

AperTO - Archivio Istituzionale Open Access dell'Università di Torino

Modeling and Visualization of Drama Heritage

This is the author's manuscript

Original Citation:

Availability:

This version is available <http://hdl.handle.net/2318/137622> since 2016-11-29T09:55:05Z

Publisher:

Springer

Published version:

DOI:10.1007/978-3-642-41190-8_31

Terms of use:

Open Access

Anyone can freely access the full text of works made available as "Open Access". Works made available under a Creative Commons license can be used according to the terms and conditions of said license. Use of all other works requires consent of the right holder (author or publisher) if not exempted from copyright protection by the applicable law.

(Article begins on next page)

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison

Lancaster University, UK

Takeo Kanade

Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler

University of Surrey, Guildford, UK

Jon M. Kleinberg

Cornell University, Ithaca, NY, USA

Alfred Kobsa

University of California, Irvine, CA, USA

Friedemann Mattern

ETH Zurich, Switzerland

John C. Mitchell

Stanford University, CA, USA

Moni Naor

Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz

University of Bern, Switzerland

C. Pandu Rangan

Indian Institute of Technology, Madras, India

Bernhard Steffen

TU Dortmund University, Germany

Madhu Sudan

Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos

University of California, Los Angeles, CA, USA

Doug Tygar

University of California, Berkeley, CA, USA

Gerhard Weikum

Max Planck Institute for Informatics, Saarbruecken, Germany

Alfredo Petrosino Lucia Maddalena
Pietro Pala et al. (Eds.)

New Trends in Image Analysis and Processing – ICIAP 2013

ICIAP 2013 International Workshops
Naples, Italy, September 9-13, 2013
Proceedings



Springer

Volume Editors

see next page

Cover illustration: "ICIAP 2013" by Laura Zoé (2013)

ISSN 0302-9743

e-ISSN 1611-3349

ISBN 978-3-642-41189-2

e-ISBN 978-3-642-41190-8

DOI 10.1007/978-3-642-41190-8

Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013948504

CR Subject Classification (1998): I.5, I.2.9-10, I.4, K.4, J.3, I.7, H.5, H.3, F.2

LNCS Sublibrary: SL 6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

© Springer-Verlag Berlin Heidelberg 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Volume Editors

Alfredo Petrosino
Department of Science and Technology
University of Naples Parthenope, Italy
alfredo.petrosino@uniparthenope.it

Lucia Maddalena
Institute for High Performance
Computing and Networking
National Research Council, Italy
lucia.maddalena@cnr.it

Pietro Pala
Department of Information
Engineering
University of Florence, Italy
pietro.pala@unifi.it

Virginio Cantoni
Department of Industrial
and Information Engineering
University of Pavia, Italy
virginio.cantoni@unipv.it

Michele Ceccarelli
Department of Biological
and Environmental Science
University of Sannio, Italy
ceccarelli@unisannio.it

Robert F. Murphy
Department of Biological Sciences
Carnegie Mellon University, USA
murphy@cmu.edu

Alberto Del Bimbo
Department of Information
Engineering
University of Florence, Italy
delbimbo@dsi.unifi.it

Maja Pantic
Department of Computing
Imperial College London, UK
m.pantic@imperial.ac.uk

Costantino Grana
Department of Engineering
University of Modena and
Reggio Emilia, Italy
costantino.grana@unimore.it

Johan Oomen
Netherlands Institute for Sound and Vision
The Netherlands
joomen@beeldengeluid.nl

Giuseppe Serra
Department of Engineering
University of Modena and
Reggio Emilia, Italy
giuseppe.serra@unimore.it

Marco Leo
Institute of Optics
National Research Council, Italy
marco.leo@cnr.it

Danilo P. Mandic
Department of Electrical and
Electronic Engineering
Imperial College of London
d.mandic@imperial.ac.uk

Giuseppe Pirlo
Department of Computer Science
University of Bari, Italy
giuseppe.pirlo@uniba.it

Michael Fairhurst
School of Engineering and Digital Arts
The University of Kent, UK
M.C.Fairhurst@kent.ac.uk

Donato Impedovo
Dyrecta Lab, Italy
impedovo@gmail.com

Preface

This volume contains the papers accepted for presentation at the workshops hosted by the 17th International Conference on Image Analysis and Processing (ICIAP 2013), held in Naples, Italy, September 9–13, 2013, in the magnificent Castel dell’Ovo, (www.iciap2013-naples.org), organized by the CVPR Lab of the University of Naples Parthenope (cvprlab.uniparthneope.it).

The International Conference on Image Analysis and Processing (ICIAP) is an established biennial scientific meeting promoted by the Italian Group of Researchers in Pattern Recognition (GIRPR), which is the Italian IAPR Member Society, and covers topics related to theoretical and experimental areas of image analysis and pattern recognition with emphasis on different applications. ICIAP 2013 was endorsed by the International Association for Pattern Recognition (IAPR), the IEEE Computer Society’s Technical Committee on Pattern Analysis and Machine Intelligence (TCPAMI), and the IEEE Computational Intelligence Society (CIS).

ICIAP 2013 hosted a range of workshops focusing on topics of interest to the pattern recognition, image analysis, and computer vision communities, exploring emergent research directions or spotlight cross-disciplinary links with related fields and/or application areas. Five individual workshops were selected to complement ICIAP 2013 in Naples, three one-day and two half-day workshops. The topics addressed constituted a good mix between novel current trends in computer vision and the fundamentals of image analysis and pattern recognition.

- *ACVR 2013*, the First International Workshop on Assistive Computer Vision and Robotics.
- *EAHSP 2013*, the International Workshop on Emerging Aspects on Handwritten Signature Processing.
- *MMACH 2013*, the 2nd International Workshop on Multimedia for Cultural Heritage.
- *PR PS BB 2013*, the 2nd International Workshop on Pattern Recognition in Proteomics, Structural Biology, and Bioinformatics.
- *SBA 2013*, the International Workshop on Social Behaviour Analysis.

The *ACVR 2013* workshop was aimed to give an overview of the state of the art of perception and interaction methodologies involved in this area with special attention to aspects related to computer vision and robotics. Assistive technologies provide a set of advanced tools that can improve the quality of life not only for disabled people, patients, and elderly, but also for healthy people struggling with everyday actions. After a period of slow but steady progress, this scientific area seems to be mature for new research and application breakthroughs. The rapid progress in the development of integrated micro-mechatronic tools has boosted this process. However, many problems remain open especially as regards

environment perception and interaction of these technological tools with people. The ACVR 2013 workshop was organized by Marco Leo from the Institute of Optics and the Institute of Intelligent Systems for Automation of the National Research Council (Italy) and by Danilo Mandic from the Department of Electrical and Electronic Engineering of the Imperial College of London (UK). Based on rigorous peer reviews by the Program Committee members and the reviewers, six papers were selected for presentation in an half-day workshop. All the papers thoroughly cover a broad range of topics related to the research areas of assistive technologies, addressing major advances in knowledge and effective use of computer vision and robotics in a variety of applications. ACVR 2013 also included an outstanding presentation given by Andrea Cavallaro of the Queen Mary University of London (UK) about new techniques for localizing people and understanding their interactions, which is a desirable yet demanding task for assistive computer vision applications.

The *EAHSP 2013* workshop, organized by Michael Fairhurst of The University of Kent (UK), Donato Impedovo of Dyrecta Lab (Italy), and Giuseppe Pirlo of the University of Bari (Italy), focused on the frontiers of research and applications in the field of static and dynamic signature analysis and processing. Indeed, in the era of Internet, there is a growing interest for personal verification, and a handwritten signature is one of the most useful biometric traits, since the verification of a person's identity by signature analysis does not involve an invasive measurement procedure. Furthermore, handwritten signatures are a well-established means of personal identification, and their use is widespread and well-recognized by administrative and financial institutions.

