NOSMOG

Newsletter Of the Shape MOdelling Group

Issue 4, March 2011

http://www.ge.imati.cnr.it/ima/smg/home.html

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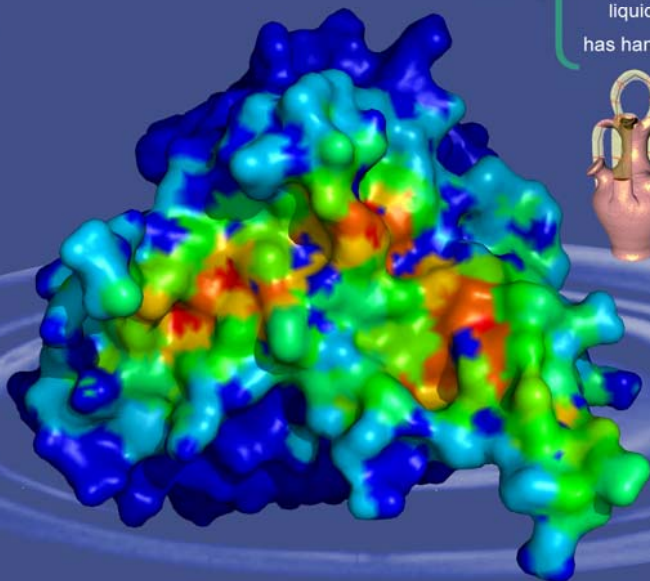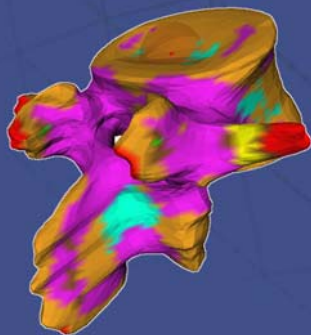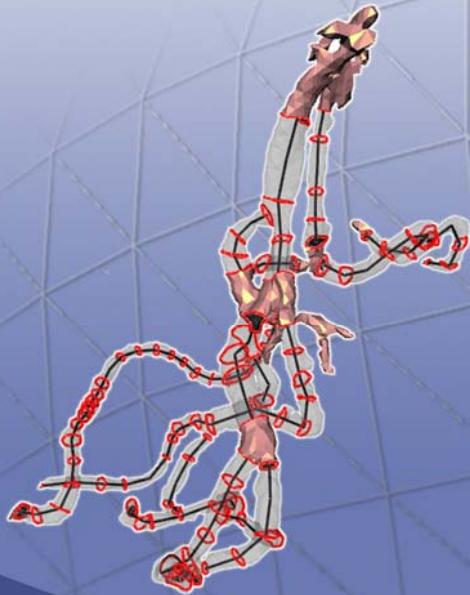
amphora
container
can be filled with liquids
has handles

pliers
can be grasped
can act on small metal pieces

table
has a flat top
is large
is heavy
is robust

chair
can be grasped
is small
is wooden

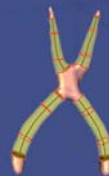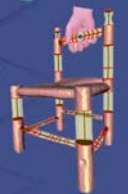@ imati

EDITORIAL

In September 2010 the Newsletter Of the Shape MOdelling Group started as an experiment. The declared objective was to provide a regular and comprehensive overview of the ongoing activities and the research results of the Shape Modeling Group at IMATI. It is a pleasure for me to see that after four issues this newsletter is still interesting and appreciated.

As usual, you will find here the recent achievements and new challenges of the SMG from the point of view of financed projects, research and networking activities. Since the end of the FOCUS K3D project, the center of mass of the group's activities moved towards the conception of new breakthrough project proposals and new collaborations, and we are starting to see some of the benefits in these recent months.

So, besides our participation in the Network of Excellence "GaLA" on Serious Gaming, we are happy to announce our involvement in the newborn "VISIONAIR" project, a European infrastructure providing visualization facilities for research.

Furthermore, we started a collaboration with the Drug Design group of the Italian Institute of Technologies, and are glad to welcome Dr. Sergio Decherchi that will spend one year at IMATI working on themes related to shape modelling and analysis as a tool for biomolecule understanding.

In the latest six months, the group has been particularly active regarding general public outreach and promotion initiatives, and we were pleased to see an unexpectedly large and interested audience for two events that the SMG contributed organizing: the workshop on "We will meet you in the virtual reality", organized as part of the European project "The Researcher's Night", and the exhibition on "Laser – light beyond the horizon", realized as part of the annual Science Festival in Genova.

I wish you a pleasant reading!

