manpower and external funding. The Centre for Cultural Informatics pursues a comprehensive, cross-disciplinary approach to supporting the entire lifecycle of cultural information and documentation procedures for the benefit of study, preservation and promotion of cultural heritage. Special focus is laid on semantic interoperability, information integration and integrated access. The cross-disciplinary mission of the Centre is underpinned by maintaning rich co-operations with cultural institutions and scientists from the humanities, that range from pure research, community work on documentation methods and standards down to rich application development and consulting.

Main activities of the unit unfold in three directions: (1) Targeted research with focus on the formal representation of information structure and scientific discourse in the humanities, in the machine - supported communication and in the semantic interoperability. (2) Community building for the promotion of standards, complementary skills and know-how in the creation, processing, integration and presentation of cultural information for the benefit of quality, accessibility and exploitation of digital cultural content. (3) Targeted development of advanced information systems that provide a scientific challenge or a proof -of -concept in real settings.

Results of these activities include: Data models and standards, Monuments' and museums' information systems, Source material management systems, Terminology systems, X3ML Toolkit.

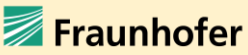
(www.ics.forth.gr/isl)

Supervisor

Dr. **Martin Doerr** is a Research Director at the Information Systems Laboratory and head of the Centre for Cultural Informatics of the Institute of Computer Science, FORTH. He has been leading the development of systems for knowledge representation and terminology, metadata and content management. He has been leading or participating in a series of national and international projects for cultural information systems. His long-standing interdisciplinary work and collaboration with the International Council of Museums on modeling cultural-historical information has resulted besides others in an ISO Standard, ISO21127:2006, a core ontology for the purpose of schema integration across institutions.

Partners

Research



Fraunhofer IGD

Competence Center for Cultural Heritage Digitization - CultLab3D

Location: Darmstadt, Germany

Supervisors:
Prof. Dieter Fellner
Pedro Santos

Fraunhofer

Fraunhofer is Europe's largest application-oriented research organization. Its research efforts are geared entirely to people's needs: health, security, communication, energy and the environment. The **Competence Center for Cultural Heritage Digitization** focuses on: (a) Fast and economic digitization technologies for an accurate virtual reproduction of heritage objects. (b) State-of-the-art scanning and lighting technologies to capture the exact geometry, texture, and optical material properties and, (c) the **CultLab3D** project - the world's first automatic modular 3D digitization pipeline – which focuses mostly on digitization of three-dimensional artifacts in 3D with millimeter accuracy in an automated process. For a photo-realistic rendering of the objects, their geometry, texture and optical material properties are incorporated. By automating the entire scanning process, the aspect of fast and efficient 3D mass digitization is implemented for the first time.

(www-old.igd.fraunhofer.de/en/Institut/Abteilungen/Digitalisierung-von-Kulturerbe)
(http://www.cultlab3d.de/)

Supervisor 1. Since October 2006, **Dieter Fellner** is a Professor of Computer Science at TU Darmstadt, Germany, and Director of the Fraunhofer Institute for Computer Graphics Research IGD. His research activities over the last years covered algorithms and software architectures to integrate modeling and rendering, efficient rendering and visualization algorithms, generative and reconstructive modeling, virtual and augmented reality, graphical aspects of internet-based multimedia information systems and cultural heritage as well as digital libraries. He is a member of the editorial boards of leading journals, member of the program committees of many international conferences and workshops, EUROGRAPHICS, ACM, IEEE Computer Society and the Gesellschaft für Informatik (GI). Furthermore, he is an advisor for the German Research Foundation (as a member of DFG's AWBI) and the European Commission.

Supervisor 2. Pedro Santos has been Head of the Competence Center for Cultural Heritage Digitization since 2012. His department 'Interactive Engineering Technologies', develops the world's first approach for fast, economic, and automated 3D digitization of cultural heritage with emphasis on capturing optical material properties. He has been researcher at Fraunhofer IGD since 2002, he studied computer science at the University of Darmstadt and the Technical University of Lisbon. During his professional career, he was involved in the development of the first immersive CAD modeling systems to be used for the early stages of product development as well as in the design of 'see-through head-mounted displays', mobile applications in augmented reality and optical 'marker-based' and 'markerless' tracking systems. He is also an author and co-author of over 50 publications as well as reviewer.

Partners

Research

Fondazione Bruno Kessler

3D Optical Metrology Unit

Location: Trento, Italy

Supervisor:
Prof. Fabio Remondino

Fondazione Bruno Kessler

Fondazione Bruno Kessler (FBK) is the top Research institute in Italy, ranked at the 1st place for scientific excellence within 3 different subject areas (ICT, History and Sociology) and for the economic and social impact according to the quality of research ANVUR evaluation for the period 2010-2014. FBK is a research non-profit public interest entity.

