REVIVING ANCIENT ROME:
VIRTUAL REALITY AT THE SERVICE OF CULTURAL HERITAGE

Philippe Fleury and Sophie Madeleine,

Équipe de Recherchesur les Langues, les Imaginaires et les Sociétés (ERLIS),
axe ERSAM, groupe "Plan de Rome"
Centre Interdisciplinaire de Réalité Virtuelle (CIREVE)
University of Caen Basse-Normandie, Esplanade de la Paix, MRSH,
14032 Caen cedex 5, France
philippe.fleury@unicaen.fr- sophie.madeleine@unicaen.fr

Abstract:

Since the Renaissance, the remains, myths and visual representations of ancient Rome have influenced not only European culture but also the architecture and urban planning of the big cities of Europe and of the Americas through the process of colonization. The University of Caen Basse-Normandie (France) has a famous visual representation of ancient Rome in the scale model of Paul Bigot, a French architect who lived at the beginning of the 20th century. This exceptional part of our cultural heritage has been the pretext for a virtual reconstruction of ancient Rome. The technologies used and, in particular, the interactive visit with access to ancient source materials give a new life to the myth. Our team has developed a fully interactive model of ancient Rome which allows a visitor to move freely in a full-scale city and enter the main public buildings as well as some private apartments. The aim is both scientific and didactic. Scholars can use the model as a regularly updated database for reference and possible experiments. The general public can visualize a world that is now beyond their reach. This paper will focus on a particular example

==

HISTORICAL SOCIAL HOUSING:
SMART ANALYSIS AND DESIGN FOR CONSERVATION AND ENERGY REGENERATION

Elena Gigliarelli[1], Donato Carlea[2,1], Angela Corcella[2], Heleni Porfyriou[3]

[1]National Council of Research CNR, Institute for Technologies Applied to Cultural Heritage,
ITABC Via Salaria km. 29.300, 00016 Monterotondo, Italy
[2]Sapienza University, Faculty of Architecture,
Via Gramsci, 53 00197 Rome, Italy
[3]National Council of Research CNR, Institute for the Conservation and Valorization of Cultural Heritage,
ICVBC, Via Salaria km. 29.300, 00016 Monterotondo, Italy
elena.gigliarelli@itabc.cnr.it,
donato@carlea.net, angela-corcella@hotmail.it, porfyriou@icvbc.cnr.it

Abstract:

The article presents the results of a methodological study aimed at the development of an integrated, intelligent and expeditious system for the understanding, evaluation, and upgrading of energy efficiency in historical urban social housing neighborhood's. The possibilities offered by GIS and ICT systems were explored for the analysis and planning of building and energy improvements. The purpose of the study was to provide a support tool for upgrade projects planned for social housing which would include the multiple variables necessary for an understanding of the transformation process which led to the current state of the buildings, and which would be able to provide alternatives and solutions for their regeneration.

==

AN AUTOMATED METHODOLOGY FOR ASSESSING THE DAMAGE ON BYZANTINE ICONS

Anastasios Maronidis and Andreas Lanitis

Department of Multimedia and Graphic Arts, Cyprus University of Technology,
P.O. Box 50329, 3036 Lemesos, Cyprus.
{anastasios.maronidis, andreas.lanitis}@cut.ac.cy

Abstract:

Byzantine art is overwhelmed by a multitude of icons that portray sacred faces. However, a large number of icons of historical value are either partially or totally damaged and thus in need of undergoing conservation. The detection and assessment of damage in cultural heritage artifacts comprise an integral part of the conservation process. In this paper, a method that can be used for assessing the damage on faces appearing in Byzantine icons is presented. The main approach involves the estimation of the residuals obtained after the coding and reconstruction of face image regions using trained Principal Component Analysis texture models. The extracted residuals can be used as the basis for obtaining information about the amount of damage and the positions of the damaged regions. Due to the specific nature of Byzantine icons several variations of the basic approach are tested through a quantitative experimental evaluation so that the methods most suited to the specific application domain are identified. As part of the experimental evaluation, holistic as well as patch-decomposition techniques have been utilized in order to catch the global and local information of the images, respectively. According to the results it is possible to detect and localize with reasonable accuracy the damaged areas of faces appearing in Byzantine icons.

==

TACTILE REPRESENTATION OF PAINTINGS: AN EARLY ASSESSMENT OF POSSIBLE COMPUTER BASED STRATEGIES.

Monica Carfagni[1], Rocco Furferi[1], Lapo Governi[1], Yary Volpe[1], Giovanna Tennirelli[2]

[1]Dipartimento di Meccanica e Tecnologie Industriali, Università degli Studi di Firenze,
Via S. Marta, 3 50141, Firenze, Italy
{monica.carfagni, rocco.furferi, lapo.governi, yary.volpe}@unifi.it
[2]Facoltà di Lettere e Filosofia, Università degli Studi di Firenze,
Piazza Brunelleschi, 3-4 50121, Firenze, Italy
giovanna.tennirelli@unifi.it

Abstract:

In recent years, a number of works meant to define the criteria for translating two-dimensional art into tactile representation, to be benefit of blind and visually impaired people. Due to technology-related limitations, however, these studies mainly investigated only some kinds of possible representations (e.g. tactile diagrams). This work deals with the analysis of 4 alternative translation strategies, implemented using computer-based tools, to determine the most effective one in delivering blind people a correct perception of pictorial artworks. The outcomes of the study contribute new information to the field of tactile paintings for blind and visually impaired individuals by testing the response of a panel of potential users.