Handwritten signature analysis and processing is a multi-disciplinary field involving aspects of disciplines ranging from human anatomy to engineering, from neuroscience to computer and system sciences. Also from the application point of view, signature analysis and processing is useful in many fields, from security to physical areas, from security for internet-based systems to forensic and medical applications. The ten papers accepted for presentation to *EAHSP 2013* define a useful scenario of the field from both the scientific and applicative point of view.

The *MMACH 2013* workshop, organized by Costantino Grana and Giuseppe Serra of the University of Modena e Reggio Emilia (Italy) and Johan Oomen from the Netherlands Institute for Sound and Vision (The Netherlands), had the aim of creating a profitable informal working day to discuss together hot topics in multimedia applied to cultural heritage. Multimedia technologies have recently created the conditions for a true revolution in the cultural heritage area, with reference to the study, valorization, and fruition of artistic works. The use of these technologies allows us to create new digital cultural experiences by means of personalized and engaging interaction. New multimedia technologies could be used to design new approaches to the comprehension and fruition of the artistic heritage, for example through smart, context-aware artifacts and enhanced interfaces with the support of features like story-telling, gaming, and learning. To these aims, open and flexible platforms are needed, to allow building services

that support use of cultural resources for research and education. A likely expectation is the involvement of a wider range of users of cultural resources in diverse contexts and considerably altered ways to experience and share cultural knowledge between participants. The scientific community has shown great interest in this timely topic. Indeed, 27 papers were received and, after the review process, 17 were accepted (acceptance rate 62%). Papers were contributed from 14 different countries (Austria, China, the Czech Republic, France, Greece, India, Italy, Morocco, The Netherlands, Norway, Poland, Switzerland, the UK, and the USA) demonstrating the universal importance of cultural heritage.

The *PR PS BB 2013* workshop covers topics related to pattern recognition in proteomics, structural biology, and bioinformatics. The amount and complexity of bioinformatics data, such as DNA and protein sequences, genetic information, biomedical text, and molecular data, exploded in the past decade. The importance of studying such amounts of data, for the analysis of structural building blocks, their comparison, and their classification is instrumental to practical problems of the maximum impact, such as the design of a small molecule to bind a known protein or the scan of drugs libraries to detect a suitable inhibitor for a target molecule. Advanced pattern recognition methods can also play a significant role in high-throughput functional genomics and system biology, where the classification of complex large-scale expression profiles, and their link with motif discovery and inference of gene regulatory networks, is a major research challenge in the field of computational biology. However, current pattern recognition techniques to tackle these huge data are still not sufficient. The development of approaches for the improvement of current performance was the scope of the *PR PS BB 2013* workshop, organized by Virginio Cantoni of the University of Pavia (Italy), Michele Ceccarelli of the University of Sannio (Italy), and Robert Murphy, Carnegie Mellon University (USA). Featuring 13 accepted papers, the workshop was intended, through its informal nature, as the foremost platform for exchanging ideas and giving to top researchers, practitioners, and students from around the world, of the computing and biological communities, excellent opportunities to meet, interact, and find synergies.

The *SBA 2013* workshop, organized by Alberto Del Bimbo and Pietro Pala of the University of Florence (Italy) and Maja Pantic of the Imperial College London (UK), aimed to bring together researchers to advocate and promote research into human behavior and social interactions analysis, to disseminate their most recent research results, to discuss rigorously and systematically potential solutions and challenges, and to promote new collaborations among researchers. In the new digital age, progress and development in science and technology have a great impact on our daily activities and lifestyle. Models and tools for the automatic analysis of human behavior and social interactions are increasing their relevance in a broad range of application domains, including entertainment, security, surveillance, human-computer interfaces, and psychology among other fields. The availability of new devices capable of multimodal data acquisition paves the way to new solutions to the analysis and recognition of human activities in social contexts, hand and body gestures, facial expressions, interactions

with objects, and expressive speech. All submitted papers were reviewed by at least three PC members or external reviewers who volunteered to contribute their time and expertise to the review process. The 14 accepted papers, coming from 7 different countries worldwide, were organized into 3 sessions: 3D Behaviour Analysis; Social and Multimodal Analysis; and Applications, Benchmarking, Verification. The technical program featured one invited talk, by Alessandro Vinciarelli from the University of Glasgow, and oral presentation of all the accepted regular papers.

Many people helped make the ICIAP 2013 workshops a success. I would like to thank all the ICIAP 2013 workshop organizers and their organizations for soliciting and reviewing submissions, which guaranteed the high quality of the technical program, all the members of the Program Committees, who dedicated their time and energy to reviewing the papers, and the authors for having submitted their own valuable work. Special thanks should be tributed to all those involved in the preparation of the event, especially Lucia Maddalena for her unfaltering dedication to the coordination of the event.

All these people made it possible to build such a rich supplementary program beside the main ICIAP 2013 scientific program, which justified, for the first time for ICIAP, the publication of ICIAP 2013 workshops proceedings in a separate volume.

September 2013

Alfredo Petrosino

ICIAP 2013 Organization

Organizing Institution

CVPR Lab of the University of Naples Parthenope, Italy
<http://cvprlab.uniparthenope.it>

General Chair

Alfredo Petrosino University of Naples Parthenope, Italy

Area Chairs

Pattern Recognition and Machine Learning:

Marco Gori University of Siena, Italy
Kai Yu Baidu Inc., Germany

Human Recognition Systems:

Paola Campadelli University of Milan, Italy
Caroline Pantofaru Google, USA

BioMedical Imaging Applications:

Joan Martí Universitat de Girona, Spain
Francesco Tortorella University of Cassino, Italy

Multimedia Interaction and Processing:

Rita Cucchiara University of Modena and Reggio Emilia, Italy
Fatih Porikli MERL, USA

3D Computer Vision:

Shaogang Gong Queen Mary University of London, UK
Vittorio Murino University of Verona and IIT, Italy

Understanding Objects and Space:

Silvio Savarese University of Michigan, USA
Jiambo Shi University of Pennsylvania, USA

Steering Committee

Virginio Cantoni University of Pavia, Italy
Luigi Cordella University of Naples Federico II, Italy
Alberto Del Bimbo University of Florence, Italy
Marco Ferretti University of Pavia, Italy

Fabio Roli University of Cagliari, Italy
Gabriella Sanniti di Baja ICIB-CNR, Italy

Local Committee Chairs

Alessio Ferone University of Naples Parthenope, Italy
Maria Frucci ICIB-CNR, Italy

Workshop Chairs

Lucia Maddalena ICAR-CNR, Italy
Pietro Pala University of Florence, Italy

Tutorial Chairs

Francesco Isgrò University of Naples Federico II, Italy
Giosuè Lo Bosco University of Palermo, Italy

Industrial Liason Chairs

Michele Nappi University of Salerno, Italy
Francesco Camastra University of Naples Parthenope, Italy

International Program Committee

Jake Aggarwal, USA	Kalman Palagyi, Hungary
Marco Andreetto, USA	Witold Pedrycz, Canada
Edoardo Ardizzone, Italy	Marcello Pelillo, Italy
Isabelle Bloch, France	Fatih Porikli, USA
Gunilla Borgfors, Sweden	Carlo Sansone, Italy
Alfred Bruckstein, Israel	Raimondo Schettini, Italy
Rama Chellappa, USA	Mubarak Shah, USA
Leila De Floriani, Italy	Josè Ruiz Shulcloper, Cuba
Aytul Ercil, Turkey	Stefano Soatto, USA
Gianluca Foresti, Italy	Arnold Smeulders, The Netherlands
Ashish Ghosh, India	Steven Tanimoto, USA
Edwin Hancock, UK	Massimo Tistarelli, Italy
Xiaoyi Jiang, Germany	John Tsotsos, Canada
Etienne Kerre, Belgium	Shimon Ullman, Israel
Walter Kropatsch, Austria	Mario Vento, Italy
Yanxi Liu, USA	Alessandro Verri, Italy
Gerard Medioni, USA	Hezy Yeshurun, Israel
Alain Merigot, France	Ramin Zabih, USA
Ram Nevatia, USA	Bertrand Zavidovique, France
Sankar Kumar Pal, India	Jacek Zurada, USA