The **3D Optical Methodology Unit** focuses on Metrology software and methodologies based on terrestrial, UAV, aerial and satellite photogrammetry as well as on triangulation and time-of-flight optical active sensors (e.g. laser scanners). Moreover, research is carried out on optimization and development of methods and tools for virtual reconstruction and visualization of natural and man-made sites or objects, with great attention to the automation of photogrammetric methods, the fusion of 3D models acquired with different techniques (at different point densities and measurement accuracies) and the development of new data processing pipelines.

(www.fbk.eu/en/)
(3dom.fbk.eu/)

Supervisor

Fabio Remondino is head of the 3D Optical Metrology research unit (http://3dom.fbk.eu/) at the Bruno Kessler Foundation. He received a PhD in photogrammetry from ETH Zurich in 2006 and an Italian scientific qualification as Full University Professor in 2013. His main research interests are in the field of reality-based surveying and 3D modeling for earth observation, monitoring, heritage documentation and industrial metrology. He is interested in automation aspects concerning image orientation, dense image matching, registration of range data, semantic classification, etc. He has authored over 200 publications in journals and international conferences and he received 10 awards for best papers. He has organized more than 50 international scientific events, among conferences, workshops, summer schools and tutorials. Fabio is currently serving as President of the ISPRS Technical Commission V (http://www.isprs.org), as Vice-President of CIPA (http://cipa.icomos.org) and President of EuroSDR Commission I (http://www.eurosdr.net/).

Partners

Research

Centre National de la Researche Scientifique

Models and simulations for Architecture and Cultural Heritage

Location: Marseille, France

Supervisor:
Dr. Livio De Luca

Centre National de la Researche Scientifique

The French National Center for Scientific Research is the largest governmental research organisation in France and the largest fundamental science agency in Europe. It employs 32,000 permanent employees (researchers, engineers, and administrative staff) and 6,000 temporary workers. The National Center for Scientific Research is a public organization under the responsibility of the French Ministry of National Education, Higher Education and Research.

The unit of **Models and simulations for Architecture and Cultural Heritage** focuses on: (a) ICT for advancing knowledge on architecture and cultural heritage (b) Integration of skills and through the (c) scientific project founded on the Interdisciplinarity (human science and computer science) researches on (1) Models, methods and tools for documenting architectural heritage and (2) Models and digital environments for the architectural design.

(www.map.cnrs.fr)

Supervisor

Architect, Doctor of Arts et Métiers ParisTech, HDR in Computer Science, **Livio De Luca** is the Research Director at CNRS and Director of the UMR (CNRS / MCC) MAP (Models and simulations for Architecture and Heritage). His research activities focus on the survey and geometric modeling of heritage buildings and on the design and development of architectural information systems.He is co-president of the International Digital Heritage congress (2013 in Marseille, 2015 in Granada) and member of various international scientific committees, scientific and technical coordinator of many European projects. He was awarded in 2007 by the 'Prix Pierre Bézier de la Fondation Arts et Métiers and in 2016 by the 'Medaille de la recherche et de la technique de l'Académie d'Architecture'.

Partners

Industry

ArcTron 3D

3D Laser Scanning (Airborne, Terrestrial, Mobile), Photogrammetry & UAV Aerial Survey - 3D as-built documentation, is the core competence of the company. ArcTron3D uses the latest technologies and leading expertise to carry out its services fast and cost-effective while delivering high-quality results. ArcTron3D delivers photorealistic 3D models, digital terrain models, CAD drawings; a customized 3D data analysis. ArcTron's service scope is going beyond regular data.

The company offers a comprehensive service and product range all around 3D laser scanning, airborne, terrestrial and high resolution 3D surveys, multimedia visualisation and reconstruction, virtual reality, CGI and 3D content, 3D software development as well as 3D model building. Today the team of 25 experts (surveying engineers, scientists, 3D multimedia designers and artists, IT and software programming specialists) stands for complex 3D projects. Modeling department produces exhibition models in museum quality. The 3D multimedia team integrates 3D data in film productions and creates digital building phase reconstructions, animations, content for multimedia applications, VR & more.

The roots and main focus of the ArcTron company group lie within the 3D documentation of cultural heritage, landmarked buildings, 3D software development and museum services. At the Quo Vadis, ArcTron3D would like to present the process chain from 3D laserscanning to multimedia-based processing for generating 3D content for the film and computer games industry.