==

AN ENHANCED DISTRIBUTED REPOSITORY
FOR WORKING WITH 3D ASSETS IN CULTURAL HERITAGE

Xueming Pan[1], Thomas Schiffer[1], Martin Schröttner[1], René Berndt[2], Martin Hecher[2],
Sven Havemann[1], Dieter W. Fellner[1,3]

[1]Institute of Computer Graphic and Knowledge Visualization,
Graz University of Technology, 8010 Graz, Austria
{x.pan, t.schiffer, s.havemann}@cgv.tugraz.at
[2]Fraunhofer Austria Research GmbH, Visual Computing, 8010 Graz, Austria
{Rene.Berndt, Martin.Hecher}@vc.fraunhofer.at
[3]GRIS, TU Darmstadt &Fraunhofer IGD, 64283 Darmstadt, Germany

Abstract:

The development of a European market for digital cultural heritage assets is impeded by the lack of a suitable marketplace, i.e., a commonly accepted distributed exchange platform for digital assets. We have developed such a platform over the last two years, a centralized content management system with distributed storage capability and semantic query functionality. It supports the complete pipeline from data acquisition (photo, 3D scan) over processing (cleaning, hole filling) to interactive presentation, and allows collecting a complete process description (paradata) alongside. In this paper we present the components of the system and explain their interplay. Furthermore, we present and explain which functional components, from transactions to permission management, are needed to operate the system. Finally, we prove the suitability of the API and present a few software applications that use it.

==

3D INFORMATION SYSTEM FOR THE DIGITAL DOCUMENTATION AND THE
MONITORING OF STONE ALTERATION

Chiara Stefani[1], Xavier Brunetaud[2,3], Sarah Janvier-Badosa[2], Kevin Beck[2,3], Livio De Luca[1], Muzahim Al-Mukhtar[2,3]

[1]UMR 3495 MAP - Modèleset simulations pour l'Architecture et le Patrimoine, ENSA
Marseille, 184 Av. de Luminy, 13288 Marseille Cedex 9, France.
[2]Université d'Orléans, Ecole Polytechnique d'Orléans,
8 rue Léonard de Vinci, 45072, Orléans, France.
[3]CRMD - Centre de Recherchesur la Matière Divisée,
1B rue de la Férollerie, 45071 Orléans Cedex 2, France.
{chiara.stefani, livio.deluca}@map.archi.fr{xavier.brunetaud}@univ-orleans.fr
{sarah.janvier, kevin.beck, muzahim.al-mukhtar}@cnrs-orleans.fr

Abstract:

Today mapping of alterations of cultural heritage buildings and estimation of their degradation patterns is still a difficult task for several reasons. On one hand, buildings suffer from degradation problems depending on physical and chemical factors, whose causes can be difficult to determine. On the other hand, at the level of data representation, graphic supports need to be defined for deterioration analysis and heterogeneous data manipulation. The goal of this research is to supply experts with a tool for scientific monitoring and decision support so to permit rational programming operations of restorations. This paper proposes an approach for digital documentation of conservation state of buildings (stone alteration, dating, material), permitting to display and cross-reference data related to degradations. This approach will be described through the study case of stones at Chambord Castle.

==

3D HERITAGE ON MOBILE DEVICES: SCENARIOS AND OPPORTUNITIES

Karina Rodriguez Echavarria, Jaime Kaminski, David Arnold

Cultural Informatics Research Group, University of Brighton, Moulsecoomb, BN2 4GJ

{K.Rodriguez, J.Kaminski, D.B.Arnold}@brighton.ac.uk

Abstract:

The cultural heritage sector's interest in mobile and 3D technologies has increased in recent years. This is partly because heritage organisations have a large amount of compelling content – much of which simply cannot be displayed in physical museums and other venues because of space constraints. Consequently, mobile technology represents an exceptional opportunity for the sector to offer innovative approaches for individuals to interact with cultural heritage assets. This paper presents visions for exploiting 3D mobile technologies in the cultural heritage sector by employing a use-inspired basic research approach based on hypothetical scenarios. These scenarios focus on different fields such as archaeology, preservation, education and tourism. Moreover, the paper examines the opportunities required to address the challenges in several research areas, including 3D technology, semantically linked data, crowdsourcing as well as privacy and copyright. Finally, the paper acknowledges the challenges involved on ensuring the business sustainability of these innovative applications.

==

AN INFORMATION SYSTEM FOR MEDIEVAL ARCHAEOLOGY BASED ON PHOTOGRAMMETRY AND ARCHAEOLOGICAL DATABASE: THE *SHAWBAK CASTLE PROJECT*.

Pierre Drap[1], Djamal Merad[1], Julien Seinturier[1], Jean-Marc Boï[1], Daniela Peloso[1],
Guido Vannini[2], Michele Nucciotti[2], Elisa Pruno[2]

[1]LSIS umr CNRS 6168, Centre National de la Recherche Scientifique, Marseille, France
name.surname@univ-amu.fr
[2]Dipartimento di Studi Storici e Geografici dell' Università degli Studi di Firenze, Florence, Italy.
guido.vannini@unifi.it, nucciotti@unifi.it, elisa.pruno@unifi.it

Abstract:

The paper presents an interdisciplinary project which is a work in progress towards a 3D Geographical Information System (GIS) dedicated to Cultural Heritage with a specific focus application on the Castle of Shawbak, one of the best preserved rural medieval settlements in the entire Middle East). The Shawbak archaeological project is a specific and integrated project between medieval archaeological research and computer vision done thanks to a long cooperation between University of Florence and CNRS, LSIS, Marseille. Focusing mainly on stratigraphical analysis of upstanding structures we provide archaeologists with two-step pipeline. First a survey process using photogrammetry, both in a traditional way with additional annotations and using the most advanced technique to obtain dense maps and then a tool for statistical analysis. Two main applications are presented here, stratigraphy analysis with Harris matrix computed on the fly from the 3D viewer and statistical tools, clustering operation on ashlar in order to show new relationships between the measured artifacts.
All these developments are written in Java within Arpenteur framework.