Endorsing Institutions

International Association for Pattern Recognition (IAPR)
IEEE Computer Society's Technical Committee on Pattern Analysis and
Machine Intelligence (IEEE-TCPAMI)
IEEE Computational Intelligence Society (IEEE-CIS)
Italian Group of Researchers in Pattern Recognition (GIRPR)
National Group for Scientific Computing (GNCS)

Institutional Patronage

Università di Napoli Parthenope, Italy
Campania Regional Board, Italy
National Research Council of Italy (CNR), Italy

Sponsoring Institutions

Italian Ministry of Education, University and Research (MIUR), Italy
Italian Ministry of Economic Development (MiSE), Italy
Comune di Napoli, Italy
Google Inc., USA
Ansaldo STS, Italy
Italian Aerospace Research Center (CIRA), Italy
Selex ES, Italy
ST-Microelectronics, Italy
Unlimited Software srl, Italy

Acknowledgments

We acknowledge the support of the Project PT2LOG, National Operational Program for "Research and Competitiveness" 2007-2013, made available by the Italian Ministry of Education, University and Research (MIUR) and the Ministry of Economic Development (MiSE).

ACVR 2013 Organization

General Chairs

Marco Leo (Italy)

Danilo P. Mandic (UK)

Steering Committee

Cosimo Distante (Italy)

Annalisa Milella (Italy)

David Looney (UK)

Program Committee

Salvatore M. Anzalone (France)

Liliana Lo Presti (USA)

Donato Di Paola (Italy)

Pier Luigi Mazzeo (Italy)

Cem Direkoglu (Ireland)

Markos Mentzelopoulos (UK)

Arcangelo Distante (Italy)

Mikel Rodriguez (France)

Flavio Esposito (USA)

Davide Scaramuzza (Switzerland)

Giovanni Indiveri (Italy)

Paolo Spagnolo (Italy)

Henry Kautz (USA)

EAHSP 2013 Organization

General Chairs

Giuseppe Pirlo (Italy)
Donato Impedovo (Italy)

Michael Fairhurst (UK)

Program Committee

Marjory Abreu (Brazil)
Michael Blumenstein (Australia)
Alexander Filatov (USA)
Sonia Garcia Salicetti (France)
Laurent Huette (France)
Marcus Liwicki (Germany)
Muhammad Imran Malik (Germany)

Angelo Marcelli (Italy)
Javier Ortega-Garcia (Spain)
Umapada Pal (India)
Rejean Plamondon (Canada)
Robert Sabourin (Canada)
Nicole Vincent (France)
Elias Zois (Greece)

Additional Reviewers

Donato Barbuzzi (Italy)

Francesco Maurizio Mangini (Italy)

MM4CH 2013 Organization

General Chairs

Costantino Grana (Italy)
Johan Oomen (The Netherlands)

Giuseppe Serra (Italy)

Program Committee

Maristella Agosti (Italy)
Olga Regina Pereira Bellon (Brazil)
Lamberto Ballan (Italy)
Tsuhan Chen (USA)
Rita Cucchiara (Italy)
Alberto Del Bimbo (Italy)
Matteo Dellepiane (Italy)
Kate Fernie (UK)
Antonio Gentile (Italy)

Martin Kampel (Austria)
Eamonn Keogh (USA)
Martha Larson (The Netherlands)
Josep Lladós (Spain)
Luca Mainetti (Italy)
Jan Nouza (Czech Republic)
Nicola Orio (Italy)
Edgar Roman-Rangel (Switzerland)
Enrique Vidal (Spain)

Sponsors

Gruppo Italiano Ricercatori in Pattern Recognition
Università degli Studi di Modena e Reggio Emilia
Franco Cosimo Panini Editore
Laboratorio Imagelab

PR PS BB 2013 Organization

General Chairs

Virginio Cantoni (Italy)
Michele Ceccarelli (Italy)

Robert Murphy (USA)

Program Committee

Pierre Baldi (USA)
Paola Bertolazzi (Italy)
Mario Cannataro (Italy)
Virginio Cantoni (Italy)
Alessandra Carbone (France)
Jens Michael Carstensen (Denmark)
Rita Casadio (Italy)
Michele Ceccarelli (Italy)
Angelo Facchiano (Italy)
Concettina Guerra (USA)
Alamgir Hossain (UK)

Tom Lenaerts (Belgium)
Le Ly (Vietnam)
Giuseppe Maino (Italy)
Elena Marchiori (The Netherlands)
Giancarlo Mauri (Italy)
Giovanni Paoletta (Italy)
Alfredo Petrosino (Italy)
Michael Schroeder (Germany)
Ekaterina Shelest (Germany)
Roberto Tagliaferri (Italy)
Alfredo Vellido (Spain)

Additional Reviewers

Luigi Cerulo (Italy)
Fulvio D'Angelo (Italy)

Pietro Zoppoli (USA)

Workshop Organization and Scientific Secretary

Alessandra Setti (Italy)

SBA 2013 Organization

General Chairs

Alberto Del Bimbo (Italy)
Maja Pantic (UK)

Pietro Pala (Italy)

Program Committee

Andrew Bagdanov (Spain)
Stefano Berretti (Italy)
Michael Bronstein (Switzerland)
Petros Daras (Greece)
Hatice Gunes (UK)
Irene Kotsia (UK)
Tung-Ying Lee (Taiwan)
Giuseppe Lisanti (Italy)

David Marshall (UK)
Mohammad Soleymani (UK)
Michela Spagnuolo (Italy)
Anuj Srivastava (USA)
Michel Valstar (UK)
Hazem Wannous (France)
Stefanos Zafeiriou (UK)

Sponsors

STC Social Networking

Table of Contents

ACVR 2013 - First International Workshop on Assistive Computer Vision and Robotics

A Robust Hand Pose Estimation Algorithm for Hand Rehabilitation	1
<i>Francesca Cordella, Francesco Di Corato, Loredana Zollo, and Bruno Siciliano</i>	
Natural User Interfaces in Volume Visualisation Using Microsoft Kinect	11
<i>Anastassia Angelopoulou, José García-Rodríguez, Alexandra Psarrou, Markos Mentzelopoulos, Bharat Reddy, Sergio Orts-Escolano, Jose Antonio Serra, and Andrew Lewis</i>	
A Fast and Precise HOG-Adaboost Based Visual Support System Capable to Recognize Pedestrian and Estimate Their Distance	20
<i>Takahisa Kishino, Sun Zhe, and Ruggero Micheletto</i>	
Mobile Visual Assistive Apps: Benchmarks of Vision Algorithm Performance	30
<i>Jose Rivera-Rubio, Saad Idrees, Ioannis Alexiou, Lucas Hadjilucas, and Anil A. Bharath</i>	
Tracking Posture and Head Movements of Impaired People During Interactions with Robots	41
<i>Salvatore Maria Anzalone and Mohamed Chetouani</i>	
Scene Perception and Recognition for Human-Robot Co-operation	50
<i>Nikhil Somani, Dean-León Emmanuel, Caixia Cai, and Alois Knoll</i>	

EAHSP 2013 - International Workshop on Emerging Aspects on Handwritten Signature Processing

Two Bioinspired Methods for Dynamic Signatures Analysis	60
<i>Jânio Canuto, Bernadette Dorizzi, and Jugurta Montalvão</i>	
Online Signature Verification: Improving Performance through Pre-classification Based on Global Features	69
<i>Marianela Parodi and Juan Carlos Gómez</i>	
Event Based Offline Signature Modeling Using Grid Source Probabilistic Coding	77
<i>Konstantina Barkoula, Elias Zois, Evangelos Zervas, and George Economou</i>	