(www.arctron.de)

Supervisor

Martin Schaich, M.A, is an archaeologist (Prehistoric Archaeology, Classical Archaeology). After his studies in 1989, he founded the ArcTron company group and has been the managing director ever since. As a surveying specialist, he advanced and broadened the company's scope of business in the year 2000 by implementing 3D scanning technology. This lead ArcTron 3D to its status of an established 3D-expert for cultural goods.

Partners

Industry

7Reasons

Location: Vienna, Austria

Supervisor: Michael Klein

7Reasons

For over 15 years, is leading SME in the area of film production and other media and supplied information technology solutions for renowned companies and institutions. Lately, beside classical media production, 7Reasons have specialised in visualising and explaining research results in exhibitions, documentaries, print and interactive media, as well as the development of robust hardware for use in public areas like museums, exhibitions, and the point of sale.

Services:

CH -Use and Re-use of content: 3D Multimedia Content, Digital Signage Systems, Science Film, Augmented Reality, Exhibition Media Support, 3D Reconstruction, Virtual Reality3D Model Printing, Interactive Solutions, Motion Capture Service, Large Screen Projections, UAV – Aerial Photography, Mobile App Development, Industrial Film Production.

(www.7reasons.net)

Supervisor

Michael Klein, founder and CTO of 7reasons GmbH, Vienna, is a professional in Computer Graphics and serving for more than 3 decades for computer graphics applications in archaeology and cultural heritage. He delivered astonishing deliverables for the Naturhistorisches Museum (NHM) Vienna, the outdoors preservations of the roman settlement Carnuntum, Austria, the Virgil chapel Vienna, and Haus der Geschichte Bonn, Germany, to name only a few. He studied originally design at the University of Applied Arts in Vienna and changed his professional orientation in the beginning of the 1990 ties to 3D Modelling and Animation and applied these skills to the sector of cultural heritage and film production. Most recently he is creating apps for Windows, iOS and Android platforms to transform archaeological and CH content for 'on the move' usage. He is also a professional for AR and VR applications exploiting recent computer graphics hardware for 3D/4D indoors and outdoors visualizations.

Advisory Committee

Jill Cousins

Jill Cousins is the Executive Director of the Europeana Foundation. She has a background in web publishing, event management and research. Her past employment includes commercial publishing as European Business Development Director of VNU New Media and scholarly publishing with Blackwell Publishing. She worked for Learned Information as the Event and Marketing Director of Online Information and Internet World and has worked in financial research for Disclosure having sold her Information research company, First Contact, in an earn out.

Experience at the management consultancy Bain & Co gave her some useful tools and being a map researcher for the Ministry of Defense for the first 18 months of working life an insight into different views of our world. Her passion is enticing unlikely people into their cultural heritage.

(www.pro.europeana.eu)

John Van Oudenaren

Van Oudenaren received an A.B. degree from Princeton University and a Ph.D. in political science from the Massachusetts Institute of Technology. Prior to joining the Library, he worked at the RAND Corporation, the U.S. Department of State and the Kennan Institute for Advanced Russian Studies.

Van Oudenaren has served as chief of the Library's European Division since 1996. He also heads the Library's Global Gateway digital library project, which was launched in 2000. Global Gateway presents international collections of primary source materials from the Library of Congress and contributing partner libraries from around the world. Current contributors to the site are libraries, archives and museums from Russia, Spain, Brazil, the Netherlands and France. The bilingual, multimedia presentations in Global Gateway concentrate on the historical intersections and parallels between the United States and participating nations. The new World Digital Library will broaden the geographic scope of the Library's international digital collaborations by including many more non-Western nations and cultures.

(www.loc.gov/)
(www.wdl.org/)

Advisory Committee

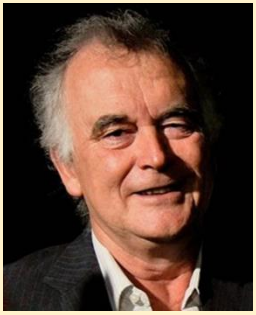
Michael T. Jones

Michael Jones is Google's Chief Technology Advocate, charged with advancing the technology to organize the world's information and make it universally accessible and useful. Michael travels the globe to meet and speak with governments, businesses, partners and customers in order to advance Google's mission and technology. He previously was Chief Technologist of Google Maps, Earth, and Local Search - the teams responsible for providing location intelligence and information in global context to users worldwide. Before its acquisition by Google, Michael was CTO of Keyhole Corporation, the company that developed the technology used today in Google Earth. He was also CEO of Intrinsic Graphics, and earlier, was Director of Advanced Graphics at Silicon Graphics. A prolific inventor and computer programmer since the 4th grade, he has developed scientific and interactive computer graphics software, held engineering and business executive roles, and is an avid reader, traveler and amateur photographer using a home-built 4 gigapixel camera made with parts from the U2/SR71.