==

AUTOMATED GENERATION OF AN HISTORIC 4D CITY MODEL OF HAMBURG AND ITS VISUALISATION WITH THE GE ENGINE

Thomas P. Kersten[1], Friedrich Keller[2], Jerome Saenger[4] and Jochen Schiewe[3]

[1]Hafen City University Hamburg, Photogrammetry & Laser Scanning Lab,
[2]HafenCity University Hamburg, Geodetic Lab,
[3]Hafen City University Hamburg, Lab for Geoinformatics and Geovisualization,
Hebebrandstr. 1, 22297 Hamburg, Germany
[4]Hospitalstraße 8, 06536 Bennungen, Germany
{Thomas.Kersten, Friedrich.Keller, Jochen.Schiewe}@hcu-hamburg.de
Jerome.Saenger@t-online.de

Abstract:

Current 3D city models are already available for many cities world-wide. However, the production of historical city models is still in its infancy. In this paper a procedure is presented that combines different data sources in order to derive individual 3D city models of different time periods using the example of the Free and Hanseatic City of Hamburg. A wooden model of the city from the year 1644 and an official map from 1859 have been used as a basis for the generation of the 4D city model. The physical model (~1:1000) was scanned by a fringe projection system for 3D modelling, while the digitized data from the map were combined with height information from different data sources. These two geo-referenced 3D city models were used to derive further epochs (1200, 1400, 1589 and 1700) using different historical bird's-eye views (isometric views) of the city. For interactive navigation and visualization of the 4D city model a program was developed using the Google Earth Application Programming Interface.

==

SEMANTIC MODELS FOR ARCHITECTURAL HERITAGEDOCUMENTATION

Erik Costamagna, Antonia Spanò

Politecnico di Torino, viale Mattioli 39, 10125 Torino Italy
{erik.costamagna,antonia.spano}@polito.it

Abstract:

In the field of CH metric documentation management the development of GIS tools has radically improved the capability of handling complex geometric models and the quantity of the semantic values of spatial data. These improvements in GIS tools have been followed by the development of data models and data definition languages able to manage such a complexity through a set of open rules and vocabularies. We need to change the application-driven practice of the GIS to a common set of rules and frameworks through the adoption of open-standards and languages. The aim of this study is to showcase the results of the test of framework for the management of a 3D metric survey archive by means of CityGML standard.

==

ALBERTI'S BOX. THE CULTURAL MULTIMEDIA PROJECT ON THE ARCHITECTURES OF LEON BATTISTA ALBERTI

Marcello Balzani[1], Carlo Bughi[2], Federico Ferrari[3],
Luca Rossato[2] and Alessandra Tursi[2]

[1]TekneHub and Department of Architecture, University of Ferrara, Ferrara, Italy
marcello.balzani@unife.it
[2]Department of Architecture, University of Ferrara, Ferrara, Italy
{carlo.bughi, luca.rossato, alessandra.tursi}@unife.it
[3]Tekne Hub, University of Ferrara, Ferrara, Italy
federico.ferrari@unife.it

Abstract:

Far from their physical locations, buildings can be visualized, perceived and understood only thanks to a digital action of dematerialization and re-materialization., The Alberti's Box was developed starting from this awareness. The intense collaboration between the DIAPReM Centre (Development of Integrated Automatic Procedures for Restoration of Monuments) of the Ferrara University, the Consorzio Ferrara Ricerche and the Leon Battista Alberti Study Centre Foundation of Mantua realized a cultural project allowing everyone the gathering of all the data and documentation related to the Alberti's architecture: the flow of multimedia suggestions and digital reconstruction tries to describe the dynamics of his thought and tries also to explain which are the design, the technology and the interpretation queries the Alberti's architecture still place. Alberti's Box is an ideal magical box containing the philosophy of a humanist who has generated both architectural forms as well as thoughts.
The idea is very simple: the aim is to stimulate the direct vision of the building, not its replacement. The digital interpretation of the buildings inside the Alberti's Box has an analytical, documentary and explanatory function and the integration of various languages is the key to understand the architectures of Leon Battista Alberti, even if absent.

==

VIRTUAL ARCHITECTURAL 3D MODEL OF THE IMPERIAL CATHEDRAL (KAISERDOM) OF KÖNIGSLUTTER, GERMANY THROUGH TERRESTRIAL LASER SCANNING

Thomas P. Kersten and Maren Lindstaedt

Hafen City University Hamburg, Photogrammetry & Laser Scanning Lab,
Hebebrandstr. 1, 22297 Hamburg, Germany
{Thomas.Kersten, Maren.Lindstaedt}@hcu-hamburg.de

Abstract:

The imperial cathedral (Kaiserdom) of Königslutter, Germany, is one of the most important examples of Romanesque architecture north of the Alps. In April 2010 complex conservation and restoration works were finished to celebrate the 875th anniversary of the laying of the cathedral's foundation stone. The imposing structure of the cathedral was recorded internally and externally in 3D using terrestrial laser scanning in January and June 2010 as part of a student project at the Hafen City University Hamburg. The goal of the project was the 3D CAD construction of the cathedral using laser scanning point clouds to derive both a virtual and physical (replica) 3D model for the documentation and visualisation of the building. Furthermore, a virtual tour around and through the cathedral was generated from spherical panorama photographs, which were acquired from several camera stations surrounding and inside the building.

==

IMAGE-BASED LOW-COST SYSTEMS
FOR AUTOMATIC 3D RECORDING AND MODELLING
OF ARCHAEOLOGICAL FINDS AND OBJECTS

Thomas P. Kersten and Maren Lindstaedt

Hafen City University Hamburg, Photogrammetry & Laser Scanning Lab,
Hebebrandstr. 1, 22297 Hamburg, Germany
{Thomas.Kersten, Maren.Lindstaedt}@hcu-hamburg.de

Abstract:

In most cases archaeological finds and objects remain in the country of origin. Thus, for potential users away from that location, 3D models of archaeological finds and objects form an increasingly important resource since they can be analysed and visualised in efficient databases using web-based tools over the Internet. Since typical 3D recording technologies for archaeological objects, such as terrestrial laser scanning or fringe projection systems, are still expensive, cumbersome, inconvenient, and often require expert knowledge, camera-based systems offer a cost-effective, simple and flexible alternative that can be immediately implemented. This paper will demonstrate how the geometry and texture of archaeological finds and objects can be automatically constructed, modelled and visualized from digital imagery using freely-available open-source software or web services. The results of several objects derived from different tested software packages and/or services are compared with reference data in order to analyse the accuracy and reliability of such objects.