Learning Strategies for Knowledge-Base Updating in Online Signature Verification Systems	86
<i>Giuseppe Pirlo, Donato Impedovo, and Donato Barbuzzi</i>	
A Dissimilarity-Based Approach for Biometric Fuzzy Vaults–Application to Handwritten Signature Images	95
<i>George S. Eskander, Robert Sabourin, and Eric Granger</i>	
Local Features for Forensic Signature Verification	103
<i>Muhammad Imran Malik, Marcus Liwicki, and Andreas Dengel</i>	
Exploiting Stability Regions for Online Signature Verification	112
<i>Antonio Parziale, Salvatore G. Fuschetto, and Angelo Marcelli</i>	
Stability of Dynamic Signatures: From the Representation to the Generation Domain	122
<i>Giuseppe Pirlo, Donato Impedovo, Rejean Plamondon, Christian O’Reilly, A. Cozzolongo, R. Gravinese, and Andrea Rollo</i>	
SID Signature Database: A Tunisian Off-line Handwritten Signature Database	131
<i>Imen Abroug Ben Abdelghani and Najoua Essoukri Ben Amara</i>	
A Two-Stage Approach for English and Hindi Off-line Signature Verification	140
<i>Srikanta Pal, Umapada Pal, and Michael Blumenstein</i>	

MM4CH 2013 - 2nd International Workshop on Multimedia for Cultural Heritage

Improving Ancient Roman Coin Classification by Fusing Exemplar-Based Classification and Legend Recognition	149
<i>Sebastian Zambanini, Albert Kavelar, and Martin Kampel</i>	
Stopwords Detection in Bag-of-Visual-Words: The Case of Retrieving Maya Hieroglyphs	159
<i>Edgar Roman-Rangel and Stephane Marchand-Maillet</i>	
3D Object Partial Matching Using Panoramic Views	169
<i>Konstantinos Sfikas, Ioannis Pratikakis, Anestis Koutsoudis, Michalis Savelonas, and Theoharis Theoharis</i>	
Reconstructing Archeological Vessels by Fusing Surface Markings and Border Anchor Points on Fragments	179
<i>Fernand Cohen, Zexi Liu, and Zhongchuan Zhang</i>	
Automatic Single-Image People Segmentation and Removal for Cultural Heritage Imaging	188
<i>Marco Manfredi, Costantino Grana, and Rita Cucchiara</i>	

An Early Framework for Determining Artistic Influence	198
<i>Kanako Abe, Babak Saleh, and Ahmed Elgammal</i>	
Identifying Vandalized Regions in Facial Images of Statues for Inpainting.	208
<i>Milind G. Padalkar, Manali V. Vora, Manjunath V. Joshi, Mukesh A. Zaveri, and Mehul S. Raval</i>	
Detection and Correction of Mistracking in Digitalized Analog Video . . .	218
<i>Filippo Stanco, Dario Allegra, and Filippo Luigi Maria Milotta</i>	
Using Various Types of Multimedia Resources to Train System for Automatic Transcription of Czech Historical Oral Archives	228
<i>Josef Chaloupka, Jan Nouza, and Michaela Kucharova</i>	
Dealing with Bilingualism in Automatic Transcription of Historical Archive of Czech Radio	238
<i>Jan Nouza, Petr Cerva, and Jan Silovsky</i>	
Passive Profiling and Natural Interaction Metaphors for Personalized Multimedia Museum Experiences	247
<i>Svebor Karaman, Andrew D. Bagdanov, Gianpaolo D'Amico, Lea Landucci, Andrea Ferracani, Daniele Pezzatini, and Alberto Del Bimbo</i>	
Recommending Multimedia Objects in Cultural Heritage Applications.	257
<i>Iliara Bartolini, Vincenzo Moscato, Ruggero G. Pensa, Antonio Penta, Antonio Picariello, Carlo Sansone, and Maria Luisa Sapino</i>	
Model-Driven Generation of Collaborative Virtual Environments for Cultural Heritage	268
<i>Alberto Bucciario and Luca Mainetti</i>	
Enhancing End User Access to Cultural Heritage Systems: Tailored Narratives and Human-Centered Computing.	278
<i>Maristella Agosti, Marta Manfioletti, Nicola Orio, and Chiara Ponchia</i>	
Modeling and Visualization of Drama Heritage	288
<i>Vincenzo Lombardo and Antonio Pizzo</i>	
An Intellectual Journey in History: Preserving Indian Cultural Heritage	298
<i>Anupama Mallik, Santanu Chaudhury, T.B. Dinesh, and Chaluvaraju</i>	
'A Is for Art' – My Drawings, Your Paintings	308
<i>Min Zhang, Sarah Atkinson, Natasha Alechina, and Guoping Qiu</i>	

PR PS BB 2013 - 2nd International Workshop on Pattern Recognition in Proteomics, Structural Biology and Bioinformatics

Identification of Protein Interaction Partners from Shape Complementarity Molecular Cross-Docking	318
<i>Elodie Laine and Alessandra Carbone</i>	
A Supervised Approach to 3D Structural Classification of Proteins	326
<i>Virginio Cantoni, Alessio Ferone, Alfredo Petrosino, and Gabriella Sanniti di Baja</i>	
SVM-Based Classification of Class C GPCRs from Alignment-Free Physicochemical Transformations of Their Sequences	336
<i>Caroline König, Raúl Cruz-Barbosa, René Alquézar, and Alfredo Vellido</i>	
Structural Investigation of Supercooled Water Confined in Antifreeze Proteins: Models' Performance Evaluation between Coarse Grained and Atomistic Simulation Models	344
<i>Nghiep H. V, Hung, P.N, and Ly, L.</i>	
Comparison of GHT-Based Approaches to Structural Motif Retrieval . . .	356
<i>Alessio Ferone and Ozlem Ozbudak</i>	
CCMS: A Greedy Approach to Motif Extraction	363
<i>Giacomo Drago, Marco Ferretti, and Mirto Musci</i>	
Structural Blocks Retrieval in Macromolecules: Saliency and Precision Aspects	372
<i>Virginio Cantoni and Dimo T. Dimov</i>	
Discovering Typical Transcription-Factors Patterns in Gene Expression Levels of Mouse Embryonic Stem Cells by Instance-Based Classifiers . . .	381
<i>Francesco Gagliardi and Claudia Angelini</i>	
Motif-Based Method for the Genome-Wide Prediction of Eukaryotic Gene Clusters	389
<i>Thomas Wolf, Vladimir Shelest, and Ekaterina Shelest</i>	
An Approach to Identify miRNA Associated with Cancer Altered Pathways	399
<i>Giovanna Maria Ventola, Antonio Colaprico, Fulvio D'Angelo, Vittorio Colantuoni, Giuseppe Viglietto, Luigi Cerulo, and Michele Ceccarelli</i>	
Performance Comparison of Five Exact Graph Matching Algorithms on Biological Databases	409
<i>Vincenzo Carletti, Pasquale Foggia, and Mario Vento</i>	