(www.google.com/intl/el/earth/)

David Arnold, 1951-2016 †

University of Brighton



David Arnold was involved for over 40 years in research into the design of interactive computer graphics systems and their application in architecture, engineering, cartography, scientific visualisation and over the past 18 years in Cultural Heritage. David was educated at the University of Cambridge and held an MA in Engineering and Computer Science and a PhD in Architecture. He subsequently spent 24 years at the University of East Anglia, Norwich, UK and 14 years at the University of Brighton where he was Dean of the Faculty of Management and Information Sciences and later the University's Director of Research Initiatives and Dean of the Brighton Doctoral College. Critically for the field of Digital Heritage, David was also the director of the university's Cultural Informatics Research Group which he founded in 2002. David was a pioneer and a real European in the area of the e-documentation of the Past.

(www.brighton.ac.uk)

Advisory Committee

Alex Ya-Ning Yen

Alex Ya-Ning Yen is Associate Professor, Department of Architecture and the Director, Center for Cultural Sites Rehabilitation and Development, China University of Technology, Taipei. He holds a Ph.D. in Architectural History and Theory, Southeast University, China, 1997 and a M.A. in Architecture, National Cheng Kung University, Taiwan. His research specialties cover the history of architecture and urban environments, cultural heritage conservation and architectural design. Professor Yen chaired the 25th International Symposium of the International Committee for Documentation of Cultural Heritage (CIPA) in 2015 and is an associate member of the Executive Board. He is Director of both the Architectural Institute of Taiwan and the Association for the Conservation of Cultural Property of the Republic of China. (www.cute.edu.tw/en/)

Eleanor E. Fink

Eleanor E. Fink has held senior positions at the Smithsonian, J. Paul Getty Trust, and World Bank. She is one of the founding directors of the Getty Center in Los Angeles where she initially formed and headed the Getty Vocabulary Program and later became director of the Getty Information Institute (GII). As director, she oversaw the Getty's flagship scholarly art history research databases including the Census of Antique Art and Architecture Known to the Renaissance; the Bibliography of the History of Art; and the Provenance Index. The National Initiative for a Networked Cultural Heritage (NINCH), Getty Vocabularies, Categories for the Description of Works of Art (CDWA), and Object ID are some of the products of her leadership. At the World Bank, she initially served as Senior Cultural Heritage Specialist to the President and then as point person for the Bank's relationships with private foundations. During her tenure at the Smithsonian American Art Museum, she was Chief of the Office of Research Support. She managed several national art research database projects that were created to help the scholarly and museum community better understand the history and significance of American art. Most recently, she initiated and manages the American Art Collaborative Linked Open Data project (AAC) that brings together 14 U.S. museums interested in erasing data silos to provide seamless access about American art across museum collections. She serves on advisory committees including the Dpt of Art and Archaeology at Princeton University, the ITN-DCH and the EU ViMM project. She is a former director of the Museum Computer Network and a former President of the Visual Resources Association. (www.getty.edu/about/), (www.worldbank.org/)

Advisory Committee

Fathi Saleh

Dr. Saleh is a Professor of Computer Engineering at Cairo University and is the Director of the Center for Documentation of Cultural and Natural Heritage (CultNat), which is part of Bibliotheca Alexandrina with the support of the Ministry of Communications and Information Technology. He is also a Member of the Supreme Council of Culture. From 1995 to 1997 he occupied the position of Cultural Councilor at the Embassy of Egypt in Paris, and from 1997-1999, he was the Ambassador of Egypt to the UNESCO. Dr Saleh graduated from the Faculty of Engineering, Cairo University and obtained his Ph.D, Diplôme d'Études Approfondies and Certificat d'Études Supérieures from the University of Paris, France. His main interest is applying new technologies in the different fields of Cultural and Natural Heritage.

