



ITN-DCH: PROJECTING OUR PAST TO THE FUTURE

ITN-DCH Newsletter

March 2017

IN THIS ISSUE

ITN-DCH Final Conference on May 23rd - 25th, Olimje, Slovenia

by ITN-DCH

As ITN-DCH project is undergoing its final year, it organizes a unique Conference at Olimje, Slovenia (23-25th May), in the domain of Digital Cultural Heritage. The Conference aims to bring together experts, stakeholders, policy makers and leaders from the field, addressing the current challenges and start a dialogue that will lay the foundation for the creation of a multidisciplinary community of practice.

The conference will focus on encouraging the discussion between young researchers, scientists and experts in the area of digital applications for the analysis of cultural heritage object/ practices, as well as exchange of ideas and opinions. One of the aims is also to inform the researchers and professionals interested in safeguarding heritage assets in earthquake prone areas about possibilities offered by digital technologies.

A perfect platform will be provided for examining the new research opportunities and professional collaborations. Furthermore, it will support the networking between different disciplines; support the

initial stage of researchers' careers and the enhancement of young researchers' networks.

We are seeking for original and innovative contributions in theoretical and practical applications of digital cultural heritage focusing on three main thematic topics: Data Acquisition, Semantic enrichment and Creative Reuse (More at the Section *Forthcoming Events*)



Visit <http://www.digitalheritage2017.eu/> to find out more details about our conference and the Call for extended abstracts!

Cover Photo: "Olimje Castle", CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=1470936>

- ITN-DCH Final Conference Page 1
- KU Leuven domes shine new light on artefacts Page 2
- 12th International Digital Curation Conference Page 3
- Workshop on Interdisciplinary Approach to Monuments' Conservation Page 4
- 10th European Conference on Games Based Learning Page 5
- Secondment @ 7Reasons Page 6
- Deica logo! Page 7
- My personal experience with the ITN-DCH Page 8
- Marie Curie Alumni Association Cyprus Chapter Page 10
- Development of Android Apps for 3D Data Collection using Photogrammetry and Computer Vision Page 11

KU Leuven domes shine new light on artefacts

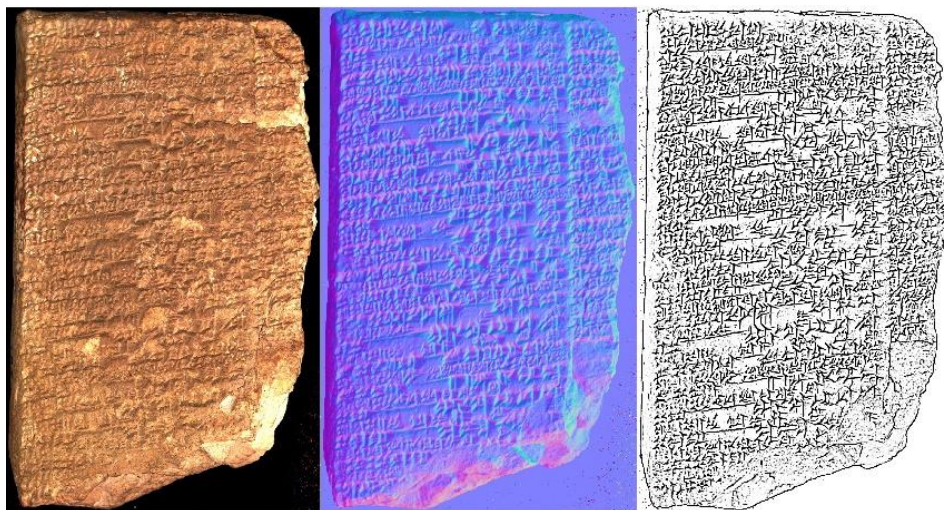
By KU Leuven; Gina Stavropoulou, Dr. Marc Proesmans, Prof. Luc Van Gool



Over several years, KU Leuven has designed and built a photometric stereo setup, that allows to model small surface indentations or protrusions in 3D. This tool is also adequate to capture the sometimes intricate reflectance of their surfaces. The photometric stereo setup consists, as the photo shows, of a hemispherical shell, covered on the inside with several LEDs. These are automatically switched on, one by one, and every time a photo is taken of the artefact lying at the center of the dome, with the overhead camera.

From the different shading patterns observed in these images, a 3D model can be generated, including minute details that are difficult to capture with alternative 3D acquisition tools. The domes come with software that allows scholars to virtually remove the surface texture, to highlight high curvature areas, etc. This tool set also allows to virtually illuminate the model, as they would otherwise do physically. Feedback has been very positive, emphasizing the usefulness of the dome to visualize aspects that may be easily overlooked.

Four versions of the dome were built, in two sizes, and mono-spectral (white LEDs) or multi-spectral (LEDs for 5 different spectral bands: R,G,B,NIR,UV). The smaller version has been combined with a book stand, such that it can be moved across the pages of large tomes in a scanning fashion. It can also be easier to handle for smaller objects, like coins.



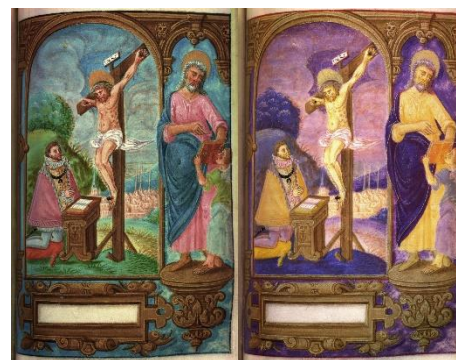
The multi-spectral version is especially useful when the distinction between different paints, dyes, or materials needs to be made.

In the scope of the ITN-DCH network, the doctoral researcher Gina Stavropoulou has used the larger, mono-chromatic dome to deliver services to multiple organizations dealing with cultural heritage. Her main focus was on the creation of software to automatically delineate symbols in cuneiform tablets, for which she has worked together with Dr. Hendrik Hameeuw of KU Leuven,



working with the Royal Museum of Art and History in Brussels. Also the Illuminare Lab of the KU Leuven has become a very regular user (see e.g. the Rich Illuminare channel on Youtube).

KU Leuven can provide versions of each of the 4 types of the domes, on a non-commercial basis.



People interested can contact Paul Konijn, konijn@esat.kuleuven.be

12th International Digital Curation Conference

"Upstream, Downstream: embedding digital curation workflows for data science, scholarship and society"

By Nicola Carboni, ESR8

ESR8 Nicola Carboni attended the 12th International Digital Curation Conference "Upstream, Downstream: embedding digital curation workflows for data science, scholarship and society". The conference, held from the 20 till the 23 February 2017 in Edinburgh, brought together the digital curation community with data producers and consumers to analyze the current digital curation problems and perspective in interdisciplinary. The specific focus of the conference was to embed in the curator's workflow the necessary digital activities for ensuring access, retrievability and interoperability of the data. Specific emphasis was given to the creation and integration of digital infrastructure for serving the data to the community of practice.

Starting on Monday 20/02 with a series of workshop for building up an infrastructure and a workflow for data curation and preservation, the conference offered, in the evening, the first social event, gathering its participants to the beautiful Playfair Library where a pre-conference drinks reception was hosted. The day after the conference opened with a very interesting keynote of Dr. Maria Wolters, which introduced the rich information which hides in the missing data. The keynote speaker showed how much knowledge we can gather considering not only what is describe but what it is not, giving an example of a pattern of missing data that can help gather contextual information over phenomena.