Pardiff: Inference of Differential Expression at Base-Pair Level from RNA-Seq Experiments	418
<i>Bogdan Mirauta, Pierre Nicolas, and Hugues Richard</i>	
Environmental Risk Assessment of Genetically Modified Organisms by a Fuzzy Decision Support System	428
<i>Francesco Camastra, Angelo Ciaramella, Valeria Giovannelli, Matteo Lener, Valentina Rastelli, Antonino Staiano, Giovanni Staiano, and Alfredo Starace</i>	
SBA 2013 - International Workshop on Social Behaviour Analysis	
Recognition of Human Actions from RGB-D Videos Using a Reject Option	436
<i>Vincenzo Carletti, Pasquale Foggia, Gennaro Percannella, Alessia Saggese, and Mario Vento</i>	
Weakly Aligned Multi-part Bag-of-Poses for Action Recognition from Depth Cameras	446
<i>Lorenzo Seidenari, Vincenzo Varano, Stefano Berretti, Alberto Del Bimbo, and Pietro Pala</i>	
Space-Time Pose Representation for 3D Human Action Recognition	456
<i>Maxime Devanne, Hazem Wannous, Stefano Berretti, Pietro Pala, Mohamed Daoudi, and Alberto Del Bimbo</i>	
Human Body Language Analysis: A Preliminary Study Based on Kinect Skeleton Tracking	465
<i>Daniilo Avola, Luigi Cinque, Stefano Levialdi, and Giuseppe Placidi</i>	
Toward an Integrated System for Surveillance and Behaviour Analysis of Groups and People	474
<i>Edoardo Ardizzone, Alessandro Bruno, Roberto Gallea, Marco La Cascia, and Giuseppe Mazzola</i>	
User-Oriented Social Analysis across Social Media Sites	482
<i>Ming Yan, Zhengyu Deng, Jitao Sang, and Changsheng Xu</i>	
Towards the Parody Machine. Qualitative Analysis and Cognitive Processes in the Parody of a Politician	491
<i>Isabella Poggi and Francesca D'Errico</i>	
Natural Interactive System for Hemispatial Neglect Rehabilitation	501
<i>Gianpaolo D'Amico, Lea Landucci, and Daniele Pezzatini</i>	
Customers' Activity Recognition in Intelligent Retail Environments	509
<i>Emanuele Frontoni, Paolo Raspa, Adriano Mancini, Primo Zingaretti, and Valerio Placidi</i>	

Viewing the Viewers: A Novel Challenge for Automated Crowd Analysis	517
<i>Daide Conigliaro, Francesco Setti, Chiara Bassetti, Roberta Ferrario, and Marco Cristani</i>	
JAR-Aibo: A Multi-view Dataset for Evaluation of Model-Free Action Recognition Systems	527
<i>Marco Körner and Joachim Denzler</i>	
Head Dynamic Analysis: A Multi-view Framework	536
<i>Ashish Tawari and Moham M. Trivedi</i>	
Attention Control during Distance Learning Sessions	545
<i>Giuseppe Mastronardi, Vitoantonio Bevilacqua, Roberto Fortunato Depasquale, and Massimiliano Dellisanti Fabiano Vilardi</i>	
Statistical Person Verification Using Behavioral Patterns from Complex Human Motion	550
<i>Felipe Gomez-Caballero, Takahiro Shinozaki, Sadaoki Furuji, and Koichi Shinoda</i>	
Author Index	559

Modeling and Visualization of Drama Heritage

Vincenzo Lombardo¹ and Antonio Pizzo²

¹ University of Torino - Dip. Informatica - CIRMA
{vincenzo.lombardo,antonio.pizzo}@unito.it

² University of Torino - Dip. Studi Umanistici - CIRMA

Abstract. This paper presents a multimedia system for the modeling and visualization of drama heritage. The system consists of an ontology based annotation schema for the dramatic metadata of the cultural heritage artifacts (in textual or audiovisual form), a web-based platform for the introduction of the metadata, and a module for the visualization and exploration of such metadata. The system was tested on the cross-media studies of drama.

Keywords: narrative audiovisual, ontological representation, information visualization, film heritage.

1 Introduction

In the last decade, the notion of cultural heritage has been extending from the tangible to the intangible heritage, i.e. heritage that is “not closely linked to the physical consistency” [20]. Often this heritage presents artifacts that are digitized, although there is a general agreement about the lack of resources for “cataloguing” the collections and “make them accessible to the tradition bearers and the general public” [9]. Quite often the focus of cultural heritage cataloguing has been put on the audiovisual resources and the safeguarding activity has been coinciding with the preservation of the physical storage of the data, in both analogical and digital formats. Although there are a number of examples where the physical support (film and tape) has been augmented with metadata in order to preserve/represent information otherwise lost, yet there is not a shared system to represent the symbolic features. On the one hand, the efforts of digitisation of Cultural Heritage are providing common users with access to large amount of materials (see, e.g., Europeana¹), on the other, the amount of metadata is very restricted, items come with very short descriptions and lack contextual information. Complying with the UNESCO *Convention for the Safeguarding of Intangible Cultural Heritage*, we can stress the “cultural” side, henceforth pointing at the social and symbolic values [16].

There are a number of approaches for enriching cultural heritage items with metadata. Some authors have resorted to Wikipedia, which offers in-depth descriptions and links to related articles, and is thus a natural target for the automatic enrichment of CH items (see, e.g., [1]). Other approaches come from the

¹ <http://www.europeana.eu/>

field of video indexing, where semantic descriptors are automatically associated with videos. Semantic descriptors have been growing from a few tens of the first TRECVID conferences to a few thousands², and individual concepts are connected through the creation of semantic relations and ontological organization: for example, LSCOM is an ontology of concepts targetedly designed for a corpus of broadcast news [13] and the MediaMill dataset relies on a set of 101 semantic descriptors that are best suited for that repository [17]. Finally, a relevant source are the user-generated metadata, such as the tags that are freely inserted by users to annotate the items contained in public repositories. With reference to the audiovisual CH items, [10] report an informal survey carried out on the clips extracted from the feature film from *North by Northwest* (the famous 1959 MGM-Hitchcock's movie), contained in the YouTube repository. The survey reveals that of the 183 unique tags, split manually, into eleven different categories (Title, Actor, Director, Production, Editing, Publish, Genre, Character, Object, Environment, Action), following grounded-theory based analysis [18], only 32 could be interpreted as content metadata (such as, e.g., auction, boulevard), with most tags referring to characters ("Roger", "mother") or their qualities ("blonde", "dress"). The other tags all concern the resource itself (actors, director, ...) and could be retrieved from other sources, such as IMDB.

In this paper we address CH items that have a narrative form, i.e. they tell a story about characters who perform live actions. The fruition of this cultural heritage mostly focuses on *enjoying* the *story* rather than appreciating the aesthetic features, although the latter are appraised by professionals and knowledgeable users. The notion of "story" is widely acknowledged as the construction of an incident sequence [3], that, abstracting from the cinematographic properties, is motivated by the cause-effect chain [15]; this chain results from a complex interplay among agents, events, and environments, well known in playwriting techniques [6]. We propose an annotation relying on user tagging, driven by a narration model that is encoded in an ontology and an access that takes advantage of a visualization tool that reveals interesting properties of the item. Hence, the multimedia application we present is designed to model, annotate, and visualize the dramatic values of the narrative heritage (such as film, video and drama), and provides a cross-media, abstract representation of a narration sequence (a timeline of incidents) and of the complex interplay.

The structure of the paper is the following. In the next section we sketch the CADMOS (Character-based Annotation of Dramatic Media Objects) suite, which, relying on the computational ontology Drammar, provides an interface for annotating the dramatic features of a narrative heritage item and visualizes the structure to the benefit of drama scholars and narration enthusiasts. Then we run a classic example, a scene extracted from Shakespeare's *Hamlet* to illustrate how the CADMOS suite works. Finally, we discuss the contribution of the representation in analyzing the differences between the original Shakespeare's screenplay and Olivier's film adaptation, a topic of much interest for drama scholars. Conclusions end the paper.