(www.cultnat.org)

France Desmarais

As the International Council of Museums' (ICOM) Director of Programmes and Partnerships, since 2010, France Desmarais develops the institution's strategic partnerships and leads the organisation's programmes department in all issues which concern it, specifically in the field of museum emergency preparedness and response, in ICOM's international fight against illicit traffic in cultural goods, as well as diverse tangible and intangible heritage related issues. Under her leadership and initiative, ICOM's Programmes Department created, in 2013, the International Observatory on Illicit Traffic in Cultural Goods (obs-traffic.museum). In developing ICOM's programmes and actions to protect cultural heritage at risk, France works closely with different museums around the world, national governments and international organizations such as UNESCO, INTERPOL, UNODC, WCO, UNIDROIT. She is the permanent Secretary of ICOM's Disaster Relief Task Force for Museums and is administrator of the International Committee of the Blue Shield (ICBS). Before joining ICOM, Ms. Desmarais had previously worked in museum management for over ten years, namely as Head of Strategic Initiatives for a museum in Montreal, Canada, where she is from. She also worked and lived in Central Africa and in the Middle East, teaching at the Faculty of Arts at the Lebanese University. France is now based in Paris, at ICOM's international headquarters.

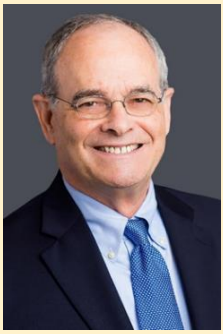
(icom.museum)

Advisory Committee

Friedrich Lüth

Prof. Dr Friedrich Lüth is the President of European Association of Archeologists in Germany, and is a representative for the Conference of German cultural ministers for negotiations on the UNESCO Charta for the protection of underwater archaeology, as well as for the Verband der Landesarchäologen (for European affairs). He advises the European Council on archaeological heritage management. He is a founding member of the Europeae Archaeologiae Consilium. His research interests focus on the area of the Ost See, especially the Northern European Meso- and Neolithic between 6000 and 4000 BC. He is involved in several international projects, e.g. MACHU (MAnaging Cultural Heritage Underwater; funded by the EU); SINCOS (Sinking Coasts: Geosphere, Climate and Anthroposphere of the Holo-cene Southern Baltic Sea, funded by the German Research Council). (www.e-a-a.org)

Thomas R. Kline



Thomas R. Kline advises clients on a wide variety of art, museum, and cultural heritage matters, including issues of ownership, theft, authenticity, breach of contract, insurance, and related disputes. Since 1989 he has practiced in litigation, arbitration, and dispute resolution, and he has represented governments, museums, churches, foundations, and families in recovering stolen art and cultural property. He also represents American museums and collectors responding to claims. He was awarded the Medal of Cyprus Technical University for protecting the cultural heritage of Cyprus and the Officer's Cross of the Order of Merit of the Federal Republic of Germany (Das Verdienstkreuz des Verdienstordens). Tom is experienced in matters concerning art claimed to have been taken by the Nazis during World War II in the systematic looting of art owned by Jews and others. A nationally-recognized authority on Holocaust-related art claims, Tom has appeared before the Presidential Advisory Commission on Holocaust Assets in the United States, and he has helped clients resolve Holocaust-related claims both in and outside of court. Tom also advises clients on modern thefts from archaeological sites and on the illegal removal, export, and import of cultural artifacts. Tom writes and speaks on art, museum and cultural property issues and serves on the Advisory Board of the German/English publication Kunst und Recht. For fifteen years, he has taught a course in museums and cultural heritage at the George Washington University Museum Studies Program. Tom is the president of the Lawyers' Committee for Cultural Heritage Preservation, and on the advisory board of the Initial Training Network for Digital Cultural Heritage. (www.culturalheritagelaw.org)

Advisory Committee

Robert Davies until 2016

Robert Davies is an experienced researcher, creator, leader and manager of European projects and networks with an unbroken track record over more than 20 years. He has initiated and successfully managed a number of key EU actions in the fields of digital cultural heritage, public sector information and e-learning, in relation to Europeana and local heritage. More than 40% of the content in EU digital library Europeana are coming directly from projects coordinated by Rob Davies. He has strong expertise in results-based management and impact evaluation and worldwide experience in consultancy and project development for clients including the World Bank, the Asian Development Bank, the European Development Fund, The Bill and Melinda Gate Foundation, DFID and USAID. He is currently Project Manager of H2020 'Virtual Multimodal Museum' (H2020 CULT-COOP-8).

Monika Hagedorn-Saupe

Staatliche Museen zu Berlin
Preußischer Kulturbesitz

Prof. Monika Hagedorn-Saupe studied mathematics, sociology, psychology, and education with a focus on adult education at the Ruhr-Universität Bochum, at Kings College London, and at the Freie Universität Berlin. Since 1985, she has been staff member of the Institut für Museums¬forschung (Staatliche Museen zu Berlin, Stiftung Preußischer Kulturbesitz), overseeing the annual visitor statistics of all German museums. Since 1994, she has been Head of the department "Visitor related museum research and museum statistics", is responsible for several European projects and acts as the Deputy Director of the Institute. Since 2007 she is a member of the Board of the German Museum Association, since 1997 she chairs the Special Interest Group on Documentation (FachgruppeDokumentation) in the German Museum Association (Deutscher Museumsbund e.V.) and chairs the Information Centres Working Group in CIDOC, the documentation committee in ICOM. In 2001, she was nominated from the German Federal government to participate in the European NRG (National Representatives Group on Digitisation in Culture) and is now a member in the MSEG. She is Professor in museology at the University of Applied Sciences HTW in Berlin/Germany, and teaches terminology in museums in Krems/Austria.