> Marco Attene

Group @ CNR-IMATI Ge

SMG: the Shape Modelling

SMG: The Shape Modelling Group @ CNR-IMATI-Ge

The Shape Modelling Group (SMG) is a research team of the Institute of Applied Mathematics and Information Technology, branch of Genova (IMATI-Ge), of the Italian National Council of Research (CNR).

The mission of the group is to advance research in the field of geometric modelling and computer graphics. Geometric modelling has been a key research topic at IMATI for several years. Geometric modelling is a set of mathematical and computer science techniques which relate to different fields, such as geometry, computational topology and computer graphics. The main aim is to describe the shape of an object or phenomenon, through the definition of geometric primitive entities and the classification of the reference context. A "shape" is here intended as an entity having both a specific geometry and a meaning associated.

Currently the research activities of the SMG are grouped into two main research units:

➢ Advanced techniques for 3D digital shapes analysis and synthesis

➢ Coding, elaboration and restitution of multidimensional media knowledge

In the first research activity, fundamental research is performed on algorithmic and computational methods for shape modelling, processing, analysis and retrieval, using geometric and topological approaches. To this aim, new models for the representation of topological and geometrical information are defined, and new tools for the classification and recognition of shape features and topological structures are developed.

In the area of multidimensional media knowledge, the aim is to define a new modelling paradigm, based on the formalisation of several aspects related to the shape, which can be used to formalise the geometric form of an object (geometric model) as well as the set of contexts, or views, which could use this model (semantic model).

The research target of the SMG is to broaden the role of traditional modelling by the definition of new strategies for shape representation and analysis, in order to highlight the semantic level that better reflects the perception of shapes. Other topics of research are related to the fields of computer graphics, industrial design, reverse engineering, and geographical information systems.

➢ Bianca Falcidieno
Head of the SMG

SMG Website: *http://www.ima.ge.cnr.it/ima/smg/home.html*

Highlights

IMATI is involved in the newborn **VISIONAIR** Project! >*More on page 5*

Silvia Biasotti visits the French **Université Blaise Pascal**! > *More on page 11*

Welcome to **Sergio De Cherchi** in the SMG team! >*More on page 20*

EUROPEAN PROJECTS

VISIONAIR - Vision Advanced Infrastructure for Research

Visionair calls for the creation of a European infrastructure for high level visualisation facilities and resources that will be open to research communities across Europe and around the world. Both physical access and virtual services will be provided by the infrastructure. Within Visionair, the SMG at IMATI will take care of the Visualization Virtual Services (VVSs), which provide access to virtual facilities through a remote connection. Based on the Digital Shape Workbench paradigm developed within the AIM@SHAPE project (see NoSMoG #1, pg. 4, or http://www.aimatshape.net), the virtual facilities are provided as online services that allow to share digital shapes and software tools to process and analyze them. The VVSs act as an e-Science framework in terms of an operational, distributed and web-based software system.

They involve a Shape Repository, a Tool Repository and an Ontology and Metadata Repository, and provide search services for both 3D shapes and software tools. The VVSs will offer a valid support for all those application fields that have to deal with the processing and visualization of digital shapes, with a particular focus to 3D. The objective is to speed-up and improve the visualization of multidimensional data by supporting the retrieval of useful processing software and geometric shapes. This supports the creation of original digital shapes (2D images, videos, 3D shapes, and higher-dimensional geometric models) that will be possibly analyzed, enriched and combined with other data, with the objective of providing useful information to be visualized.
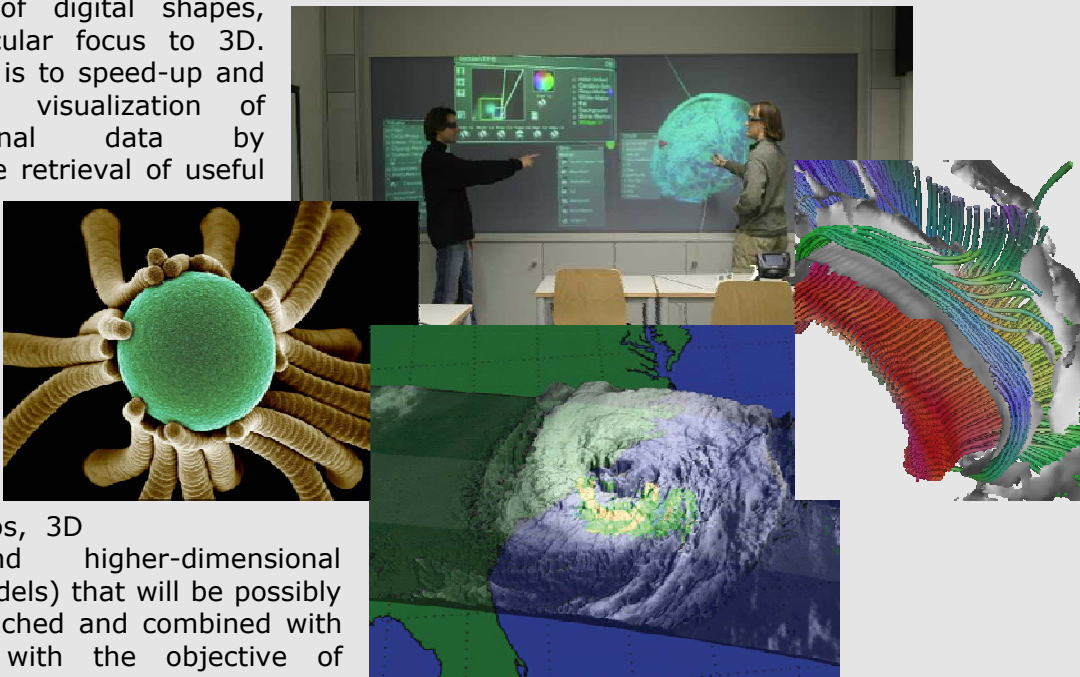
> *M. Attene & F. Giannini*