===

A CONTRIBUTION TO A UNIFIED APPROACH IN POLICY MAKING THROUGH DOCUMENTING CULTURAL HERITAGE

Barbara Vodopivec[1], Rand Eppich[2], Ingval Maxwell[3], Alessandra Gandini[2]
Roko Žarnić[1]

[1]University of Ljubljana, Faculty of Civil and Geodetic Engineering, Jamova 2, SI-1000 Ljubljana
barbara.vodopivec@fgg.uni-lj.si; roko.zarnic@fgg.uni-lj.si
[2] Fundación Tecnalia, Research & Innovation, Spain
rand.eppich@tecnalia.com; alessandra.gandini@tecnalia.com
[3]Consultant in Architectural Conservation, Edinburgh, EH9 3AN, Scotland
ingval@blueyonder.co.uk

Abstract:

The paper presents the results of an interdisciplinary research project, bridging technical sciences and the humanities, with the purpose of conducting research, exploring arguments and options for the potential of a unified data management system in the European area. Recognizing the ambitiousness of such a project, the primarily intention is to provide well founded arguments to explore the implementation of a unified pan-European approach to cultural heritage data management; including the collection, presentation and storage of tangible and intangible material data on each location under observation.

=======================================

VIRTUAL RECONSTRUCTIONS IN A DESKTOP PLANETARIUM FOR DEMONSTRATIONS IN CULTURAL ASTRONOMY

Georg Zotti[1,2] and Wolfgang Neubauer[2,1]

[1]Vienna Institute for Archaeological Science
Franz Klein-Gasse 1/III, 1190 Vienna, Austria
[2]Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology
Hohe Warte 38, 1190 Vienna, Austria
{Georg.Zotti, Wolfgang.Neubauer}@univie.ac.at

Abstract:

Many cultures throughout history have erected sacred and profane buildings orientated according to astronomical principles. A new plugin for the open-source desktop planetarium Stellarium allows the demonstration and interactive exploration of such buildings.

===

MOBILE DEVICES FOR THE VISIT OF "ANFITEATRO CAMPANO" IN SANTA MARIA CAPUA VETERE

Giuseppina Renda[1], Stefania Gigli[1], Alba Amato[2],
Salvatore Venticinque[2], Beniamino Di Martino[2], Francesca Romana Cappa[1]

[1]Dipartimento di studio delle componenti culturali del territorio
Second University of Naples
Santa Maria Capua Vetere (Caserta), Italy
[2]Department of Information Engineering
Second University of Naples
Aversa (Caserta), Italy
{giuseppina.renda, stefania.gigli, alba.amato, salvatore.venticinque}@unina2.it,
beniamino.dimartino@unina.it, francesca.cappa@gmail.com

Abstract:

Archaeological sites become pervasive environments because of personal devices like tablets and smart-phones, which are able to detect and explain ruins, artifact and points of cultural interest by their on-board peripherals. In this context pervasiveness offers to software applications the possibility to interact with the reality by the device, in order to perceive the information surrounding the users, and to adapt their own behavior and the environment itself. By modeling an archaeological site as a pervasive environment we are able to improve its exploitation by the visitors. Here we present, by a relevant case study, a framework that supports experts in the domain of the Cultural Heritage to augment the archaeological site with a set of multimedia contents, which are delivered by innovative services to the visitors in order to guide their tour and to enhance their perception of the reality.

===

PROSPECTING ARCHAEOLOGICAL LANDSCAPES

Immo Trinks[1], Wolfgang Neubauer[1,2] and Michael Doneus[3,2,1]

[1]Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology, Hohe Warte 38, 1190 Vienna, Austria
[2]Vienna Institute for Archaeological Science, Vienna University, Franz-Klein-Gasse 1/III, 1190 Vienna, Austria
[3]Institute for Prehistory and Early Medieval History, University of Vienna, Franz Klein-Gasse 1/III, 1190 Vienna, Austria

{Immo.Trinks, Wolfgang.Neubauer, Michael.Doneus}@archpro.lbg.ac.at

Abstract:

The future demands on professional archaeological prospection will be its ability to cover large areas in a time and cost efficient manner with very high spatial resolution and accuracy. The objective of the 2010 in Vienna established Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology in collaboration with its nine European partner organizations is the advancement of the state-of-the-art by focusing on the development of remote sensing, geophysical prospection and virtual reality applications, as well as of novel integrated interpretation approaches dedicated to non-invasive spatial archaeology combining cutting-edge near-surface prospection methods with advanced computer science. Within the institute's research program different areas for distinct case studies in Austria, Germany, Norway, Sweden and the UK have been selected as basis for the development and testing of new concepts for efficient and universally applicable tools for spatial, non-invasive archaeology. The collective resources and expertise available amongst the new research institute and associated partners permit innovative approaches to the archaeological exploration, documentation and investigation of the cultural heritage contained in entire archaeological landscapes. First promising results illustrate the potential of the proposed methodology and concepts.

==

AN EXPERT SYSTEM FOR QUALITY ASSURANCE OF DOCUMENT IMAGE COLLECTIONS*

Roman Graf[1], Reinhold Huber-Mörk[2], Alexander Schindler[2,3], and Sven Schlarb[4,1]

[1]Research Area Future Networks and Services
Department Safety & Security, Austrian Institute of Technology
roman.graf@ait.ac.at[2]
[2]Research Area Intelligent Vision Systems
Department Safety & Security, Austrian Institute of Technology
reinhold.huber-moerk@ait.ac.at[3]
[3]Department of Software Technology and Interactive Systems
Vienna University of Technology
schindler@ifs.tuwien.ac.at[4]
[4]Austrian National Library
sven.schlarb@onb.ac.at

Abstract:

Digital preservation workflows for automatic acquisition of image collections are susceptible to errors and require quality assurance. This paper presents an expert system that supports decision making for page duplicate detection in document image collections. Our goal is to create a reliable inference engine and a solid knowledge base from the output of an image processing tool that detects duplicates based on methods of computer vision. We employ artificial intelligence technologies (i.e. knowledge base, expert rules) to emulate reasoning about the knowledge base similar to a human expert. A statistical analysis of the automatically extracted information from the image comparison tool and the qualitative analysis of aggregated knowledge are presented.