(www.preussischer-kulturbesitz.de)

Advisory Committee

Ewald Quak, 2015 †

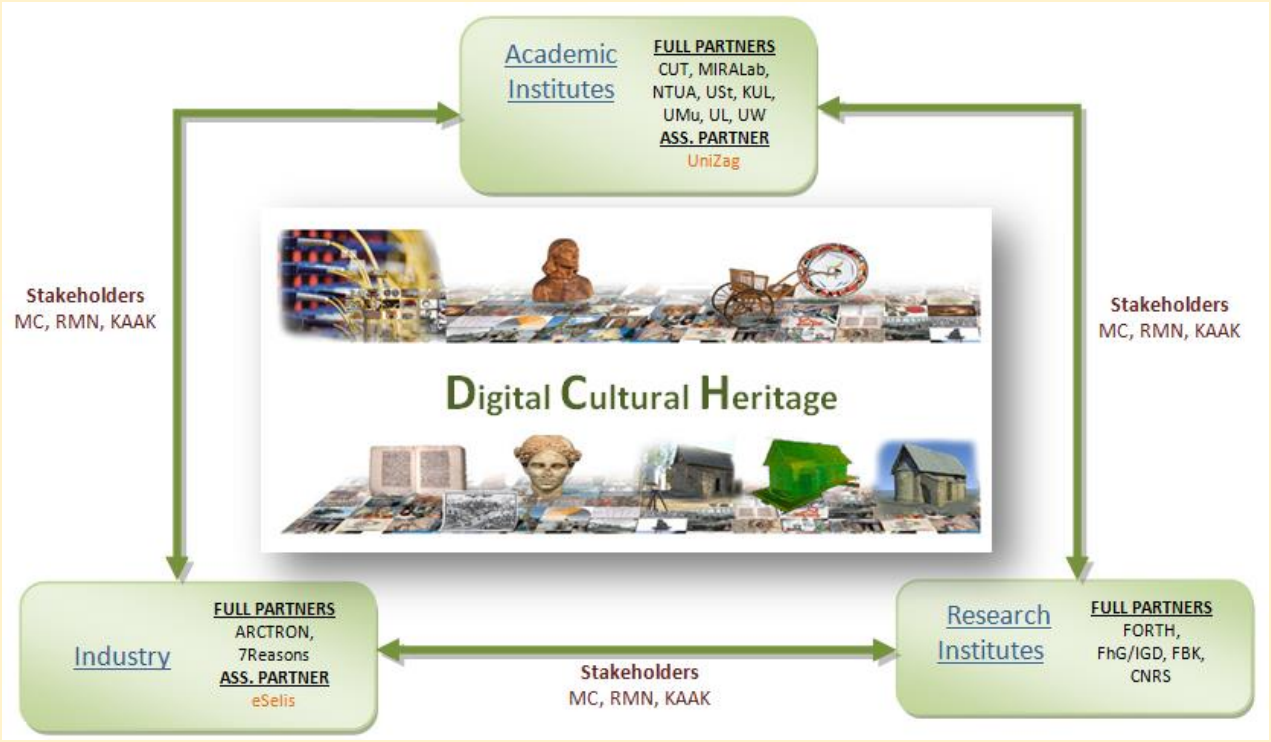
Ewald Quak received his PhD from the University of Dortmund in 1985, and until 1987 worked as a researcher at the same time. He was a fellow of the Alexander von Humboldt Foundation and he worked as an academician and researcher in leading institutions in the USA, Norway, Germany and Estonia. During the last decades, he worked intensively in the area of Cybernetics, Computer Graphics and Digital Heritage. For more than 15 years he was Evaluator, Reviewer and Vice-Chair in the area of Engineering by the European Commission in Brussels. He is one of the visionionaries of the Marie Curie Initial Training Network (ITN-DCH), and he served as the Chair of the Advisory Board until he passed away. Ewald was the Co-Editor of the first Volume (published by Springer Verlag in 2015) of 3D Challenges in Cultural Heritage, about one of the most complicated areas of research in Cultural Informatics. Springer-Nature Verlag has agreed to continue this publication, which will be always dedicated to Ewald's memory. During EuroMed2016 International Conference, we presented the second volume of this unique series of books.