² <http://www.lsc.com.org>

2 CADMOS Suite for the Annotation of Metadata

CADMOS suite is a set of applications built around a computational ontology of the notion of story, called Drammar (see [4] for details). Based on the Drammar ontology, we have introduced an annotation schema, which is employed for the construction of a repository of drama items enriched with metadata, and a visualization tool, for the exploration of the metadata in the interest of scholars and enthusiasts. The Figure 1 illustrates the workflow of the CADMOS suite. Given an audiovisual item³ the annotator, being her/him an expert or a visitor, splits the item into units (CADMOS segmentation phase), and defines a timeline of incidents as perceived from the movie. Then, he/she annotates the metadata for each unit, encoding the character's intentional behaviors in terms of goal, plans and achievement states, also with the support of the information from Shakespeare's text (CADMOS annotation phase). Timeline incidents, actions, goals, and plans are encoded according to the Drammar ontology. Finally, the encoding is displayed by matching the timeline incidents with the actions and plans assigned to the characters, to reveal the structure of the story plot (CADMOS vistool).

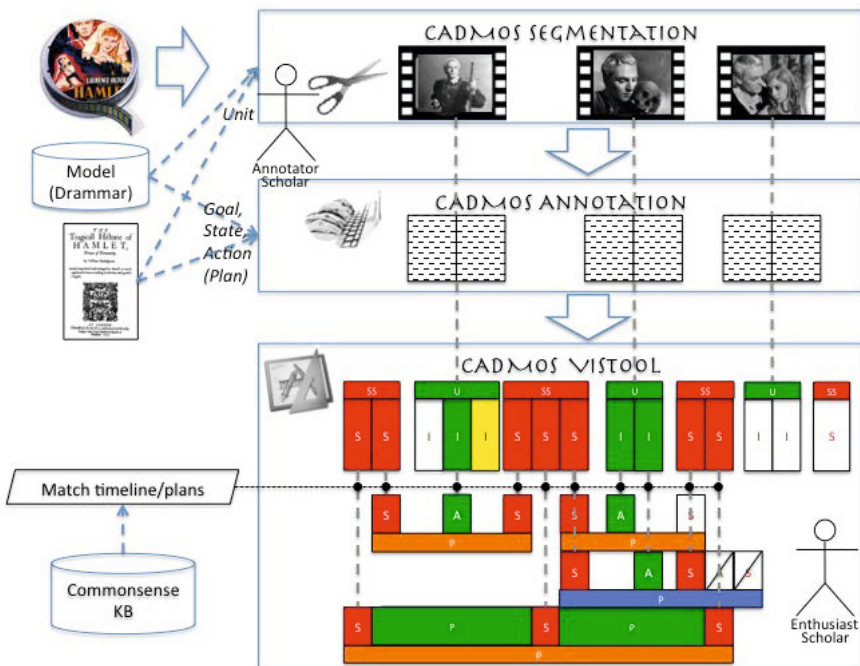


Fig. 1. The CADMOS suite workflow for metadata annotation and exploration

³ In the figure, we have used the CH item *Hamlet*, the film directed by Laurence Olivier, UK, Two Cities Film production, 1948.

Now we introduce the ontology, the web-based application for annotating the metadata, and eventually the visualization tool.

2.1 Ontology Drammar

The Drammar ontology describes the content and structure of a story in terms of Units (the incidents of a story are grouped in segments), Entities (i.e., Agents, Objects and Environments of the story incidents), and Actions/States (that relate the entities one another). Drammar generalizes over the specific format by which a story is expressed (novel, screenplay, etc.) and the medium through which it is conveyed. Following the paradigm of linked data[8], the ontology refers to external resources for the description of facts that are common to other domains: the large-scale commonsense ontologies SUMO (Suggested Upper Merged Ontology [14]) and YAGO (Yet Another Great Ontology [19]), merged into YAGO-SUMO [5], which provide very detailed information about millions of situations, including entities and process concepts; the lexical resources WordNet [12] and FrameNet [2], providing the means for an annotation interface based on linguistic terms and describing incidents and states through semantic templates expressed in terms of predicates and roles played by the participating elements; design patterns provided by other descriptive ontologies, such as DOLCE [7].

As an example of ontological encoding, we describe the annotation of a story incident (see Figure 2), driven by the Time Indexed Situation design pattern. This incident is extracted from the “nunnery scene” in the Third Act of Shakespeare’s *Hamlet*. In this scene, Ophelia is sent to Hamlet by Polonius and Claudius to confirm the assumption that his madness is caused by his rejected love. According to the two conspirers, Ophelia should induce him to talk about his inner feelings. The girl is ready to return the love gift received by the prince, and hence hopes to induce him to confess his love and his suffering. Figure 2 shows the representation of the incident in which Ophelia is returning the gift to Hamlet.

The whole story is a sequence of incidents arranged on a timeline. Incidents are motivated by the achievement of agents’ goal that are functional to the story advancement. Each agent features a library of plans that link the agents’ goals with the actions they are committed to for the achievement of their goals. Actions then become actual incidents on the timeline, though some remain unrealized in favor of the realization of other agents’ plans, who act in conflict with them. The plan structure is the following:

$$P[Goal] = PreConditions(A) A Effects(A)$$

$$P[Goal] = +_{i=1}^M PreConditions(P) P_i Effects(P)$$

A base plan for the achievement of some goal consists of an action A and its Precondition and Effect states, respectively. States are ontological structures similar to processes (see Figure 2). A generic plans is then recursively defined as a sequence of (sub)plans, with Precondition and Effect states again (+ is the concatenation operator). Preconditions can be mental states, i.e. goals (G) and beliefs (B), and states of affairs in the story world (SOA). A base plan annotated for the agent Ophelia in the previous example is the following:

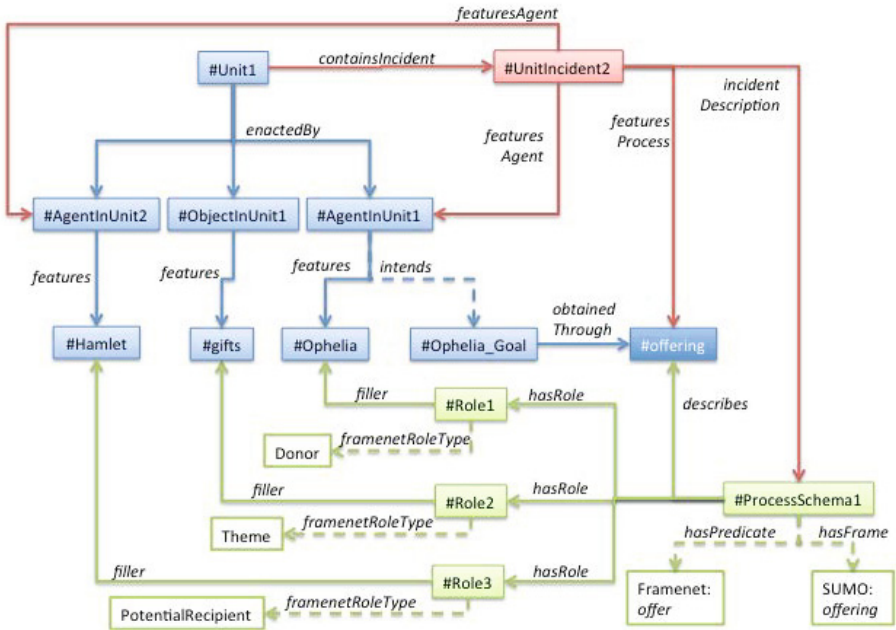


Fig. 2. The annotation of the incident where Ophelia offers the gift back to Hamlet, with instances (#) of Unit (*#Unit1*), Agent (*#Hamlet*, *#Ophelia*), and Object *#gift*). The action/process *#offering* (a SUMO concept) is connected to the role fillers (Framenet frame *offer*): *#Ophelia* is the *Donor*, *#Hamlet* the *PotentialRecipient*, gift the *Theme*.

$$P_{b1}^{Ophelia} [G : Ophelia \text{ wants } Ophelia \text{ interact with}(Hamlet)] =$$

- SOA : *Ophelia neglected*
- A : *Ophelia returning gift to(Hamlet)*
- SOA : *Hamlet have gift*

In this example, Ophelia, convinced by Claudius and Polonius, tries to induce Hamlet to reveal his deeper feelings. She use the gift once received as love signs as a means to provoke the prince. Thus, the action of returning gift is motivated by Ophelia’s goal of having an interaction with Hamlet and because of the pre-conditional state of affairs that she is neglected; the effect should be that Hamlet is in possess of the gift (but this state will remain unrealized).