> *FP7-INFRASTRUCTURES-2010-1*   > *Duration: Feb 2011 – Jan 2015*

> Coordinator: *Prof. Frédéric Noël (Grenoble INP)*

> IMATI's contact person: *Bianca Falcidieno*

> *Consortium*: • European Manufacturing and Innovation Research Association (BE) • University of Twente (NL) • Royal Institute of Technology (SW) • Fraunhofer-Instituts für Produktionsanlagen und Konstruktionstechnik (GE) • RWTH Aachen University (GE) • University of Kaiserslautern (GE) • High Performance Computing Center Stuttgart (GE) • Poznań Supercomputing and Networking Center (PL) • Poznań University of Technology (PL) • Computer and Automation Research Institute, Hungarian Academy of Sciences (HU) • Technion - Israel Institute of Technology (IS) • Laboratory for Manufacturing Systems & Automation (GR) • Politecnico di Milano (IT) • Consiglio Nazionale delle Ricerche (IMATI and ITIA) (IT) • Université de la Méditerranée (FR) • i2CAT Foundation (ES) • INPG Entreprise SA (FR) • Grenoble INP (FR) • Ecole Centrale de Nantes (FR) • Institut National de Recherche en Informatique et Automatique (FR) • Arts et Métiers ParisTech (FR) • University College London (UK) • Cranfield University (UK) • University of Salford (UK) • University of Essex (UK)

EUROPEAN

PROJECTS

GaLA – Games and Learning Alliance

http://www.galanoe.eu

GaLA gathers cutting edge of European Research & Development organizations on Serious Games, involving 31 partners from 14 countries. The Network aims at favouring a strong integration among leading researchers, developers and users of serious games. The project will identify key issues in the adoption and development of Serious Games and draw a roadmap for future research on the topic. A strong concern is the current standards of education, in order to favour a real uptake and scaling of the educational games initiatives.

 CNR participates in GaLA with two institutes: the Institute for Educational Technology (ITD) and IMATI. IMATI is responsible of gathering the needs and desiderata of the stakeholders in the main application fields of Serious Games (WP3). Moreover, IMATI is leading the Special Interest Group on Humanities and Heritage, a very wide domain ranging from architecture to archaeology, history, languages, tourism, literature, law, philosophy, religion and art. Really beneficial for this field are 3D virtual worlds (think of architecture, archaeology, virtual tourism) which the user can explore and where he can interact with objects and people in their realistic context. The focus is therefore not only on games but also on (online) virtual environments, virtual museums, historical reconstructions: Serious Virtual Worlds.

> M. Mortara

> FP7 - IST ICT, Technology Enhanced Learning   > Duration: Oct 2010 – Sep 2014

> IMATI's Responsible Persons: Bianca Falcidieno and Michela Mortara

> Consortium: UNIGE (CH, coordinators), CNR-IMATI-Ge and other 29 partners from *IT, FR, RO, DK, UK, ES, PT, NL, FN, DE, NO, IR, CH and AU.*

Rock'n … Researchers on the rock

http://nottedeiricercatori.comune.genova.it

   IMATI took part in the FP7 EU Coordination and support action "Rock'n … Researchers on the rock" and organised the Workshop "We will meet you in the virtual reality" at Museo di Archeologia Ligure located in Pegli (Genoa) on September 24th 2010. The aim of the initiative was to introduce the citizens to the creation of virtual worlds which can be populated with digital copies of real objects.