Andreas Nicolaides

Andreas Nicolaides is an Associate Professor at Aix Marseille University, Department of Archeology and History of Art / Laboratoire d'Archéologie Médiévale et Moderne en Méditerranée. His main Research areas are: History of Byzantine Art and Archeology, Iconography / Material Culture, and Byzantine monuments of Cyprus. Born on 4 January 1954 in Limassol, Cyprus, he received his PhD at the University of Provence in 1993. Andreas is a Lecturer at the University of Provence since 1995. He was also a fellow at Dumbarton Oaks (Washington DC), from June to August 1995 and June to August 1997. He beame Project manager for the University of Provence at the Euroméditerranéenne Téthys University, since October 2002. Andreas Nicolaides is also a Member of the Mission of the Civilizations and Humanities Pole at the International Relations of the AMU, since June 2014.

He has participated at important excavations and prospections in Cyprus: Kourion (la basilique portuaire), and Potamia-Agios Sozomenos-Dali, France: Saint-Blaise and Aix-en-Provence (Les Thermes, Rue des Magnans, Palais-Montclar), as well as Lebanon: Beirut (Place des Martyrs). He was involved in research projects resulting at numerous publications.

(la3m.cnrs.fr)



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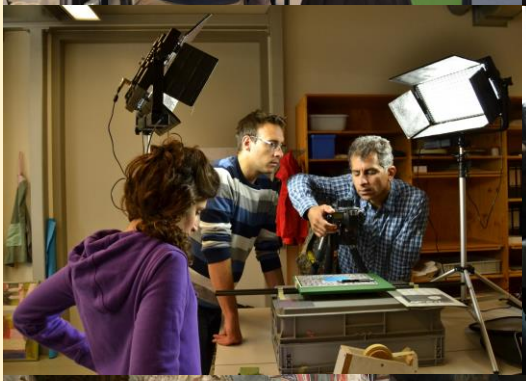


FARO


LA STORIA IN 3D


CARNUNTUM


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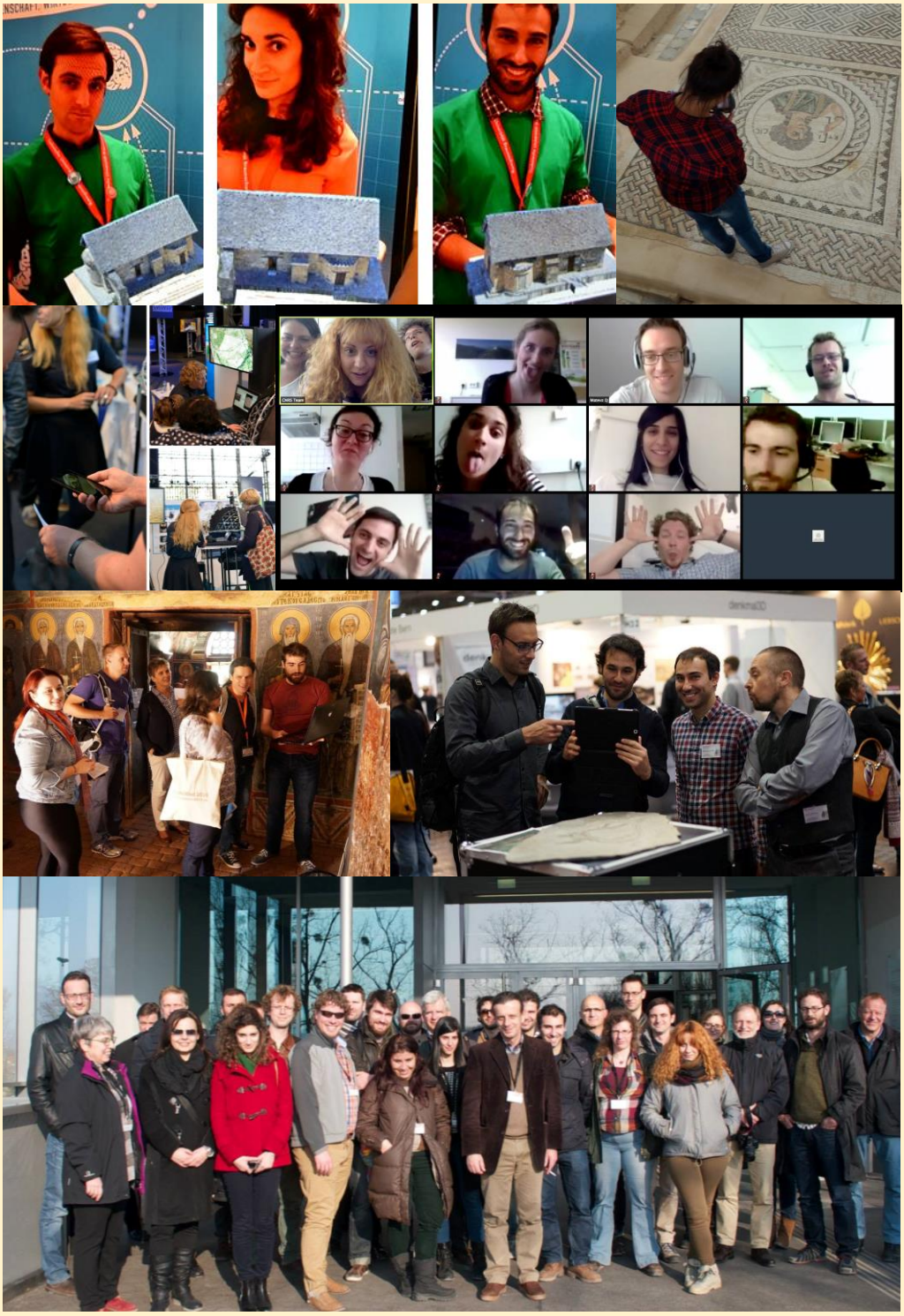