2.2 CADMOS Annotation and Mapping

Within the CADMOS project we have developed a web based interface and annotation tool (see Figure 3), that was designed to carry out the annotation without the load of formality on the annotator. The annotation process starts by identifying the meaningful units of the item, by marking its boundaries through

a video player interface (Figure 3, above right); then, selecting the appropriate tabs, the annotator introduces the metadata for the story entities (agents, objects, environments); finally, the annotator retrieves the incident templates (a similar template concerns actions, events, and states), with roles that are filled with the story elements (the M–e–s tab concerns the mise–en–scène properties of the scene, i.e. camera movements, camera angle, type of shot, staging of actors). The annotation of actions also include their motivations, namely goals and plans, with precondition and effect states. The appropriate metadata are identified through natural language words that are used to retrieve the formal terms in the lexical and commonsense knowledge ontologies.

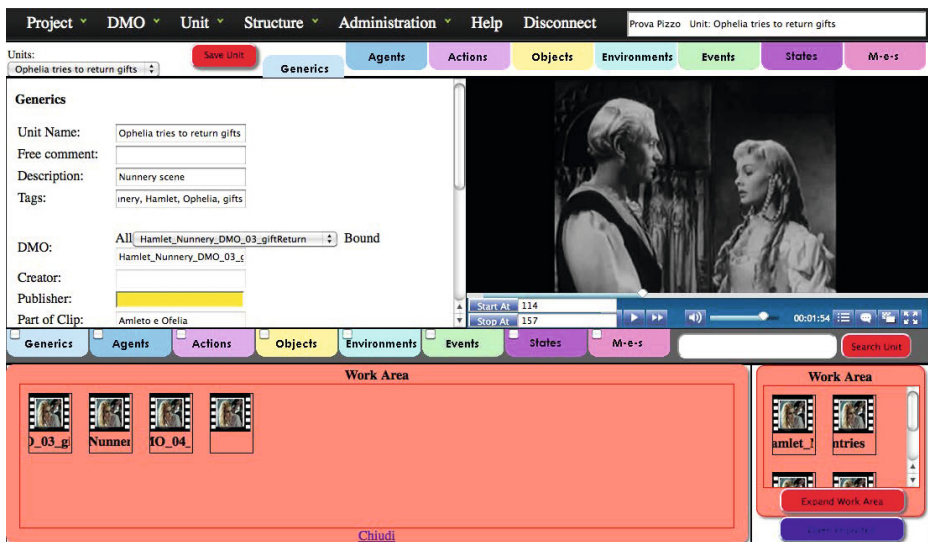


Fig. 3. The Cadmos Web Application for the segmentation and the annotation phases

The mapping of plan actions over timeline incidents is useful to visualize the motivations underlying agents' actions. First, we analyze the plans, and discover the actions that match (i.e., motivate) the incidents of the timeline; then, we point out successes and failures of characters' behaviors, i.e. we evaluate what plans can be fully realized or what plans fail; finally, we project the states required by the plan, as preconditions or effects of the plan actions, onto the timeline incidents.

This mapping is realized in the ontology by 1) modeling the timeline and the plans as sketched above, 2) defining the incident mapping through SWRL (Semantic Web Rule Language) IF–THEN rules, and 3) augment the timeline with states through an off–line algorithm. Both Timeline and Plan classes modeling relies on the generic class *OrderedList*, that represents the incidents' positions. An instance of Process or State refers to some position (relation *refersToTimeline*) in the Timeline or in a Plan, respectively. Based on the representation

above, the reasoner infers that some ordered list of incidents in the timeline belongs to some plan. The reasoner works with inferences of an ontological nature and with a SWRL rule that validates the mapping of some incident to some plan action. Finally, the timeline of the incidents is augmented through an off-line algorithm that takes as inputs the timeline, the plans, and the incident mapping, and returns as output an `OrderedList` named `Augmented Timeline` that contains the incidents of the `Timeline`, in the same partial order as in the `Timeline`, interspersed with states (agglomerated into story world states) as projected from the plans. So, if a state `S` is a precondition of the action `A` in the plan `P`, and the action `A` is mapped the incident `I` in the `Timeline`, then a state `S'`, that is the same as `S` is inserted in the `Timeline` before `I` (and after the incident preceding `I` in the `Timeline`). The augmented timeline `OrderedList` features a total order over incidents and states.

2.3 CADMOS Visualization Tool

In this section we describe the design, both interface and interaction, and the implementation of the visualization tool. The visualization concerns multiple trees of characters' intentions (or plans), possibly arranged hierarchically on a tree that spans a timeline of events.

The whole visualization space is split into three areas (refer to Figure 4): the `Agents` area (top), where the characters involved are listed and the `Timeline` area, where the augmented timeline is displayed with the incidents and the states, the `Plans` area, where the plans are displayed in hierarchical order. Each narrative incident or state is represented by a box (green for actions, yellow for events, red for states). White boxes in the `Plans` area are actions not mapped in the timeline, but the plan is activated because some of its actions or states have been mapped. Finally, the boxes filled with white color and barred diagonally means have not been realized in the `Timeline`, thus the plan failed.

All the incidents or states in the timeline have occurred in the plot realization. The timeline incidents pivot the horizontal alignment: each realized plan action is aligned with the matching timeline incident; at the same time states of the plans are projected onto the timeline to represent the story world state between adjacent units. The incidents that occur in a unit are considered in parallel, though we decided to assign them an individual position to allow for a visible alignment with the plan action. The plan label is an horizontal box that spans all the states and actions that belong to it.

In figure 4 there is the visualization of the excerpt of “nunnery scene” described above. As an example of mapping, consider the actional incident `I_OLL_0016` (“Ophelia returning gift to(Hamlet)”), mapped onto the plan action `A_0005` (“Ophelia returning gift to(Hamlet)”). A plan participates to the mapping and the augmentation of a timeline when the order of the incidents on the timeline respects the order of the mapped actions in the plan. In our example, since we have the mapping `I_OLL_0016`–`A_0005`, and the subsequent mapping `I_OLL_0017` (Hamlet denying gift)–`A_1112`(Hamlet refuse gift), the plan `P_P_0003Ophelia` can participate to mapping (notice that the last part of the plan

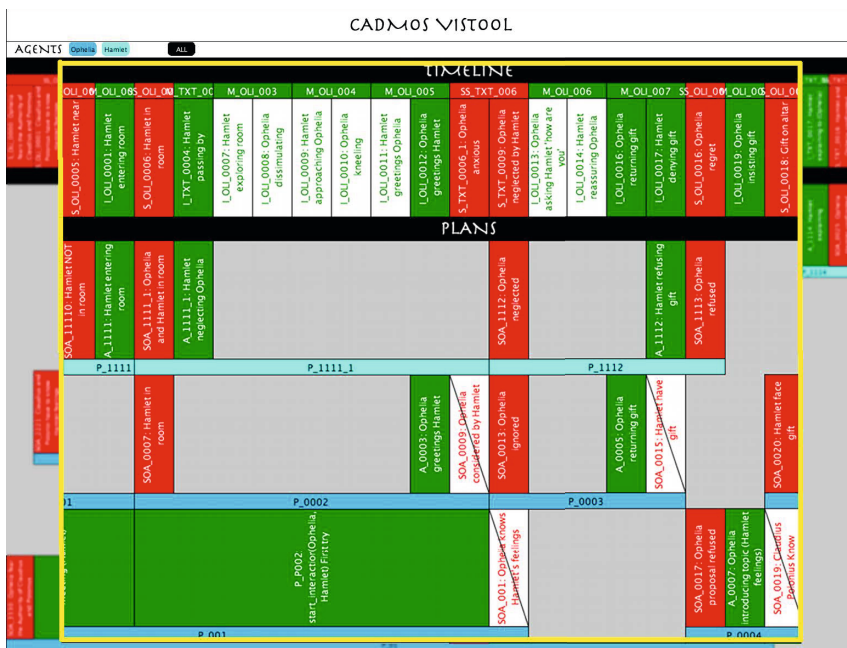


Fig. 4. Augmenting timeline with states projected from plans, with an enlargement in the middle area

is not mapped then). If the sequence of incidents does not respect the order exhibited by the mapping actions in some plan, that plan is not activated for contribution to mapping.