Two parallel sessions were presented after this initial introduction. Very interesting was the research-oriented one, where the diverse approaches to the visualisation and documentation of data workflows were introduced, together with technique to be put in place to improve the lifecycle of data and their quality over time. Particularly important for the fellow was the work presented in the afternoon, specifically the integration of IIF and controlled sources made in the context of the Humanities Data Library by the Sheridan Libraries of the Johns Hopkins University, as well as the integration of geographical and textual source developed in the Charles Booth's London project by the LSE (London School of Economics and Political Science).

Another very interesting keynote was organized at the end of the day, which saw a data scientist from the British Museum laying down the strategy and opportunities given by a data-driven approach to the museum management. Of paramount importance in this workflow is a good data engineering, which is the basis for data structuration and exploitation. The day ended with a second social event, a dinner hosted in the beautiful scenario of the Caves in Edinburgh. The second day was greatly introduced by the keynote of Chris Williams "Towards Automating the Data Analytics Process", which focused on supervised and un-supervised learning strategies for using data in diverse context.



Figure 1. Photo courtesy of Digital Curation Centre
<https://www.flickr.com/photos/digitalcurationcentre/sets/72157679199535930/>

During the rest of the day various interesting papers were presented, such as "Curating Humanity's Research Data: Managing Workflows for Adjusting a Repository Framework" and "Setting up a National Research Data Curation Service for Qatar: Challenges and Opportunities" by, respectively, Hagen Peukert and Arif Shaon. At the end of the day the Executive Director of the Coalition for Networked Information, Clifford Lynch, made some closing remarks and a general wrap up of the conference.

Last but not least, Thursday saw another series of workshops. The fellow followed "Curating Digital Content with Fedora" hosted by David Wilcox of Duraspace, which greatly introduced Fedora and its use for storing and retrieving semantically described digital objects.



Figure 2. Photo courtesy of Digital Curation Centre
<https://www.flickr.com/photos/digitalcurationcentre/sets/72157679199535930/>

Workshop on Interdisciplinary Approach to Monuments' Conservation

By Eirini Papageorgiou, ER2

On Saturday 4/2/2017 the International Council of Monuments and Sites, Cyprus section and the Department of Antiquities of Cyprus have co-organized a very interesting workshop on Interdisciplinarity in the field of Cultural Heritage. The workshop was held in the greek language and under the auspices of the Greek ambassador in Cyprus Mr. Elias Fotopoulos.

In the workshop the case study of the monastery complex of Dafni was presented as well as the exemplary restoration work done (Figure 3). Its first construction phase is dated back to the 11th century, while the complex has many construction phases and additions up to the 19th century. An extended restoration project has been launched after the catastrophic earthquake of 1999 in Athens, Greece that has resulted serious damages on the monumental complex.



Figure 3. The monastery complex of Dafni in Athens, Greece (11th century)

In the restoration project, which is still ongoing, more than 100 people have worked, while the core teams are comprised of architects, civil engineers, rural and survey engineers, engineers for material science, and conservators. The amount of the information that these teams have collected and created alongside the progress of the project is huge, resulting to the development of an extensive archive. The aforementioned teams have collaboratively worked with each other. Collaboration has also been established between various departments of the Greek Ministry of Culture, Universities and Research Centers.



Figure 4. The complexity of monument's restoration procedure



Figure 5. The architect Nikos Delinikolas, Head of the Department of Byzantine and Post-byzantine Antiquities, presenting the architecture, the construction phases and the documentation procedure of the monumental complex

The bearing system of the complex as well as the interventions upon it, which after extended documentation and laboratory experiments was decided to be necessary for the reinforcement of the structure, were presented by the supervisor of the project, civil engineer Dr. Androniki Miltiadou, Assistant Professor at the National Technical University of Athens (NTUA).

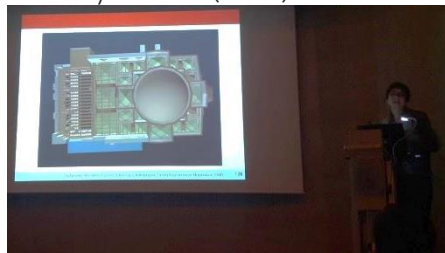


Figure 6. Androniki Miltiadou presenting the interventions upon the bearing system of the church of the monastery complex

Another very important parameter for this project was the existence of the 1000-year old mosaics, which cover the inner surfaces of the walls and vaults of the church. In particular the challenge was that the mosaics were damaged because of the earthquake and needed to be restored simultaneously with the bearing elements that supported them which also suffered their own damages.

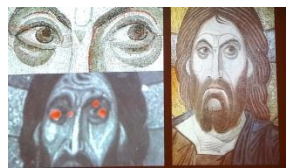


Figure 7. The restoration project has taken place under the watchful eyes of Dafni's Jesus Christ (situated at the church's dome).

Apart from the technical and conservation issues, particularly interesting was also the presentation regarding the educational aspect of a restoration project. Dr.

Stephania Chlouveraki, Professor at the Department of Conservation of Antiquities and Works of Art at the Technological Educational Institute of Athens presented the idea of "holistic approach" in the work of the philosopher and educational reformer John Dewey (1859-1952) who had stated that "We don't have a series of individual worlds, one physical, one mathematical, one historical etc. We live in a world where all aspects are interrelated", as well as in the Guidelines on Education and Training in the Conservation of Monuments, Ensembles and Sites (ICOMOS, 1993). Under the prism of a holistic approach, Education can be also regarded as a key-point for the interdisciplinary approach in the field of Cultural Heritage.

ER2 fellow Eirini Papageorgiou has participated in the workshop with special interest as an architect, but also with some emotion, since she has cooperated in the past both with Dr. Miltiadou and Mr. Delinikolas in various restoration projects in Greece. She has also escorted the multidisciplinary team of Dafni's restoration project to their visit at the ITN-DCH case study of Asinou church on Sunday 5/2 (Figure 9).



Figure 8. Androniki Miltiadou (civil engineer-Dafni project supervisor), Eirini Papageorgiou (architect-ITN-DCH ER2 fellow), Nikos Delinikolas (architect-Dafni project supervisor) and Chrisanthos Pissarides (architect-ICOMOS Cyprus president) at the interdisciplinary workshop about Dafni monastery's restoration project



Figure 9. The multidisciplinary team of Dafni restoration project and ER2 @ Asinou church.

10th European Conference on Games Based Learning

By Margarita Papaefthymiou, ESR10

The 10th European Conference on Games Based Learning was hosted by the University of the West, Paisley, Scotland on 6-7th of October 2016. The conference attracted many scientists, researchers, game designers and developers from many countries worldwide who are interested in topics related to game-based learning and serious games.