   During the workshop, the researchers explained the basic steps needed for the construction of a digital model of a real object by means of a laser scanner device and also set up an acquisition corner where participants could experience some simple scanning sessions in real time. Moreover, IMATI digitized and showed to the public the ancient Tavola di Polcevera, which is exposed in the Museum room devoted to the origin of Genoa. The artefact was acquired and modelled at different levels of resolutions together with its texture to optimise the rendering of the model. Finally, IMATI realized a short movie to introduce the following theatrical show about the history of the Tavola di Polcevera. The face of one of the actors has been digitised and the virtual model was shown during the event in different modalities starting from the 3D points alone to the tessellated surface; the model was also presented from different viewpoints and rendered using different lightings and materials, and finally with the real textures acquired from the actor himself.

> C.E. Catalano

> FP7-PEOPLE-2010, Coordination and support action   > Duration: May-Nov, 2010

> IMATI's Responsible Persons: Bianca Falcidieno

 > Consortium: Comune di Genova, CNR-IMATI-Ge, IIT, Ass. Festival della Scienza, Il giardino letterario Delfino Ass., Palazzo Oddo S.r.l., Università di Genova, Università di Pisa

NATIONAL PROJECTS

Biomedical Research Activities and Technology Transfer

The Shape Modelling Group is actively cooperating with universities and industrial partners in several regional research projects, which are finalized at the development of biomedical technologies and solutions for the prevention, early detection, screening, treatment, and follow-up of major diseases. Main application areas include oncology, cardiovascular treatments, orthopaedics, and rheumatology. The final aim is to develop diagnostic and therapeutic processes that are both personalized and effective. Furthermore, the complexity of these problems and the level of global competitiveness in specific areas of bio-medical technologies require the development of innovative strategies, which enable the exploitation of all the skills and resources available as well as a thorough technology transfer between public research institutions and enterprises. In this context, the main objectives of this interdisciplinary collaboration are (i) the promotion and activation of programs of scientific and technological research in the field of medical devices and information technology solutions; (ii) technology transfer; (iii) networking and dissemination of scientific results through local events.
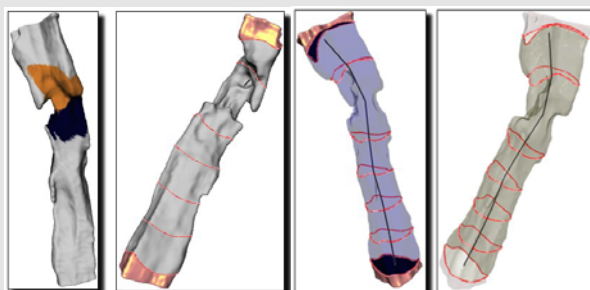
> G. Patanè

> Funding org.: MIUR - Italian Ministry for Univ. & Research (through Regione Liguria)

> IMATI's contact person: Bianca Falcidieno   > Duration: 2008-2012

> *Consortium: Univ. of Genova, CNR-IMATI-Ge and companies within Consorzio SIIT.*

Shape modelling and analysis as a tool for biomolecule understanding

The collaboration between IMATI and the Drug Discovery and Development (D3) Lab of the IIT started more then one year ago with the aim of building a multi-disciplinary group to study the relations, and possible exploitation, of shape-based tools for modelling and analysing the properties of biomolecules that are highly characterized by a geometric nature.

Recently, the IIT-D3 Lab was awarded with a five years grant of the NIH with the goal to restructure a very well-known software, DelPhi, for calculating the electrostatic free energy of biomolecular systems. Thanks to this grant, and within this context, a specific joint research project started on the modelling of the interface – the molecular surface – between solvent and the molecular solute. The Connoly surface is frequently used as a good reference for it, but we will study alternative solutions that provide a better control over smoothness properties of the surface and a smoother dependence of the surface on the atoms' positions.

The joint project will focus also on new Quantitative Structure Property Relationship methods (QSPR) widely used to understand and predict properties of a molecular compounds, such as the activity or toxicity. QSPR are based on machine learning techniques that use a variety of descriptors and are trained on annotated datasets of molecules with known properties. The challenge addressed by the joint project is to identify and evaluate descriptors that capture geometric features of the electronic density. Two members of the IIT-D3 lab started to work at the IMATI premises on the themes of the joint research project.

> M. Spagnuolo

> Funding organizations: CNR, IIT

> Responsible persons: Michela Spagnuolo (IMATI), Walter Rocchia (IIT)

> Consortium: CNR-IMATI-Ge and IIT - Drug Discovery and Development (D3)

Shape Comparison

RESEARCH

Comparing Shapes through Inter-Distances of Real Functions

The literature provides several libraries of real functions defined over a shape. We can assume that each of these functions represents a property of the shape at a time. To quantify how much these properties differ we code their distances in a matrix that could be considered an intrinsic shape pattern

The description of geometric shapes is often supported by the study of the properties of scalar functions defined over the shapes following a description paradigm based on the following sequence of concepts: shape model, scalar function, and shape descriptor. The role of the scalar function is to sift the most significant shape information and to discard the irrelevant one, acting as a filter of the features that will be stored in the shape descriptor.