==

TOWARDS AN ARCHAEOLOGICAL INDEX: IDENTIFICATION OF THE SPECTRAL REGIONS OF STRESS VEGETATION DUE TO BURIED ARCHAEOLOGICAL REMAINS

Athos Agapiou[1], Diofantos G. Hadjimitsis[1], Andreas Georgopoulos[2], Apostolos Sarris[3] and Dimitrios D. Alexakis[1]

[1]Department of Civil Engineering and Geomatics, Faculty of Engineering and Technology, Cyprus University of Technology, 3603, Limassol, Cyprus
{athos.agapiou, d.hadjimitsis, dimitrios.alexakis}@cut.ac.cy
[2]Laboratory of Photogrammetry, School of Rural & Surveying Engineering, NTUA, Greece
drag@central.ntua.gr
[3]Laboratory of Geophysical - Satellite Remote Sensing and Archaeo-environment, Institute for Mediterranean Studies, Foundation for Research & Technology, Hellas (F.O.R.T.H.), 74100, Rethymno, Crete, Greece
asaris@ret.forthnet.gr

Abstract:

This paper aims to introduce the spectral characteristics of a new Archaeological Index for supporting remote sensing applications in archaeological research. This index will be able to enhance crop marks, observed in satellite images, which are related to buried archaeological remains. For the aims of the research, ground spectral signatures were acquired from two agricultural areas of Cyprus (Alampra and Acheleia), specifically constructed in order to simulate buried archaeological remains. A complete phenological cycle of barley and wheat crops was recorded using the GER 1500 spectroradiometer with spectral range from $350 - 1050$ nm (visible – near infrared spectrum). Correlation regression analysis and evaluation separability indices have shown that results are similar for both sites –regardless crop type. The spectral sensitivity, for enhancement crop marks, was detected at the red edge and near infrared spectrum (≈ 700 and ≈ 800 nm).

=======================================

IDENTITY CARD OF CULTURAL HERITAGE:
HOW TO COLLECT AND ORGANIZE DATA

Roko Žarnić[1], Vlatka Rajčić[2], Antonia Moropoulou[3]

[1]University of Ljubljana, Faculty of Civil and Geodetic Engineering,
Jamova 2, 1000 Ljubljana, Slovenia
roko.zarnic@fgg.uni-lj.si
[2]University of Zagreb, Faculty of Civil Engineering,
Kačićeva 26, 10000 Zagreb, Croatia
vrajcic@grad.hr
[3]National Technical University of Athens, School of Chemical Engineering,
9 Iroon Polytechniou Str., 17773 Athens, Greece.
amoropul@central.ntua.gr

Abstract:

The paper presents the basic idea and content of unified approach to collecting and organizing data on cultural heritage assets in order to use them in processes of decision-making related to its preservation. This presented outline of the content and philosophy behind the European Cultural Heritage Identity Card gives some information on the proposed methodology for the collection, presentation and application of data required for the informed understanding of particular heritage buildings or assets. Combined, on the one hand the EU-CHIC structure may be used as a powerful mechanism for generating relevant data as a processing tool for the permanent maintenance and economical exploitation of heritage, and of its retention, protection and preservation on the other.

=======================================

MODEL-BASED USER INTERFACE DESIGN FOR THE ENCYCLOPEDIA OF ISLAMIC ARCHITECTURE

Osama Mohammad Alrawi

Associate Professor of Architecture, Department of Architectural Engineering, Faculty of Engineering and Technology, Future University, Cairo Egypt
PLEXIMOTIF@yahoo.com

Abstract:

The Encyclopedia of Islamic Architecture (**EIA)** provides the architectural design information that is empirically believed to best represent the content of this kind of architecture, besides being a platform for achieving all accumulated information elements. It is also containing a design information framework to operate as a mechanism for representation of design knowledge through an integrated software/hardware solution. The electronic Encyclopedia of Islamic Architecture is designed to meet the unique needs of specific professions working in true collaborative research operations across the multi-disciplinary extended enterprise including style and form design, historical background and the definition of detailed characteristics of Islamic Architecture. It is a useful research, prototyping and information seeking tool which comprise a number of activities from topic formulation to database search and browsing through accessed document providing a mechanism for user's information need that is useful in every phases of the information seeking process.

====================================

AUGMENTED REALITY FOR ARCHAEOLOGICAL FINDS

Belén Jiménez Fernández-Palacios, Alessandro Rizzi, Francesco Nex

3D Optical Metrology Unit, Fondazione Bruno Kessler,
Via Sommarive 18, Trento, Italy
{bjfernandez, rizziale, franex}@fbk.eu

Abstract:

Augmented Reality (AR) has become a suitable solution for visualization purposes in several applications such as gaming, entertainment or simple visualization. In contrast, only very few applications considers the use of AR for professional and scientific purposes as their use must be adapted to different applications and specific goals. In this paper, the use of Augmented Reality is applied to archaeological objects visualization. An *ad hoc* cube device and 3D Studio Max plug-in have been realized for automatically process 3D complex objects models and visualize them with AR open source software. The developed methodology is described in detail and tests on real archaeological objects are reported and commented.

====================================

ON-LINE SPECTRAL LEARNING IN EXPLORING
3D LARGE SCALE GEO-REFERRED SCENES

Nikolaos Doulamis[1], Christos Yiakoumettis[2] and George Miaoulis[2]

[1]Decision Support and Computer Vision Lab., Technical University of Crete, University Campus,
Kounoudiana, 73100, Chania, Crete, Greece
{ndoulam@cs.ntua.gr}
[2]Technological Educational Insititute of Athens,
Ag.Spyridonos Str. 12243, Egaleo, Athens
{christos@yiakoumettis.gr, gmiaoul@hol.gr}

Abstract:

Personalized navigation of 3D large scale geo-referred scenes has a tremendous impact in digital cultural heritage. This is a result of the recent progress in digitization technology which leads to the creation of massive digital geographic libraries. However, an efficient personalized 3D geo-referred architecture requires intelligent and on-line learning strategies able to dynamically capture user's preferences dynamics. In this paper, we propose an adaptive spectral learning framework towards 3D navigation of geo-referred scenes. Spectral clustering presents advantages compared to traditional center-based partitioning methods, such as the k-means; it effectively categorize non-Gaussian, complex distributions, present invariability to shapes and densities and it does not depend on the similarity metric used since learning is performed through similarity matrices by exploiting pair-wise comparisons. The main difficulty, however, in incorporating spectral learning in 3D navigation architecture is its static implementation. To handle this difficulty, we propose in this paper an adaptive framework through the use of adaptive spectral learning which tailors 3D navigation to user's current needs.