At the conference where invited two keynote speakers. The 1st keynote speaker that were presented on the 1st day of the conference was Dr. Baltasar Fernández-Manjón, from the Complutense University of Madrid (UCM), Spain. During his presentation entitled "Gaming Learning Analytics: Contributing to the Serious Games Ecosystem" the speaker described how Gaming Learning Analytics (GLA) can contribute to the Serious Games challenges were they are used in classroom. The second keynote speaker that gave a talk to the conference was Kam Star from the PlayGen, London, UK with the presentation "Hunting the mythical joint exploitation beast" related with gamification. During the conference there were a wide range of sessions like: "Mobile Games", "Games for STEM Learning", "Effective Persuasive Games", "Teacher's Role, Identity and Presence", "Gamification" and many other interesting topics. Apart from the interesting sessions and poster presentations a competition took place at the Conference where the participants presented their interesting educational games.

The ITN-DCH fellow ESR10, Margarita Papaefthymiou, attended and participated at this Conference and presented the accepted paper entitled "Mixed Reality Serious Games and Gamification for smart education" during the "Gamification" session. During this presentation, the fellow introduced a novel Mixed-Reality educational learning framework which involves a number of Mixed Reality Serious Games (MRSGs), referring to digital mini game-shells that allow the learners and teachers to sense the feeling of 'Presence' in both Virtual Reality (VR) as well

as Augmented Reality (AR) formal and informal learning. The aim was the creation of two MRSGs with similar educational content for both VR and AR technologies in order to compare the gamification elements, the learning experience and the gameplay and how these differ in both realities. The presentation focused on the way the realities work and how can be extracted similar gamification elements from both.



Figure 10. ESR10, Margarita Papaefthymiou presenting her work "Mixed Reality Serious Games and Gamification for smart education" during the "Gamification" session.

Secondment @ 7Reasons

By Vasiliki Nikolakopoulou, ESR12

In January 2017, I participated in my first secondment at 7Reasons, Wien, Austria. The purpose of the secondment was to promote collaboration between the two partners and joint involvement in content and context interface creation for tangible and intangible cultural heritage data (2D/3D/4D forms) together with the hosting fellow ESR9, Marleen de Kramer, exploration of different associating software, specially Agisoft, 3D-Goat, 3DsMax and Unity, their capabilities, fields of application, advantages and disadvantages. Both ESRs, we investigated the issues and problems of the existing Asinou mobile app and moved on fixing those as well as setting up the framework for the corresponding Carnuntum's mobile app, concentrating mostly on running tests, experimenting on different layouts and examining other similar applications and corresponding literature.



Figure 12. Screenshot from experimenting on setting up a panorama view: Carnuntum's 3D content

The overall aim was to exchange ideas and expertise on the creation of content and context by using the project's digital heritage data, acquired knowledge and also to hand over the technological know-how of the already developed applications (Asinou app and website).

My training focused on the aforementioned software and technology used from data acquisition to data processing and 3D modelling; operations that are mostly performed by experts both inside the project and the Digital Cultural Heritage (DCH) domain. Hence, I had the opportunity to recognize the challenges a researcher faces when reconstructing a 3D model and be provided with a clear inside view of the methodology and the procedure followed when creating 3D/4D content from raw data. This was of determinant importance for my

future involvement in ITN-DCH, realizing the problems, requirements and needs of my collaborators in a multidisciplinary project, and my research interests too, where context creation and design of the User Interface (UI) depend on the availability of the content creation ("dimensions of content"), its accuracy, data size and purpose of use.

Accordingly, my academic, research and professional background in creating mock-ups, defining user interface requirements, prototyping UIs, usability evaluation, user studies, and basic handling of 3D software were greatly improved within this secondment as well as my cooperative skills with specialists from this field (3D/4D multimedia content creation) when carrying out interdisciplinary research.

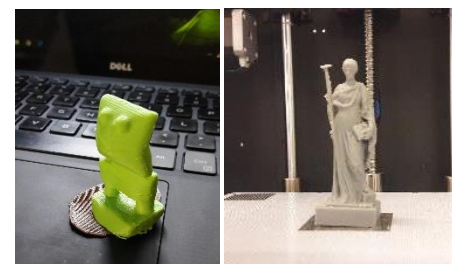
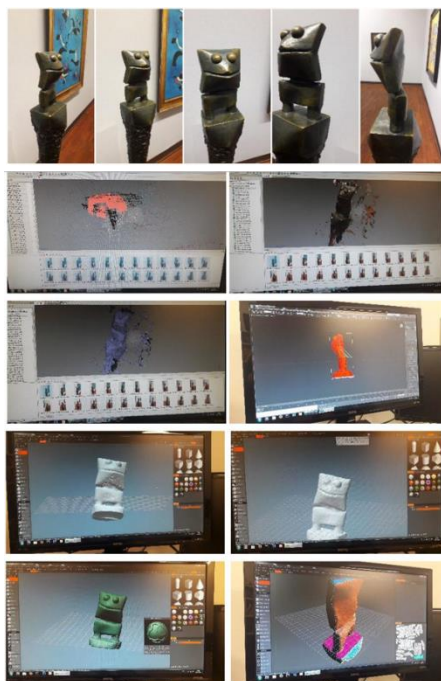


Figure 13. 3D printed models of statues – data acquired from images (left: contemporary art, right: Muse Calliope) from the Albertina museum in Wien, Austria.

Overall, the most invaluable outcome of this fruitful experience was my collaboration with Supervisor, Michael Klein, and, of course, my co-fellow Marleen, which I would also like to thank for the excellent hosting, guidance and the heritage tours!



Figure 14. ESR12 on Virtual tour with HTC Vive @ 7Reasons



Figure 11. ESR9 Marleen de Kramer, ESR12 Vasiliki Nikolakopoulou and Supervisor Michael Klein, on presentation of the project's 2nd Case Study: Carnuntum

Deica logo!

By Diego Bellido Castaneda, ESR₃

After more than two years of intensive training activities within the ITN-DCH project, my fellowship is coming to an end. Therefore, I would like to take the opportunity to reflect back the different experiences gained through this project and to thank the collaborative work and support received during this time.

These 24 months have been a combination between professional experiences and personal stories. When I looked backward in time, I see myself during the first day of my fellowship, waiting for the bus to get ArcTron3D, surrounded by snow (very different to what I was used back home) and without understanding a single word of German. Also, I remember my first ITN-DCH meeting, during the workshop at Carnuntum, when expressions such as “deliverable”, “secondment” and “work package” sounded completely strange to me. Additionally, remember the names of all the participants seemed to me an impossible task.

It is nice to look back and observe the difference with the present. Now, I am more used to the cold and the snow, I can understand a bit of German (even if it's still not as good as I would like) and I am used to the German traditions (I have even my own “lederhosen” for traditional Bavarian beer festivals). Regarding the project, these words that one day sounded strange to me, are now completely integrated into my vocabulary. Furthermore, it seems impossible to have a future without all the people I have met that day at Carnuntum. All this experiences achieve one of the goals of the project, the creation of a common identity, where the culture differences between the different regions are not a problem but an essential part of our Cultural Heritage.

Create a brief summary of all the professional activities is not easy. Beginning with the activities of my hosting institution, ArcTron3D, which has given to me the opportunity to be involved in the planning, execution and completion of different CH projects. These different projects have provided to me innovative tools to work with and therefore, the experience gained through daily work has allowed me to integrate this knowledge into the case studies, specifically in Donaustauf (case study III) and Ilmendorf (case study IV).