We augment the timeline with the states that hold between adjacent incidents on the timeline. States are taken from the preconditions and effects that are associated with the actions in the plans. So, in the case of A_0005 (“Ophelia returning gift to(Hamlet)”), we will have *SOA* : *Ophelia neglected* as precondition, and *SOA* : *Hamlet have gift* as effect.

3 Discussion and Conclusion

In order to validate our approach, we tested the differences between the original text and one specific mise-en-scène, a much appreciated topic for drama scholars. The matching of the plans over the augmented timeline shows the relation between the description of the agents’ behaviors and intentions, as implied by the text *Hamlet* and the factual representation of those behaviors in the mise-en-scène (i.e. the actors’ displayed actions). The latter can be considered a sort of translation that converts the information provided by the written text into the performance, transcoding the “dramatic text” into the “performance text” [11]. In a drama, the most important aspects of the translation are the dramatic features of the text (e.g. characters, intentions, conflicts, emotions). These

features can be considered as the intangible heritage of a dramatic item. The visualization helps to measure the degree of equivalence between this intangible cultural heritage and a specific form of representation. In our example, the beginning of the so called “nunnery scene” in Olivier’s movie shows a high grade of conformity with the drama, albeit there is a clear discrepancy regarding the Hamlet’s plan P_1111_1 for which we have to resume to the text, I_TXT_0004, as well as in the plan P_1114 that can be matched only with I_TXT_0017 (I_TXT are facts stated in the text timeline; I_OLI are facts stated in the movie timeline). This means that the movie fails to fully represent the content of the drama, i.e. the artist provides a specific personal interpretation of the intangible heritage called *Hamlet*, the Shakespeare’s play. The differences among such heritage and its numerous *mise-en-scène*’s can be considered quite common in the case of the intangibility, as in traditional folk fable where there is a flourishing of versions (for example the story of *Cinderella* from oral tale to Perrault’s or Disney’s versions). In the case of drama, we have not only a written text to preserve, but also, and most importantly, the dramatic features that shape the specific story. The representation of such features must go beyond the mere philological approach (that would undermine the quality of the performance), and can take into account the core structure of the heritage. In other words, the artist (Olivier, in our case) can neglect to display all the lines of the play as well as each action described in the text, and, in the same moment, he can comply with the drama. For example, Olivier’s rendering of Hamlet’s character seems to add actions that weren’t clearly stated in the text (the white boxes in the timeline representation - Figure 4), but nevertheless they fulfill the plan as devised in the original behaviors in the play.

In this paper, we have presented a tool for acquiring the metadata of intangible cultural heritage, specifically drama heritage. Our proposal relies on a computational ontology that encodes the major facts about drama and provides a web-based application for annotators to contribute. After computed the mapping between the agents’ intentions and the actions they carry out, the alignment is displayed through a visualization tool for study and access purposes. The approach has been tested on a study of the text/*mise-en-scène* differences on Hamlet’s nunnery scene.

References

1. Agirre, E., Barrena, A., de Lacalle, O.L., Soroa, A., Fernando, S., Stevenson, M.: Matching cultural heritage items to wikipedia. In: Calzolari, N., Choukri, K., Declerck, T., Doğan, M.U., Maegaard, B., Mariani, J., Odijk, J., Piperidis, S. (eds.) Proceedings of the Eight International Conference on Language Resources and Evaluation (LREC 2012). European Language Resources Association (ELRA), Istanbul (2012)
2. Baker, C., Fillmore, C., Lowe, J.: The berkeley framenet project. In: Proceedings of the 36th Annual Meeting of the Association for Computational Linguistics and 17th International Conference on Computational Linguistics, vol. 1, pp. 86–90. Association for Computational Linguistics (1998)

3. Bordwell, D., Thompson, K.: *Film art: An introduction*. McGraw Hill, Boston (2006)
4. Cataldi, M., Damiano, R., Lombardo, V., Pizzo, A., Sergi, D.: Integrating commonsense knowledge into the semantic annotation of narrative media objects. In: Pirrone, R., Sorbello, F. (eds.) *AI*IA 2011. LNCS*, vol. 6934, pp. 312–323. Springer, Heidelberg (2011)
5. De Melo, G., Suchanek, F., Pease, A.: Integrating yago into the suggested upper merged ontology. In: *20th IEEE International Conference on Tools with Artificial Intelligence, ICTAI 2008*, vol. 1, pp. 190–193. IEEE (2008)
6. Egri, L.: *The Art of Dramatic Writing*. Simon and Schuster, New York (1946)
7. Gangemi, A., Presutti, V.: Ontology design patterns. In: *Handbook on Ontologies*, pp. 221–243 (2009)
8. Heath, T., Bizer, C.: *Linked data: Evolving the web into a global data space. Synthesis Lectures on the Semantic Web: Theory and Technology*, pp. 1–136 (2011)
9. Kurin, R.: Safeguarding intangible cultural heritage in the 2003 UNESCO convention: A critical appraisal. *Museum International* 56(1/2), 66–77 (2004)
10. Lombardo, V., Damiano, R.: Commonsense knowledge for the collection of ground truth data on semantic descriptors. In: *Proceedings of the 2012 IEEE International Symposium on Multimedia (ISM 2012)*, pp. 78–83. IEEE Computer Society (2012)
11. Marinis, M.D.: *The Semiotics of Performance*. Indiana University Press (1993)
12. Miller, G.: Wordnet: a lexical database for english. *Communications of the ACM* 38(11), 39–41 (1995)
13. Naphade, M., Smith, J.R., Tesic, J., Chang, S.F., Hsu, W., Kennedy, L., Hauptmann, A., Curtis, J.: Large-scale concept ontology for multimedia. *IEEE MultiMedia* 13, 86–91 (2006)
14. Pease, A., Niles, I., Li, J.: The suggested upper merged ontology: A large ontology for the semantic web and its applications. In: *Working Notes of the AAAI-2002 Workshop on Ontologies and the Semantic Web* (2002)
15. Rimmon-Kenan, S.: *Narrative Fiction: Contemporary Poetics*. Routledge (1983)
16. Smith, L., Akagawa, N.: *Intangible Heritage. Key Issues in Cultural Heritage*. Taylor & Francis (2008), <http://books.google.it/books?id=voan0ESUzgAC>
17. Snoek, C.G., Worring, M., van Gemert, J.C., Geusebroek, J.M., Smeulders, A.W.: The challenge problem for automated detection of 101 semantic concepts in multimedia. In: *Proceedings of ACM Multimedia, Santa Barbara, USA*, pp. 421–430 (October 2006)
18. Strauss, A., Corbin, J.: *Basics of qualitative research: grounded theory procedures and techniques*. Sage Publications, Newbury Park (1990)
19. Suchanek, F., Kasneci, G., Weikum, G.: Yago: a core of semantic knowledge. In: *Proceedings of the 16th International Conference on World Wide Web*, pp. 697–706. ACM (2007)
20. Vecco, M.: A definition of cultural heritage: From the tangible to the intangible. *Journal of Cultural Heritage* 11(3), 321–324 (2010), <http://www.sciencedirect.com/science/article/pii/S1296207410000361>