==

COLLECTIVE INTELLIGENCE IN CULTURAL HERITAGE PROTECTION

Anastasios Doulamis[1], Anastasia Kioussi[2], Maria Karoglou[2], Nikolaos Matsatsinis[1] and Antonia Moropoulou[2]

[1]Decision Support and Computer Vision Lab. Technical University of Crete,
University Campus, Kounoudiana, 73100, Chania, Crete, Greece
{adoulam,nikos}ergasya.tuc.gr
[2]School of Chemical Engineering, National Technical University of Athens,
University Campus, Zografou, Athens, 15773, Greece
{nasiak, margo, amoropoul}@central.ntua.gr}

Abstract:

Cultural heritage protection demands targeted restoration actions in order to increase monuments' lifetime. Such actions require the use of conservation materials (e.g., consolidation materials), which can increase the durability of historic materials. However, the performance of each material on the restoration phase significantly differs with respect to its type, chemical properties and the building substrate. In this paper, we propose new decision support architecture able to face these obstacles. The system automatically recommends to the experts the most suitable consolidation material product, among the available ones in the market. Integrated protocols are exploited, computer vision tools and artificial intelligence systems via user's feedback. The proposed architecture is evaluated using a semi-supervised learning methodology on the design of consolidation materials.

==

HERITAGE-LED ECO-REGENERATION.
THE CASE OF ZHEJIANG WATER TOWNS PROTECTION, RESTORATION AND PRESERVATION

Luciano Cessari, Elena Gigliarelli

CNR National Council of Research
ITABC Institute for Technologies Applied to Cultural Heritage,
Via Salaria km. 29,300,00016 Monterotondo st., Roma, Italy
{luciano.cessari, elena.gigliarelli}@itabc.cnr.it

Abstract:

Climate changes have impacts on many sectors: land use, housing, transportation, public health, water supply and sanitation, solid waste, food security, and energy. This article presents the results of the project SECHURBA , financed by European funds, whose purpose was to examine the potential of environmental protection and sustainability in historic cities, documenting barriers and prospects of various historical communities with diversity in Europe. Critical objectives which were achieved, such as 'Historic Community Climate Change Strategies', assessment tools, route maps to intervene in areas such culturally sensitive, are under implementation in historic urban areas in Popular Republic of China. Through the application to some typical towns and villages in the Chinese province of Zeijang the outcomes of SECHURBA will developed to outline a set of actions and tools that will call 'Historic Cities Regeneration by Climate Change Strategies'.

======================================

FLAME DETECTION FOR VIDEO-BASED EARLY FIRE WARNING FOR THE PROTECTION OF CULTURAL HERITAGE

K. Dimitropoulos[1], O. Gunay[2], K. Kose[2], F. Erden[2], F. Chaabene[3], F. Tsalakanidou[1], N. Grammalidis[1] and E. Cetin[2]

[1]Information Technologies Institute, Centre for Research and Technology Hellas, Greece
dimitrop@iti.gr, ngramm@iti.gr, filareti@iti.gr
[2]Department of Electrical and Electronics Engineering, Bilkent University, Turkey
gunayosman@gmail.com, kkivanc@ee.bilkent.edu.tr, erdenfatih@gmail.com, cetin@bilkent.edu.tr
[3]École Supérieure de Communication de Tunis, Sup'Com, Tunisia
ferdaous.chaabene@supcom.rnu.tn

Abstract:

Cultural heritage and archaeological sites are exposed to the risk of fire and early warning is the only way to avoid losses and damages. The use of terrestrial systems, typically based on video cameras, is currently the most promising solution for advanced automatic wildfire surveillance and monitoring. Video cameras are sensitive in visible spectra and can be used either for flame or smoke detection. This paper presents and compares three video-based flame detection techniques, which were developed within the FIRESENSE EU research project.

======================================

A GENERIC APPROACH FOR GENERATING CULTURAL HERITAGE METADATA

Martin Schröttner[1], Sven Havemann[1], Maria Theodoridou[2], Martin Doerr[2], Dieter W. Fellner[1,3]

[1]Institute of Computer Graphics and Knowledge Visualization (CGV),
Graz University of Technology, 8010 Graz, Austria
{m.schroettner, s.havemann}@cgv.tugraz.at
[2]Institute of Computer Science, FORTH, GR-700 13 Heraklion, Crete, Greece
{maria, martin}@ics.forth.gr
[3]GRIS, TU Darmstadt & Fraunhofer IGD,
64283 Darmstadt, Germany

Abstract:

Rich metadata is crucial for the documentation and retrieval of 3D datasets in cultural heritage. Generating metadata is expensive as it is a very time consuming semi-manual process. The exponential increase of digital assets requires novel approaches for the mass generation of metadata. We present an approach that is generic, minimizes user assistance, and is customizable for different metadata schemes and storage formats as it is based on generic forms. It scales well and was tested with a large database of digital CH objects.

=======================================

MULTISPECTRALIMAGEACQUISITION OF ANCIENT MANUSCRIPTS

Fabian Hollaus, Melanie Gau and Robert Sablatnig[*]

Computer Vision Lab Vienna,
University of Technology, Vienna, Austria
{holl,mgau,sab}@caa.tuwien.ac.at

Abstract:

This paper presents image acquisition and readability enhancement techniques based on multispectral imaging. In an interdisciplinary project an imaging system using a combination of LED illumination and spectral filtering was developed. On basis of the resulting multispectral image information the readability of the texts is enhanced and palimpsest texts are made visible by applying two different methods of Blind Source Separation, namely Principal Component Analysis and Independent Component Analysis.