Donaustauf castle, has been extensively documented since the beginning of the ITN-DCH. Aerial and terrestrial images of the castle macro photogrammetry at the Historic Museum of Regensburg as well as different terrestrial laser scanners (Riegl VZ-400 and long range VZ-2000) have been used to enhance the training of the fellows in 3D documentation, using various events such as the secondment at ArcTron3D in July 2015. The last dataset was provided by an Aerial Laser Scanner survey using the Riegl VP-1 turnkey solution integrated onto the ArcTron3D paraglide trike. This information can be found in the 10th Newsletter.

Regarding Ilmendorf, close range photogrammetry as well as structured light scanner were used to digitize small findings and opening a collaborative work which finished with a scientific publication entitled: “Data provenance in photogrammetry through documentation protocols”. Furthermore, the 3D models produced were used by ESR₉, Marleen De Kramer, to produce a virtual Belt Reconstruction, which preliminary results were included in the 6th Newsletter.

The project has also offered to me the opportunity to work with institutions and professionals in the area of cultural heritage around Europe and even further afield. During this time I had participated in four secondments (University of Stuttgart, University of Warwick, Fondazione Bruno Kessler and CNRS) as well as co-organize the secondment hosted at ArcTron3D. Additionally, ITN-DCH has been an excellent opportunity to participate with different roles in enrichment events, such as conferences, workshops, seminar, dissemination activities as well as the different activities organized by ITN-DCH such as summer schools and network meetings.

Undoubtedly, this two year has enriched my knowledge and skills regarding the digitization of cultural heritage. Furthermore, it opens a possibility to remain linked to this field in the future which would not otherwise have been possible. For all of this, I would like to thank all the ITN-DCH community who have made this possible. To conclude, I would like to say “Deica logo”, which in Galician language does not mean goodbye but see you soon in forthcoming events (maybe in the ITN-DCH final conference)



My personal experience with the ITN-DCH

By Michael Klein, 7Reasons

The ITN DCH was our first experience within this special funding framework, although we had participated in Marie Curie programs and (have been) trained in industry and academic partnership programs (IAPPs), we now had the onetime chance to concentrate and transfer our know-how to a singular fellow dedicated to learn from our daily workflows.

The recruiting

The recruiting process in the industry is very much different because of the demands which are expected to the pre-conditions on the future employee, depending on the given tasks. In this case, we had to look for a combination between our possible contribution to the project and combine these with its needs. Our core business is the creation of virtual and real content for the mediation of knowledge in the field of cultural heritage and especially in the fields of archaeology. Therefore, we looked for a person skilled in technical aspects of the content creation with a background in history, archaeology and preferably also in architecture. After a thoroughly planned and executed recruiting process we met the right person, Marleen de Kramer, who seemed to combine the needed characteristics.

Everything planned but some things can never be foreseen

Already on the first working day we invited the ESR to a very complicated set – up of a large-scale projection on site of a 400m² excavated (planetological) oyster reef where projections of animated content (explaining the morphology of the regions last 20 million years) had to be adjusted in 12 meters' height. This work had to be carried on until late in to the night and proved to me, through the interest and anticipation of the fellow, that the choice of choosing this employee was the right one.

Our daily work is characterized by a high grade of flexibility since we are serving museums, sites and official communities with content and hardware for exhibitions and have to deal with unexpected challenges and changes based on the desire of our customers and their demands. Subsequently we are working with a load of different software programs for the creation of 3D and 2D content and various hardware devices ranging from motion capture suits to VR Headsets and customized installations in the exhibitions. Our aim was to introduce this world of content and hardware creation to our fellow and teach her the skills of media production in order to prepare her for other fields of work in the future.

The integration into the ITN-DCH team (fellows and advisors)

Since the program was aimed to use the know-how and facilities of all partners involved, a fruitful and harmonic collaboration between the fellows, supervisors and partners was compulsory and therefore vital for the success. Our Fellow was able to integrate herself into the team on

various occasions and meetings and also build up a strong communication throughout the project. Clearly this also had to be case within the 7Reasons team.

7Reasons participates annually in the "Tag des Denkmals", Austria's European Heritage Day initiative. It gave our fellow the opportunity to reach out to the public and explain the aims and methods of the ITN - DCH project within the framework of general heritage. The booth was situated in the heart of the historic 1st district of Vienna at the Michaelerplatz, the main square in front of Vienna's historic palace. The information booth helped direct visitors to over 50 different heritage projects in the city and answer questions about Roman Vienna, in cooperation with the archaeological service of the city of Vienna together with the reenactment group "Gentes Danubi" - and our digital reconstructions of the ancient city. Over 4500 people were counted at the booth in the first year, and nearly 10,000 in the second, which confirms the increasing interest of the public in the town's heritage. This and other occasions gave our fellow the opportunity to get in direct contact with the interested public and scientists in charge. A corresponding article was posted on the project website.



Figure 15. The Michaelerplatz on World Heritage Day

Not only the case studies

Even though the project had marked out 3 case studies for all fellows to work on, we additionally introduced our fellow to other running projects to get a hint how the production works in "real life environments" and gain experience with other media production methods like filming, motion capture and programming in 3D real-time environments. Also, we had the chance to involve Marleen de Kramer to several exhibitions on which we worked on for our clients and show the difficulties of balancing out the tasks of hardware development and installation as

well as visitors surveys to obtain a realistic feedback of the presented medias.

The result

After 30 months of internal training and collaboration with all partners our fellow was able to boost her skills in 3D modelling and animation, 3D

real-time development for mobiles, online medias, film production and 3D documentation methods and experiences with exhibition planning and production. The enrichment on her skills also lead to a new job opportunity directly after the project and will certainly server for her further work. We have made wonderful experiences with the training program and also learned a lot from all participants contributing to the overall expertise of our company.



Figure 16. ITN-DCH visits the Carnuntum artefact repository

Marie Curie Alumni Association Cyprus Chapter

By Georgios Leventis, ER3

The Marie Curie Alumni Association (MCAA) promotes an active community of researchers who currently are or were under training Marie Curie Fellows. In order to improve its proximity to its members, the MCAA has several delegations named Chapters in different geographical locations that contribute in the dissemination of Marie Skłodowska-Curie Actions, in fostering global relations as well as in creating true ambassadors immersed in different research and innovation communities. The MCAA holds its General Assembly once a year and members meet regularly at local level in different parts of Europe and other continents to develop new connections and to examine the evolution of their respective fields of research. Upon request its members can receive small grants while they are being backed-up with a growing range of information and support services through MCAA’s website (<https://www.mariecuriealumni.eu/>).