In this scenario, spectral methods are extremely promising, as they naturally provide a set of tools, i.e., eigenvalues, eigenvectors, heat kernels, which are intrinsically defined by the shape. In the Computer Graphics literature, there are several shape retrieval methods based on spectral properties like the comparison of the first k eigenvalues of the Laplace-Beltrami operator, the creation a kind of canonical, isometry-invariant shape embedding into an Euclidean space or the descriptors based on the heat-kernel signature.

Less attempts have been done to directly compare shapes through the eigenfunctions of the Laplace-Beltrami operator. They potentially contain all the information needed to reconstruct the original shape, and can be effectively used to derive a library of intrinsic shape segmentations.

However, for each eigenfunction it is hard to know a priori how it evolves on the shape; in addition its computation suffers of a problem that has hindered the usage in retrieval or comparison tasks: sign indeterminateness and swap. All these facts have prevented to pair-wisely compare eigenfunctions for shape retrieval.

To go beyond all these limitations, we have introduced the Mutual Inner Distance Matrix (MIDM), which is an intrinsic shape pattern derived from the distance between couples of eigenfunctions. This signature can be seen as a feature vector that acts as an intrinsic shape pattern. Experiments show that it can be effectively used for shape retrieval and its robustness with respect to changes in topology, model re-sampling, small perturbations and pose variations.

> S. Biasotti
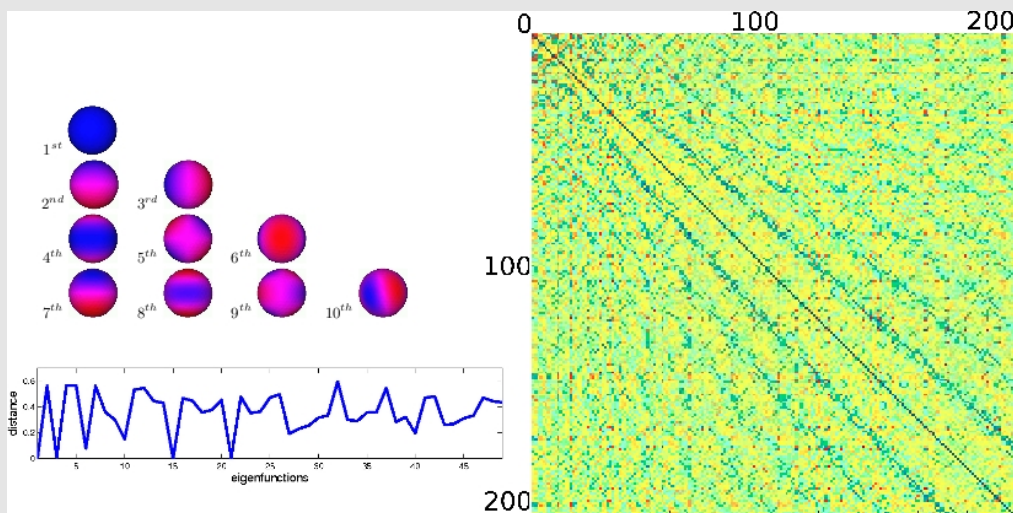
First ten eigenfunctions, first 200x200 elements of the MIDM and distance evolution on a sphere

> S. Biasotti. Shape Comparison through Mutual Distances of Real Functions. Proc. of ACM Workshop on 3D Object Retrieval. Firenze. 25 November 2010
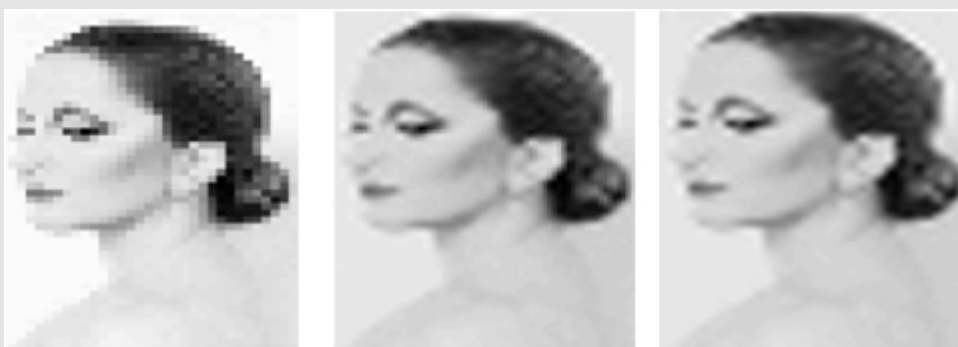
Discrete Fuzzy Transform