=======================================

MAPPING OF DEFECT STRUCTURAL MICRO-MORPHOLOGYIN THE DOCUMENTATION OF CONSERVATION APPROACHES

Eirini Bernikola[1], Elsa Tsiranidou[1], Vivi Tornari[1], Vincent Detalle[2], Jean Luc Bodnar[3]

[1]Foundation for Reseearch and Technology Hellas
Vassilika Vouton, Heraklion, Greece, 71110
[2]Laboratoire de Recherche des Monuments Historiques
29, rue de Paris 77420 Champs-sur-Marne, France
[3]Laboratoire d' Energétique et d' Optique, UFR Sciences Exactes et Naturelles
BP 1039, 51687 Reims cedex 02

Abstract:

In this paper a study of fresco wall paintings with the use of Digital Holographic Speckle Pattern Interferometry and Infrared Thermography is being presented. Fresco technical samples as well as mural paintings in the Abbey of St. Savin have being examined. The information provided by both techniques leads to valuable results concerning the state of the mural paintings and provides information for their restoration and further conservation.

==

EXPLOITATION OF THERMAL IMAGERY FOR THE DETECTION OF PATHOLOGIES IN MONUMENTS

Dafni Sidiropoulou-Velidou[1], Andreas Georgopoulos[1], José Luis Lerma[2]

[1]Laboratory of Photogrammetry, National Technical University of Athens, Greece
{rs06002, drag}@central.ntua.gr
[2]Department of Cartographic Engineering, Geodesy and Photogrammetry,
Universitat Politècnica de València
46022 Valencia, Spain
jllerma@cgf.upv.es

Abstract:

Documentation of monuments includes not only geometric analysis but also the detection of alterations and pathologies to define proper actions for protection and preservation. Several pathologies can be found on façades such as moisture, detachments, leaks and replacements. Multispectral techniques can help users to detect and determine these phenomena. Thermography is a non-intrusive imaging technique that allows the inspection of different materials and related issues based on their temperature. It has the advantage of reaching unapproachable areas onto and below the surface. However, there are still many issues in thermography when applied to cultural heritage surveys. Depending on the application, multi-temporal images can be captured and combined with conventional images to analyze its state of conservation. This paper presents an approach based on multi-temporal thermal imagery to detect alterations on building façades. Methods and tools of multispectral analysis targeting the detection of alterations and pathologies are presented and evaluated.

==

INTEGRATED DOCUMENTATION PROTOCOLS ENABLING DECISION MAKING IN CULTURAL HERITAGE PROTECTION

Anastasia Kioussi, Maria Karoglou, Asterios Bakolas and Antonia Moropoulou

National Technical University of Athens, School of Chemical Engineering
Iroon Polytechniou Str. 9,
15780 Athens, Greece
{nasiak@central.ntua.gr, margo@central.ntua.gr, abakolas@gmail.com, amoropul@central.ntua.gr}

Abstract:

Integrated documentation of cultural heritage is a necessary process that precedes any other task or procedure regarding sustainable conservation and management. In order for any new methodology for monument documentation to be effective and widely applicable, not only it needs to be harmonized with existing standards but also, most importantly, be able to cover the variety and the particularity of cultural heritage, applying the best possible organization and management of knowledge. This is achieved by selecting and integrating common criteria that formulate a dynamic archive, collecting and organizing all information on the monument, during its entire life-time and by upgrading the current documentation methodologies. The proposed integrated documentation protocols support the development of sustainable maintenance and preservation through knowledge management by incorporating and supplying with all necessary data regarding decision making on determining priorities of Cultural Heritage protection.

===

MONUMENT DAMAGE ONTOLOGY

Miroslav Blaško[1], Riccardo Cacciotti[2], Petr Křemen[1], and Zdeněk Kouba[1]

[1]Faculty of Electrical Engineering, Czech Technical University in Prague,
Technická , 16627 Praha, Czech Republic
{blaskmir, petr.kremen, kouba}@fel.cvut.cz
[2]Institute of Theoretical and Applied Mechanics, Czech Academy of Sciences,
Prosecká 76, 19000 Praha, Czech Republic
cacciotti@itam.cas.cz

Abstract:

Capturing knowledge about damages and failures of culture heritage objects is a complex task because of term ambiguity, knowledge incompleteness and variety. To tackle this complexity, the paper introduces a semantic web ontology that aims at modeling monument damage knowledge with significant contextual information, including monument identification, damage identification, risk assessment, dam-age diagnosis and remedial measures. The developed ontology is being tested in the MONDIS project as background knowledge for custom software tools for management of damage failure knowledge. During the course of the project it becomes a common model for linked-data-compliant knowledge-based system serving different stakeholders to model/retrieve/compare different cases of damage and successful interventions.

===

VIRTUAL HERITAGE: EXPLORING PHOTOREALISM

Hafizur Rahaman[1], Rana Das[2], Shehzad Zahir[2]

[1]Department of Architecture, National University of Singapore,
4 Architecture Drive, Singapore 117566
hafizur@nus.edu.sg
[2]Department of Architecture, Ahsanullah University of Science and Technology,
Dhaka-1208, Bangladesh.

Abstract:

One of the main purposes of virtual heritage (VH) is to disseminate the cultural and historic knowledge to end-users. However, in many cases VH projects are motivated towards demonstrating the technical artistry and the power of new technology to attain a certain degree of 'visual fidelity' and accuracy in representation of historical environments. Built heritage is not just the 'form' but inherits different layers of meanings, which cannot be understood by only watching 'photorealistic' representation; instead it requires proper interpretation of 'place'. The paper highlights end-users as an interpreter and emphasizes their unique cultural background to consider in the interpretive process. As a methodology, 'interpretation' is first conceptualized. Notions in 'photo-realism', end-users' engagement, cognition and interpretation is explored by reviewing present discourses. This paper finally urges for a comprehensive interpretive method for VH to prioritize end-users understanding while leaving some open ended questions for future investigation.