The MCAA’s statistics provided in the form of pie charts at the respective website’s address: <https://www.mariecuriealumni.eu/charts>, last accessed on 14/03/2017, show that only 36 people out of the current registered users (approx. 8770) possess the Cypriot Nationality, while 11 of them currently reside in Cyprus (Figure 17)! Taking into consideration the statistics, it becomes easily perceived that the number of registered Marie-Curie fellows (and Alumni) is extremely low compared to the corresponding-one in other countries, which led us in the assumption that there might be more researchers under a Marie-Curie fellowship in Cyprus. Towards the scope of disseminating further the MCAA word in Cypriot territory, Digital Heritage Research Lab took the initiative to propose a work plan of activities in Cyprus. Hence, the Association’s board deemed the planned successful and sustainable accepting our proposal for establishing the Cyprus Chapter (<https://www.mariecuriealumni.eu/groups/cyprus-chapter>) thus providing the opportunity to CUT fellows -Georgios Leventis-ER3, Eirini

Papageorgiou-ER2 and Vasiliki Nikolakopoulou-ESR12- as Chapter’s founding members to get actively involved in Chapter’s coordination. The primary goal of our Chapter is to bring together current Marie - Curie fellows and alumni that either work in Cyprus or are Cypriots conducting their research abroad are being provided the opportunity to meet, exchange opinions that address their scientific fields of expertise as well as to mutually collaborate in succeeding their common goals. In this scientific context, Chapter’s kickoff-meeting is being scheduled to be conducted within the next month, where its current 15 members will meet for the first time, present their field of expertise along with their research work and discuss the next steps towards the achievement of Chapter’s objectives. Moreover, various meetings and workshops will take place in Cyprus, where the researchers will have the opportunity to demonstrate their work through outreach activities, to build-up and strengthen their network.

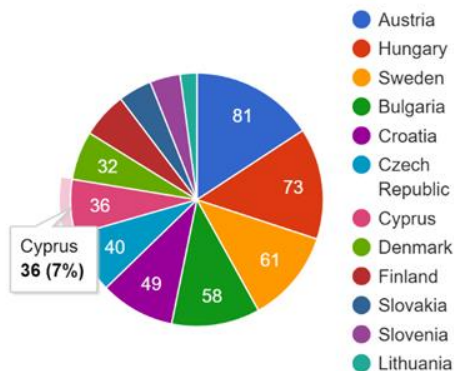


As we anticipate in recruiting new members who meet the prerequisites to the newly-founded Chapter, we strongly invite people to contact us directly through email: cyprus.chapter@mariecuriealumni.eu

Like us on our Facebook page: <https://www.facebook.com/MCAA.Cyprus/>.

Nationality

Region



Current Country of Residency

Region Current

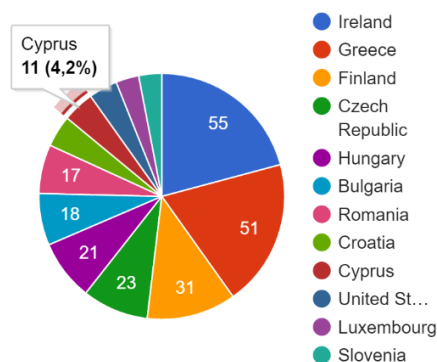


Figure 17. Left Pie-Chart depicts the nationalities of MCAA members; while the right-one depicts their country of residency. Source: <https://www.mariecuriealumni.eu/charts>

Development of Android Apps for 3D Data Collection using Photogrammetry and Computer Vision

By Dieter Fritsch, Institute for Photogrammetry / Institute for Parallel and Distributed Systems, University of Stuttgart

Introduction

With the ongoing developments of mobile devices a paradigm shift is triggered to let more and more applications run on these devices than on desktop computers. There is no doubt that also applications in geodesy, geoinformatics and photogrammetry are directly impacted by these developments. Recent market studies claim for 2015 the use of about 930,000,000 smart phones having GPS sensors on board – the predictions for 2020 are about 2 billions. Although Apple was one of the first computer companies offering smart phones with easy-to-use user interfaces by introducing iOS, in the meantime Android devices have obviously a market share of more than 80%. This is reasoned by the “openness” of Android using JAVA for program developments, which is easier to handle than Apples Objective C and/or Swift language.

These mobile devices are all equipped with cameras – it is a well-known fact that nowadays more than 70% of photos are taken with smart phones. Photogrammetry and 3D geometric computer vision have the purpose to reconstruct three-dimensional surfaces with texture from stereo-pair images. They are widely used in several fields such as mapping of topography, digital recovery of cultural relics, digital city modelling, 3D printing and film-making, VR&AR generation and game development. A high precision topographic model is normally generated by airborne photogrammetry with high-performance camera systems. The task of close-range photogrammetry and geometric computer vision, similarly, is accomplished with professional or low-cost cameras using 3D reconstruction software implemented on PC platforms.

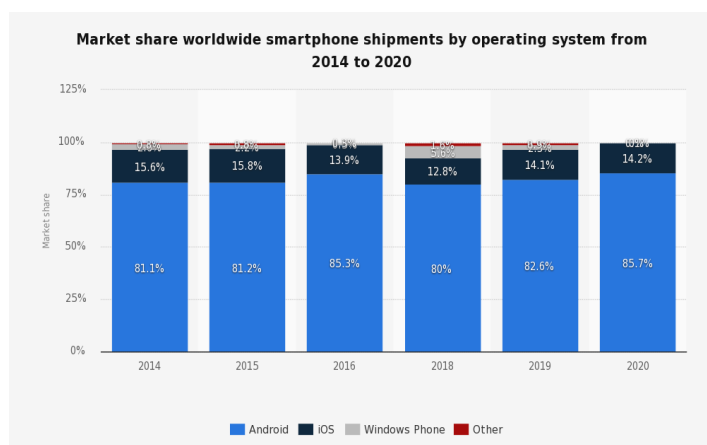


Figure 18. Market occupancy of different operating systems of smart phones from <http://www.statista.com>

Today, mobile phones become the necessity of daily life and the camera quality of the smart phone is getting better and better. Among all operating systems of mobile phones, the Android platform will account

the largest market shares from 2014 to 2020 as illustrated in Fig. 18. The Institute for Photogrammetry of the University of Stuttgart, Germany, has taken the lead of Work Package 6 of the ITN DCH project, which is dealing with “Cloud Services in Digital Cultural Heritage”. Besides the two deliverables 6.1 and 6.2 which will be delivered soon, we are developing Apps for 3D data collection using the Cloud and without the Cloud.

A first App “AndroidSfM” - renamed to “Android 3D” - has been finished end of 2014 and was presented at the SPIE Electronic Imaging Conference 2015, San Francisco (Fritsch&Syll, 2015). In the following the main issues of this development for photogrammetric 3D reconstruction are described, seen from a point of view of software engineering. The App works on smartphones and tablets likewise. Android was chosen as it will dominate the usage of mobile operating systems over the next years to come. The photos are taken with mobile devices, and can thereafter directly be calibrated using standard calibration algorithms of photogrammetry and computer vision, on the device. Due to still limited computing resources on mobile devices, a client-server handshake using a cloud service such as Dropbox, transfers the photos to the sever to run AndroidSfM for the pose estimation of all photos by Structure-from-Motion and, thereafter, uses the oriented bunch of photos for dense point cloud estimation by dense image matching algorithms. The result is transferred back to the mobile device for visualization and ad-hoc on-screen measurements. This client-server architecture is providing fast and reliable results for all situations having an Internet connection available. It can be programmed using Asynchronous Remote Procedure Calls (Asynchronous RPC). The strength and weaknesses for choosing this architecture is given below.