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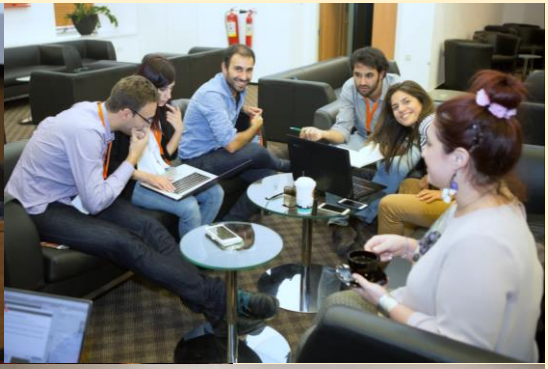





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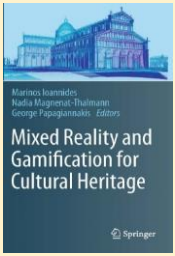


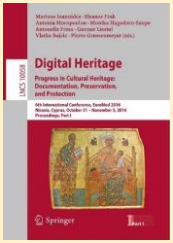
Best Seller

Ioannides, Marinos, Nadia Magnenat-Thalmann, and George Papagiannakis. "Mixed Reality and Gamification for Cultural Heritage." (2017). Springer-Nature International Publisher.
DOI: 10.1007/978-3-319-49607-8

Common book publication of the project. link

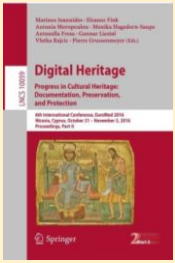
Ioannides, M., Magnenat-Thalmann, N., Fink, E., Zarnic, R., Yen, A. Y., & Quak, E. (Eds.). (2014). Digital Heritage: Progress in Cultural Heritage. Documentation, Preservation, and Protection, 5th International Conference, EuroMed 2014, Limassol, Cyprus, November 3-8, 2014, Proceedings (Vol. 8740). Springer-Nature.
DOI: 10.1007/978-3-319-13695-0

Proceedings of the 1st Conference of the project. link



Ioannides, M., Fink, E., Moropoulou, A., Hagedorn-Saupe, M., Fresa, A., Liestøl, G., Rajcic, V., Grussenmeyer, P. (Eds.). (2016). Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection, 6th International Conference, EuroMed 2016, Nicosia, Cyprus, October 31 – November 5, 2016, Proceedings. Springer-Nature. (Part I)
DOI: 10.1007/978-3-319-48496-9

Proceedings of the 2nd Conference of the project. link



Ioannides, M., Fink, E., Moropoulou, A., Hagedorn-Saupe, M., Fresa, A., Liestøl, G., Rajcic, V., Grussenmeyer, P. (Eds.). (2016). Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection, 6th International Conference, EuroMed 2016, Nicosia, Cyprus, October 31 – November 5, 2016, Proceedings. Springer-Nature. (Part II)
DOI: 10.1007/978-3-319-48974-2

Proceedings of the 2nd Conference of the project. link

and more than 100 publications in high impact journals and conferences around the world, which are available on the EC Participant Portal.

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