==

EVOLUTION OF THE E-MUSEUM CONCEPT THROUGH EXPLOITATION OF CRYPTOGRAPHIC ALGORITHMS

George S. Athanasiou[1], Harris E. Michail[2], Andreas Gregoriades[3] and Marinos Ioannides[2]

[1]Electrical and Computer Engineering Dept., University of Patras, 26500 Patras, Greece
[2]Electrical Engineering and Information Technology Dept., Cyprus University of Technology, 3036 Lemesos, Cyprus
[3]Computer Science and Engineering Dept., European University of Cyprus, Nicosia, Cyprus

gathanas@ece.upatras.gr, {harris.michail, marinos.ioannides}@cut.ac.cy, A.gregoriades@euc.ac.cy

Abstract:

Nowadays more and more modern museums have digitized their collections and created e-museums. In this paper, a novel framework for enhancing the concept of e-Museum is proposed. The framework is based on cryptographic algorithms, specifically hash functions and block ciphers. The first are used for continuous hashing and digest matching of the database's contents for quality assurance. The block ciphers are used so as to enable on-line selling, through encryption of the digital object and offering the resulted cipher text. The system's infrastructure that implements the above framework is also described. It has to be stressed that it is the first time that cryptographic principles are exploited this way in the Cultural Heritage domain.

==

AUTOMATIC FUSION OF DIGITAL IMAGES AND LASER SCANNER DATA FOR HERITAGE PRESERVATION

Wassim Moussa, Mohammed Abdel-Wahab, Dieter Fritsch

Institute for Photogrammetry (ifp), University of Stuttgart,
Geschwister-Scholl-Str. 24D 70174 Stuttgart, Germany
{wassim.moussa, mohammed.othman, dieter.fritsch}@ifp.uni-stuttgart.de

Abstract:

This paper presents an automatic procedure for combining digital images and laser scanner data in order to have a full representation of a scene. In particular, this procedure will serve photogrammetric close range applications such as 3D digital preservation and documentation of cultural heritages by generating comprehensive virtual reality models. Our method is based on a bundle block adjustment for the orientation estimation of generated images from laser data and camera images by means of an optimized Structure from Motion reconstruction method. This results in having target-free registration of multiple laser scans and absolute image orientations. The proposed pipeline was tested on a real case study and experimental results are shown to demonstrate the effectiveness of the presented approach.

=======================================

PHOTOGRAMMETRIC POINT CLOUD COLLECTION WITH MULTI-CAMERA SYSTEMS

Dieter Fritsch, Mohammed Abdel-Wahab, Alessandro Cefalu, Konrad Wenzel

Institute for Photogrammetry (ifp), University of Stuttgart,
Geschwister-Scholl-Str. 24D 70174 Stuttgart, Germany
{dieter.fritsch, mohammed.othman, alessandro.cefalu, konrad.wenzel}@ifp.uni-stuttgart.de

Abstract:

We present an efficient method for the recording of 3D point clouds using a compact handheld camera rig and an automated software pipeline for an accurate surface reconstruction. Multiple industrial cameras are mounted on a rectangular shaped frame with a size of 15cm by 15cm in order to collect images from multiple views at once. By using the presented software pipeline, one dense 3D point cloud can be computed efficiently for each shot. The system is particularly designed for close range cultural heritage applications, where the requirements regarding accuracy, density but also acquisition efficiency are high. For each shot up to 3.5 Mio. 3D points can be derived. An area of 60cm by 50cm is covered at a distance of 70cm. Depending on distance and surface texture the points reach a precision of up to 0.2mm. Within this paper, we will present the system design, the data acquisition process, the automatic orientation/registration approach and the dense surface reconstruction method. Finally, we will demonstrate results for an example covering a large scale cultural heritage project, where 2 billion 3D points were acquired efficiently with sub-mm accuracy.

=======================================

LOW-COST AND OPEN-SOURCE SOLUTIONS FOR AUTOMATED IMAGE ORIENTATION – A CRITICAL OVERVIEW

Fabio Remondino[1], Silvio Del Pizzo[2], Thomas Kersten[3], Salvatore Troisi[2]

[1]3D Optical Metrology (3DOM), Bruno Kessler Foundation (FBK), Trento, Italy
remondino@fbk.eu, http://3dom.fbk.eu
[2]Parthenope University of Naples, Dept. of Applied Science, Naples, Italy
<silvio.delpizzo><salvatore.troisi>@uniparthenope.it
[3]Photogrammetry & Laser Scanning Lab, HafenCity University Hamburg, Germany
thomas.kersten@hcu-hamburg.de, http://www.hcu-hamburg.de/geomatik/kersten

Abstract:

The recent developments in automated image processing for 3D reconstruction purposes have led to the diffusion of low-cost and open-source solutions which can be nowadays used by everyone to produce 3D models. The level of automation is so high that many solutions are black-boxes with poor repeatability and low reliability. The article presents an investigation of automated image orientation packages in order to clarify potentialities and performances when dealing with large and complex datasets.

==

COMPLETING DIGITAL CULTURAL HERITAGE OBJECTS BY SKETCHING SUBDIVISION SURFACES TOWARD RESTORATION PLANNING

Matthias Bein[1], Sebastian Peña Serna[1], André Stork[1,2], Dieter W. Fellner[1,2]

[1]GRIS – Graphisch Interaktive Systeme, Technische Universität Darmstadt,
Fraunhoferstrasse 5, D-64283 Darmstadt, Germany

[2]Fraunhofer IGD, Fraunhoferstrasse 5,
D-64283 Darmstadt, Germany

Matthias.Bein@gris.informatik.tu-darmstadt.de
Sebastian.Pena.Serna@igd.fraunhofer.de
Andre.Stork@igd.fraunhofer.de
Dieter.Fellner@igd.fraunhofer.de

Abstract:

In the restoration planning process a curator evaluates the condition of a Cultural Heritage (CH) object and accordingly develops a set of hypotheses for improving it. This iterative process is complex, time consuming and requires many manual interventions. In this context, we propose interactive modeling techniques, based on subdivision surfaces, which can support the completion of CH objects toward restoration planning. The proposed technique starts with a scanned and incomplete object, represented by a triangle mesh, from which a subdivision surfaces can be generated. Based on the mixed representation, sketching techniques and modeling operations can be combined to extend and refine the subdivision surface, according to the curator's hypothesis. Thus, curators without rigorous modeling experience can directly create and manipulate surfaces in a similar way as they would do it on a piece of paper. We present the capabilities of the proposed technique on two interesting CH objects.

==