An analysis using classical quality items driving software development: reliability, efficiency, security, maintainability, size and acceptability will come to the following conclusions:

- **Reliability:** The complete 3D reconstruction process will not depend on the number of photos and resolution, neither the hardware configuration of the mobile device nor its Android version. Is also independent of available device memory. Parallel usage seems feasible, as the user can shoot more photos during processing the first shots.
- **Efficiency:** There are only intermediate interactions with remote resources (only to send photos and get the results). Furthermore, it benefits lower usage of data access, memory and disk space.
- **Security:** All data and information are automatically backed-up on a remote server.

- Maintainability: As two applications are running (one on the device and one on the server, Fig. 19) this is more complex than running on the mobile device only.
- Size: The app running on the mobile device is a small size
- Acceptability: It will depend on the expectations of the user based on time of processing, fail rates, and quality of results.

Moreover, it is possible to enumerate further benefits because the 3D reconstruction process is realized on a server:

- By processing on a server, better hardware configurations can be used: for example, more processors, higher RAM, GPU and CUDA. Then the application will have (indirectly) the performance of a desktop application.
- Results can be delivered faster and it is also possible to process a larger number of photos and higher resolutions. Of course, the processing time will also depend on hardware capabilities and the software running on the server.
- The reconstruction can be implemented using other software tools like VisualSfM or Bundler, in addition with dense reconstruction software like PMVS or SURE. Then the data is processed using the best currently available algorithms for pose estimation and dense image matching.
- The time of development will be shorter, and already a first app version would be as powerful as existing PC applications. When the desktop applications are upgraded, the app functionality will also benefit.

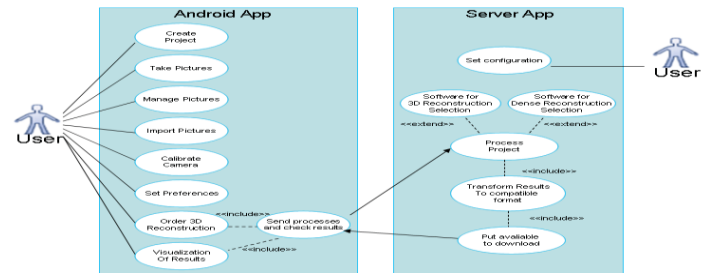


Figure 19. Use case diagram

If a Stand-Alone Application is completely programmed on the device, the following problems will appear:

- The dense 3D reconstruction using PMVS or SURE should be performed in any case onto a desktop. Then the results of the device would be preliminary.
- If we expect that the results of the 3D reconstruction on the device should have the same quality as those resulting from a desktop, then a new module has to be programmed. Additionally, code necessary to perform this task should be provided and authorized by the authors, which could be a problem.
- Even if we expect that future mobile devices are becoming more powerful and increase the chances to program a Stand Alone Application, desktop hardware will follow the same trend, and its programs will also benefit from these developments.

Most probably, as a conclusion, is to say, that the development of 3D reconstruction algorithms on mobile devices will always be behind

desktop applications due to hardware differences. This hypothesis has been proven by another App#2 AndroidSfM (see chapter 3).

Results of the App#1 AndroidSfM (Client-Server Solution)

The camera screen for taking photos is depicted in Fig. 20, for which a UI has been written to render the photo by additional informations, provided by other smartphone sensors (GPS, accelerometer, etc.).



Figure 20. Screen of mobile device for taking photos with rendered pose information

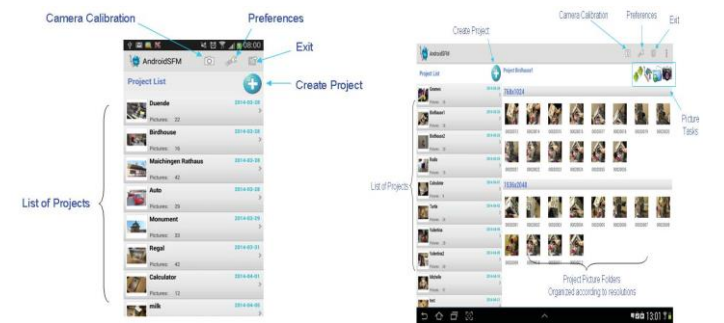


Figure 21. Main screens (left) on smartphones, (right) on tablets

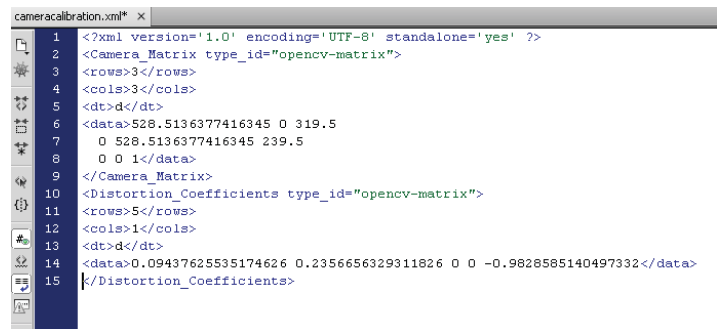


Figure 22. Camera calibration parameters

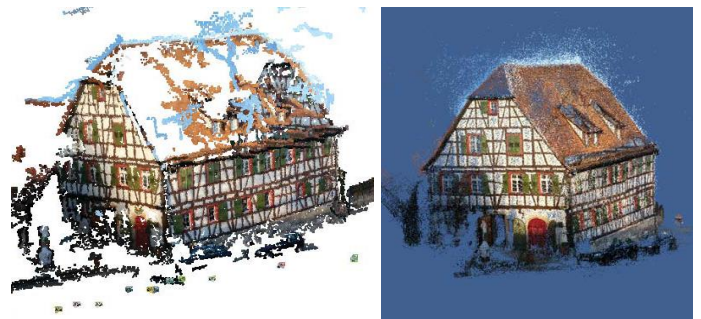


Figure 23. Point cloud of Maichingen house on smartphone (left) PMVS, (right) SURE

Results of the App#2 AndroidSfM (Stand-alone Solution)

This second App AndroidSfM (Stand-alone solution) has been developed to reconstruct 3D structure with several images input without any client-server handshake. As it is an Android app, the development platform Android Studio is selected as the IDE for development.

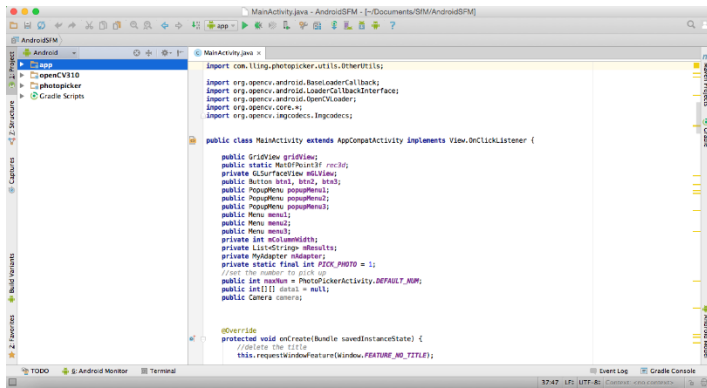


Figure 24. User interface of Android Studio

The basic pipeline of the program is demonstrated by Fig. 25. The input data are images as well as the calibration information. The structure from motion algorithm is written in an independent class based on the OpenCV3.1 library. The output result is the point cloud which will be finally visualized by OpenGL ES.