RESEARCH

Fuzzy Transform and least-squares approximation: analogies, differences, and generalizations

Investigating the relations between the least-squares approximation and the Fuzzy Transform, we have defined the geometry- and confidence-driven Discrete Fuzzy Transform, which takes into account the intrinsic geometry of the input data and the confidence weights associated to the input data

During the last decades, several transformations have been proposed to solve problems that spread from signal analysis to the solution of differential equations and the approximation of scalar functions. Among them, we mention the Fourier and Wavelet Transform in signal and image processing, linear transformations associated to the Laplace and the heat diffusion operator in differential analysis. In all the aforementioned cases, the underlying idea is to compute an approximation of the solution as member of a linear space, which is generated by a set of basis functions and whose properties (e.g., continuity, reproducing property in Hilbert spaces) are strictly related to the input data and problem. For instance, the basis functions of the Fourier and wavelet transform are sinusoidal, the function space associated to the Laplace and heat diffusion operator is generated by the eigenfunctions of the Laplace-Beltrami operator.

In fuzzy modelling, the Fuzzy Transform provides a relation between the space of continuous functions defined on the real line and Rn. In this context, our research activity has investigated the relations between the least-squares approximation techniques and the Fuzzy Transform. More precisely, we have shown that the Discrete Fuzzy Transform is invariant with respect to the interpolating and least-squares approximation of the input data set $D := \{(x_i, f(x_i))\}_{i=1}^{n}$, with $f: P \rightarrow R$, $P := \{x_i\}_{i=1}^{n}$, unknown scalar function. Additionally, the Fuzzy Transform of f outside P is approximated by simply re-sampling the continuous map f at a set of points of R^d. Using numerical linear algebra, we have also derived new properties (e.g., stability to noise, additivity with respect to P) and characterizations (e.g., radial and dual membership maps) of the Discrete Fuzzy Transform. Finally, we have defined the geometry- and confidence-driven Discrete Fuzzy Transform, which take into account the intrinsic geometry of the input data and the confidence weights associated to the f-values or the points of P.

> G. Patanè

(a) Input noisy image and (b-c) re-sampling of its Inverse Fuzzy Transform with least-squares constraints and at different resolutions. Images are courtesy of www.minamazzini.it

> Giuseppe Patanè. "Fuzzy Transform and least-squares approximation: analogies, differences, and generalizations". Fuzzy Sets and Systems. In press.
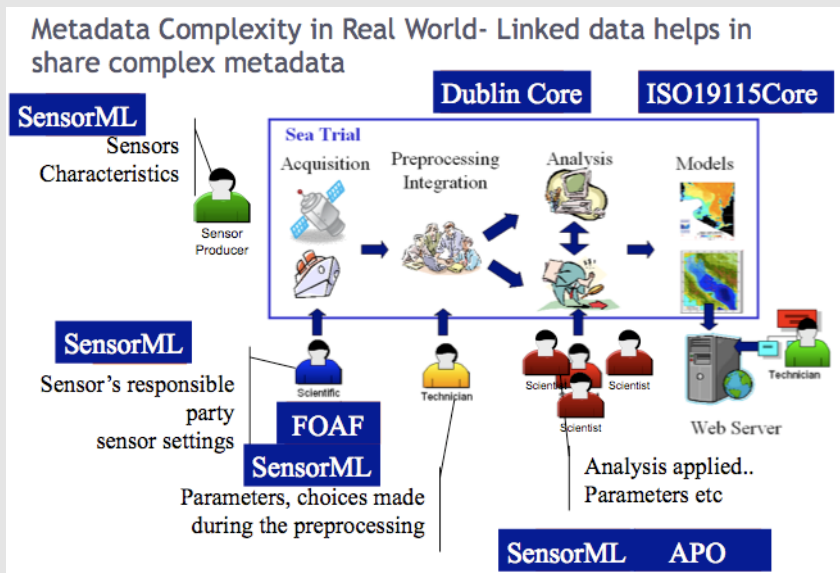
Linked Data

RESEARCH

Semantic Similarity and Selection of Resources Published According to Linked Data Best Practice

Semantic similarity analyses data and metadata to support in explorative search on web of data

Effective sharing and reuse of data are still desiderata of many scientific and industrial domains, e.g., environmental monitoring and analysis, medicine and bioinformatics, CAD/CAE virtual product modelling and professional multimedia, where the selection of tailored and high-quality data is a necessary condition to provide successful and competitive services.