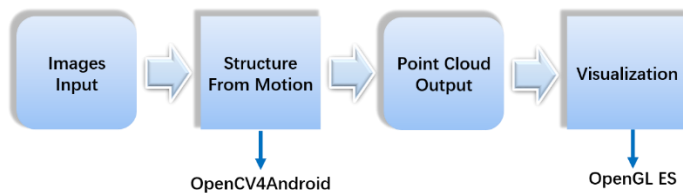


Figure 25. Pipeline of App#2 AndroidSfM

The App runs on smartphones and tablets likewise (see. Fig. 26).

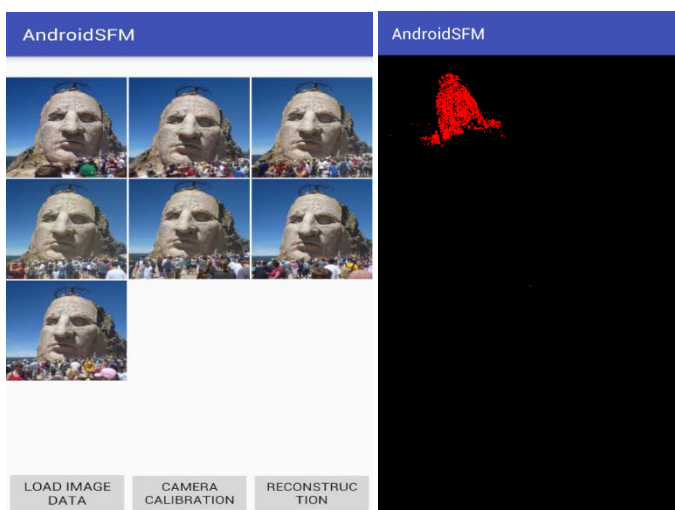


Figure 26. Images and the point cloud processed by App#2 AndroidSfM

We have learned, that it is generally possible to implement the workflow of Fig. 25 on a smartphone or tablet, as stand-alone program. The shortcomings, on the other hand, are still a big problem of direct 3D reconstructions on mobile devices.

- Photogrammetry or 3D computer vision is more focused on accuracy than efficiency. That is why professional users are mostly intended to do such reconstructions using a PC, which has CPU and GPU with higher performance.
- SfM is a time-consuming step in the workflow. Image matching and bundle adjustment are relatively slow processes. When the reconstruction is done with a large amount of images, a reconstruction on the device is almost impossible.
- Since SfM is resource consuming, it takes a lot of power to finish the process. However, the mobile device is not always fully charged. The power of a phone will become flat very soon.
- Dense reconstructions using SURE or PMVS are temporally available on PC only. To program this on Android mobile is not practical due to the limited memory and lower-performance CPU.

Conclusions

The App#1 AndroidSfM is an example or first stage of an application to make 3D reconstructions (indirectly), therefore, it is possible to add new features such as:

- Add new reconstruction applications (Bundler, Agisoft Photoscan, etc.)
- Enable new ways to exchange files (Google drive, local folders, etc.)
- Perform other tasks remotely on the point clouds using information collected by further sensors.

With regard to the Android operating system, using Asynchronous Mobile Remote Procedure Calls, we think that the system could multiply its usage for generating useful information also in the area of computer vision. It would be interesting, for example, to analyze the possible results of using arrays of synchronized devices (at different angles and overlaps as implemented in Ultracam) but in close range photogrammetry. Additionally, any further sensor information could be added to increase the collected information contents (4D, 5D, 6D?).

The App#2 AndroidSfM, developed during 2015 and 2016, has proven the implementation of calibration, Structure-from-Motion and Dense Image Matching algorithms without the Client-Server-Handshake using the Cloud. As a result, it was confirmed, that at this point in time the mobile devices are not yet powerful enough wrt to computing resources to do every steps on the device.

Dieter Fritsch, Institute for Photogrammetry / Institute for Parallel and Distributed Systems, University of Stuttgart
dieter.fritsch@ifp.uni-stuttgart.de

Forthcoming events & meetings

ITN - DCH Project's Final Conference

The Maria Sklodowska Curie Project Initial Training Network (ITN) on Digital Cultural Heritage (DCH) has its Final Conference on Digital Heritage on **May 23-25, 2017**, in Olimje, Slovenia.

ITN-DCH, being 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, sets its Final Conference on the international events' list in the respective domain. 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, 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.

Since Digital Cultural Heritage is a complex domain that requires new skills, advanced techniques and constantly upgrading know-how, for the fulfilment of which a multilevel training and an interdisciplinary collaboration among experts is necessary in order for common methodologies and best practises for the profound understanding of our past to be established.

To this cause, the following Final Conference's topics are aiming to cover a wide spectrum of the lifecycle of a digital CH artefact:

| Data Acquisition for Tangible and Intangible - Processing and Modelling | Metadata - Semantics – Ontologies | Archiving / Use and Reuse |
|--|---|--|
| Image matching and 3D reconstruction | Linked data and application | Digital curation workflows & application |
| 3D scanning & digitization (laser, structured light, motion capture, etc.) | Authenticity & provenance | Audio/video digital libraries |
| Low-cost 3D reconstruction | Metadata aggregation | Annotations & Annotation management |
| Heritage Building Information Modeling (HBIM) | Quality metrics | Data visualization |
| 4D modelling | Ontology engineering | Interactive visualization |
| Multi-source data/multi-sensors approaches | Principles, guidelines, and best practices | Storytelling and serious game |
| Image matching and 3D reconstruction | Application profile | Mixed / augmented reality |
| 3D scanning & digitization (laser, structured light, motion capture, etc.) | Interoperability and mapping across domains | |
| Low-cost 3D reconstruction | Linked data and application | |

More info: <http://www.digitalheritage2017.eu/>

and Call for extended Abstracts: http://www.digitalheritage2017.eu/file/Call_for_Abstracts.pdf

The 30th Conference on Computer Animation and Social Agents, CASA 2017

The 30th International Conference on Computer Animation and Social Agents (CASA 2017) will be held on **May 22-24, 2017** in Seoul, South Korea.

CASA is the oldest international conference in computer animation and social agents in the world. It was founded in Geneva in 1988 under the name of Computer Animation (CA). In the last past ten years, CASA was held in Switzerland (2006), Belgium (2007), Korea (2008), Netherlands (2009), France (2010), China (2011), Singapore (2012), Turkey (2013), United States (2014), Singapore (2015), and Switzerland (2016).

CASA 2017 will provide a great opportunity to interact with leading experts, share your own work, and educate yourself through exposure to the research of your peers from around the world.

The Conference seeks research full papers, short papers, and posters on a broad range of research topics, including but not limited to:

Computer Animation

- Procedural animation
- Motion capture & processing
- Data-driven animation
- Physics-based animation
- Human and animal modeling
- Motion planning
- Behavioral animation
- Plant development and growing
- Artificial animals and animals
- Population generation
- Virtual cities
- Persistent worlds
- Procedural animation
- Motion capture & processing
- Data-driven animation

Visualization

- Medical imaging and reconstruction
- Molecular graphics
- Visualization of physical phenomena
- Information visualization
- Medical imaging and reconstruction
- Molecular graphics
- Visualization of physical phenomena

Embodied Agents

- Avatars
- Autonomous Virtual Humans
- Perceptual models
- Memory and behavior models
- Emotions and personality
- Intelligent Virtual Humans
- Social and conversational agents
- Inter-agent communication
- Groups and crowd simulation
- Avatars
- Autonomous Virtual Humans

Virtual and Augmented Reality

- Tracking
- Gesture and action recognition
- 3D telepresence
- Mobile VR/AR
- Haptic interfaces
- Immersive systems
- VR/AR applications
- Tracking
- Gesture and action recognition
- 3D telepresence

More info: <https://casa2017.kaist.ac.kr/wordpress/about-casa-2017/>

COMPUTER GRAPHICS INTERNATIONAL 2017, CGI'17

The Computer Graphics International will be held on **June 27-30, 2017** in Yokohama, Japan. It is one of the oldest international annual conferences in Computer Graphics and one of the most important ones worldwide, founded by the Computer Graphics Society (CGS). It is a yearly meeting where academics present their latest algorithms, models and technologies, and explore new trends and ideas on various computer graphics topics. Since 1983 it has been held in numerous different cities worldwide including Geneva, Tokyo, Sydney, Boston, Singapore and many different countries in Europe, Asia, Australia and North & South America.

CGI'17, the 34th annual conference will take place on June 27th – June 30th 2017 in Yokohama, Japan. The conference is organized by the Computer Graphics Society (CGS) and hosted by Faculty of Science and Engineering, Keio University, in cooperation with ACM-SIGGRAPH and Eurographics.

Original contributions that advance the state-of-the-art are invited in topics related to:

- Affective Computing
- Big Data Visualization
- City Modeling
- Computational Fabrication
- Computational Geometry
- Computational Photography
- Computer Animation
- Computer Vision for Computer Graphics and HCI
- Crowd Simulation
- Data Compression for Graphics
- Deep Learning for Graphics
- Geometric Algebra Computing
- Geometric Algebra for Graphics
- Geometric Processing
- Geometric Modeling
- Global Illumination
- Human-Computer Interaction
- Sketch-based Modeling
- Solid Modeling
- Stylized Rendering
- Textures
- Web Graphics
- Human Modeling
- Image and Video Processing
- Image-based Rendering
- Information Visualization
- Interactive Graphics
- Medical Imaging
- Meshing and Remeshing
- Non-photorealistic Rendering
- Physically Based Modeling
- Point-based Graphics
- Rendering Techniques
- Saliency Methods
- Scientific Visualization
- Shape Analysis and Image Retrieval
- Shape and Surface Modeling
- Shape Matching
- Human Modeling
- Virtual and Augmented Reality
- Visual Analytics
- Virtual Geographical Environments
- Volume Rendering

More info: <http://fj.ics.keio.ac.jp/cgi17/>

MUSEUMS AND THE WEB CONFERENCE 2017, MW 17

The MW (Museums and the Web) conferences convene annually in North America and Asia. This year takes place on **April 19-22, 2017**, in Cleveland, Ohio, US. Our meetings and proceedings feature advanced research and exemplary applications of digital practice for cultural, natural and scientific heritage. Formed by leading professionals from around the world, our community has been meeting since 1997, and recognizing the best in cultural heritage innovation through the [GLAMi](#) (formerly [Best of the Web](#)) awards annually. More than 1000 [papers from the past 20 years of MW conferences](#) are freely accessible online and offer an unparalleled resource for museum workers, technologists, students and researchers that grows every year.

MW offers a range of professional learning opportunities, from plenary sessions to un-conference sessions, from formal papers to informal networking, from museum project demonstrations to commercial exhibits, from professional debates to lightning talks, from how-to sessions to crit rooms and the Best of the Web awards. Prior to the conference, there are half-day workshops and pre-conference tours. Social events include receptions each evening, and lots of refreshment breaks provide plenty of time to meet and talk with colleagues.

All kinds of people from around the world come to Museums and the Web. You will find webmasters, educators, curators, librarians, designers, managers, directors, scholars, consultants, programmers, analysts, publishers and developers from museums, galleries, libraries, science centers, and archives – as well as the companies, foundations and governments that support them – at Museums and the Web every year.

More info: <http://mw17.mwconf.org/>

ICOMOS - INTERNATIONAL DAY ON MONUMENTS AND SITES

Every year on **18 April**, ICOMOS celebrates the International Day for Monuments and Sites, whose establishment was approved by the 22nd UNESCO General Conference in 1983.

In 2017, the theme is “**Cultural Heritage & Sustainable Tourism**”, chosen in relation to the [United Nations International Year of Sustainable Tourism for Development](#) and in the context of the [2030 Agenda for Sustainable Development and the Sustainable Development Goals](#).

International Day for Monuments and Sites 2017 offers the opportunity for ICOMOS Committees across the world to celebrate the positive outcomes of a deepening partnership between sustainable tourism development and cultural heritage conservation (as well as referencing the potential negative impacts). On this day ICOMOS - through its National and International Scientific Committees - encourages local communities and individuals to consider the importance of cultural heritage to their lives, identities and communities, and to promote awareness of its diversity and vulnerability and the efforts required to protect and conserve it. This is the first time ICOMOS has invited National Committees and International Scientific Committees to share and raise awareness of innovative initiatives and current “best practice” in the field of Cultural Heritage & Sustainable Tourism with their local communities.

“Cultural Heritage & Sustainable Tourism” is an important theme in the context of conservation in the 21st century. At the outset we should remind ourselves that ICOMOS has been a leader in this field over many years producing the first ICOMOS International Cultural Tourism Charter in 1976 and the second - endorsed by the General Assembly in Mexico - in 1999. During 2017, the ICOMOS International Scientific Committee Cultural Tourism is leading a Review of the Charter and looks forward to contributions from National and International Scientific Committees in providing feedback through the meetings and events they organize to celebrate ICOMOS International Day for Monuments and Sites 2017.

More info: <http://www.icomos.org/en/what-we-do/focus/18-april-international-day-for-monuments-and-sites>

ICOM - INTERNATIONAL MUSEUM DAY

The worldwide community of museums will celebrate International Museum Day on and around **18 May 2017**.

The theme chosen for 2017 is "Museums and contested histories: Saying the unspeakable in museums".

The objective of International Museum Day is to raise awareness of the fact that, "Museums are an important means of cultural exchange, enrichment of cultures and development of mutual understanding, cooperation and peace among peoples." Organised on and around 18 May each year, the events and activities planned to celebrate International Museum Day can last a day, a weekend or a whole week.

Participation in International Museum Day is growing among museums all over the world. In 2016, more than 35,000 museums participated in the event in some 145 countries.

More info: <http://network.icom.museum/international-museum-day>



Visit:



<http://www.itn-dch.eu/>

Find us on 

<http://ww.facebook.com/itndch>

YouTube

<https://www.youtube.com/watch?v=1npcQvGaQJY>

Credits:

Thanks to all the people that have contributed to this edition of the ITN-DCH newsletter in particular:

KU Leuven: Gina Stavropoulou, Dr. Marc Proesmans and Prof. Luc Van Gool, Nicola Carboni, Margarita Papaefthymiou, Diego Bellido Castaneda, Michael Klein, Eirini Papageorgiou, George Leventis, Prof. Dieter Fritsch, Vasiliki Nikolakopoulou

Acknowledgments:

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 608013.