Semantic web and in particular the emerging linked data best practice provide a promising framework to encode, publish and share complex metadata of resources in these scientific and industrial domains. However, even supposing the linked data was massively adopted to share the metadata of complex resources, the selection of the most suitable datasets for complex domains like environmental analysis would still be an enervating task. A huge amount of resource features and their complex relations must be considered during the selection process. Especially for assisting in this process, semantic similarity algorithms supporting a deep comparison of resource features are pivotal. In our previous research activity, we developed an asymmetric and context dependent semantic similarity that supports in exploratory search and detailed comparison of resources stored local repository. As more and more data resources are exposed on the web, semantic similarity should locate data on the fly on the web of data, considering multiple and possibly unknown sources. Extending instance similarity at such a scale forces to reconsider our similarity addressing its invariance with respect to metadata varieties, namely the varieties arising when independent stakeholders provide resources (e.g., non-authoritative, heterogeneous and non-consistently identified metadata). We propose research plan to fit the similarity into the web of data, this research activity is still ongoing and it is extremely challenging when resources published by completely unrelated stakeholders are addressed. Although our research effort is still in its early stage, it has already resulted in a semantic similarity prototype consuming harmonized linked data and an exploratory phase analyzing real web data. The exploratory phase has taught unexpected lessons we have recently presented at OTM 2010.

> R. Albertoni

NURC Sea trials: a scenario where semantic similarity can be employed to compare and select data

> Albertoni R., De Martino M., Semantic Similarity and Selection of Resources Published According to Linked Data Best Practice, On the Move to Meaningful Internet Systems: OTM 2010 Workshops Lecture Notes in Computer Science, 2010, Volume 6428/2010, 378-383, DOI: 10.1007/978-3-642-16961-8_58

COLLABORATIONS and VISIT EXCHANGES

MAP-Gamsau Laboratory - National Centre for Scientific Research (CNRS), Marseille (France)

Michela Spagnuolo visited in December Dr. Livio De Luca, an architect and a researcher at CNRS. His research focuses on digital surveying, modelling and representation of architectural heritage. In this field, shapes act as a fundamental marker of trends – stylistic, geographic, historic, ethnographic. Hence, the subject of the visit has been the exploitation of IMATI's competence on semantic 3D shape modelling and analysis to define new methods for image-based modelling of artefacts; (semi-)automatic feature detection; shape similarity and classification; semantic annotation of 2D and 3D content and annotation propagation in virtual heritage applications. This collaboration originated from the participation of L. De Luca in the Archaeology and Cultural Heritage Application Working Group of the IST-FP7 project FOCUS-K3D (2008-2010) coordinated by IMATI, and is expected to continue as a long-term collaboration.

> D. Giorgi

> *Contact persons at MAP-Gamsau Laboratory:* Dr. Livio De Luca

Équipe Orpailleur, Laboratoire Lorrain de Recherche en Informatique et ses Applications (LORIA) and CNRS, Nancy, France

On the base of the extensive work on shape analysis and understanding also applied to the structural biology context, Michela Mortara was invited to visit the Orpailleur team at LORIA from 15th to 18th September 2010. The Orpailleur team is an interdisciplinary research unit focusing on knowledge extraction and management with a particular interest to bioinformatics applications. Since the shape of molecular surfaces plays a crucial role in determining their biological functions, multiresolution methods for morphological surface analysis can be useful in processes like binding affinity prediction and pocket identification. Michela gave the talk "Computer Graphics techniques for analyzing and enhancing shape information". The collaboration with Prof. Maigret is proceeding on the themes of molecular shape complementarity.

> M. Mortara

> *Contact persons at Équipe Orpailleur:* Emeritus Research Director Bernard Maigret

Université Blaise Pascal, Clermont-Ferrand II (France)

In November 2010 Silvia Biasotti was invited researcher for three weeks at the ISIMA/LIMOS labs of the Universitè Blaise Pascal, Clermont Ferrand II.

Main motivation of the visit is to consolidate the collaboration between IMATI and the ISIMA group lead by prof. V. Barra and to establish a new one with the Universitè d'Auvergne, Clermont-Ferrand I. A scientific collaboration to investigate on the use of computational topology, in particular contours and flow paths of real functions, to improve the existing shape chartification and segmentation techniques has been established and a master project on quadrangular patch optimisation has been jointly supervised. Further collaborations are expected on graph matching techniques based on the use of kernel bags and how uncertainty coding for shape description.

> S. Biasotti

> *Contact persons at Université Blaise Pascal:* Prof. Vincent Barra

TRAINING

EVENTS and *(vertical text in left margin)*

Lecture at University of Genoa, Department of Mathematics

On December 16, 2010 Marina Monti and Franca Giannini gave a lecture on "Curves & Surfaces for virtual prototyping in industrial design", within the course IGS1-Elliptical curves, at the Department of Mathematics of the University of Genova.

➢   *M. Monti*

Invited Talk at Eurographics Italian Chapter Conference (EG-IT)

EG-IT is the main Italian conference on Computer Graphics. Organized by the EUROGRAPHICS Italian Chapter, the 8th EG-IT was held in Genova on the 18th and 19th of November, 2010, with the special theme "Computer graphics meets computer vision". The scientific program consisted of both invited talks and contributions by participants.

Bianca Falcidieno was the invited speaker of the first day. In her talk, "Semantics in the Modelling Process", she pointed out how 3D content is now widely recognized as the upcoming wave of digital media, and inexperienced and professional users are becoming more and more actively involved in the content creation pipeline and ask for more intuitive and effective tools for creating, sharing, retrieving and re-using 3D content. The critical role of users as drivers of innovation is increasingly apparent and suggests that true innovation and impact can emerge from a balanced combination of technology-pushed and user-pulled solutions. In addition, the ease of producing and/or collecting data in digital form has caused a gradual shift of paradigm in various applied and scientific fields: from physical prototypes and experience to virtual prototypes and simulation. This shift has an enormous impact on a number of industrial and scientific sectors, such as Design and Manufacturing, Serious Gaming and Simulation, Cultural Heritage and Archaeology, Medical Applications, Bioinformatics and Pharmaceutical Science, where digital shapes are essential knowledge carriers and represent a huge economic factor in many content sectors. In her talk, Falcidieno presented and discussed the many issues and challenges that should be addressed in this scenario, together with some new approaches and solutions developed at IMATI.

> *B. Falcidieno*

ACM Workshop on 3D Object Retrieval – ACM 3DOR

ACM Multimedia co-event, Florence, Italy, October 25, 2010. http://www-rech.telecom-lille1.eu/acm3dor/

Specific goal of the workshop was to provide a cross-fertilization ground for researchers interested in this topic: the co-location with ACM Multimedia 2010, the worldwide premier multimedia conference, gave us the great opportunity to meet the multimedia community that hopefully will stimulate further discussions on the next steps in this important research area. The workshop co-chairs were Mohamed Daoudi, Michela Spagnuolo and Remco Veltkamp. A program committee of 36 international experts was assembled to help with the reviewing process. The response to the call for participation was a success: even if scheduled shortly after the EG 3DOR'10 workshop, the ACM 3DOR'10 received 24 full paper submissions on various topics related to 3D retrieval Out of the 24 submissions received, 7 contributions were accepted as oral papers and 7 as poster papers.

> *M. Spagnuolo*

Festival della Scienza – The Science Festival of Genova

Genova, Italy, October 29th *– November 7*[th] *2010. http://www.festivalscienza.it*

The Science Festival of Genova is a benchmark for the science communication. It's a chance of meeting for researchers, people keen on science, schools and families. It is a main international event of science dissemination. Our experience in 3D scanning has been shared within the special exhibition "Laser. Light beyond the horizon" which focused its attention on the use of laser technologies. Our Minolta Vivid 910 3D Laser Scanner has been brought to the exhibition and the principles of laser scanning technology has been explained to the public, together with hands-on scanning sessions.

> *F. Robbiano*

WHO IS WHO

Bianca Falcidieno - *Research Director*

Bianca Falcidieno is a Research Director of the National Research Council (CNR) of Italy, responsible for the Genova Branch of the CNR National Institute of Applied Mathematics and Information Technology (CNR IMATI-GE) and the President of the Research Area for the CNR in Genova.

She has been leading and coordinating research at international level in advanced and interdisciplinary fields (such as computational mathematics, computer graphics, multidimensional media and knowledge technologies), strongly interacting with outstanding industrial and social application fields: from industrial design to geographic information systems, from manufacturing to semantic web.

She is presently taking part in more than ten European and Italian research projects and she has been the coordinator of the FP6 Network of Excellence AIM@SHAPE, aiming at representing and processing knowledge related to multi-dimensional media. Since 2008, she is the coordinator of the FP7 Coordination Action FOCUS K3D, whose main aim is to promote the adoption of best practices for the use of semantics in 3D content modelling and processing.

She is the author of more than 200 scientific refereed papers and books. She is currently editor-in-chief of the International Journal Shape Modelling and Chair of the IEEE Conference SMI'10 (Shape Modeling International).

For the 80th CNR anniversary, Bianca Falcidieno was included in the 12 top-level researcher women in the CNR history.

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http://www.ge.imati.cnr.it/ima/smg/people.html

Michela Spagnuolo - *Senior Researcher*

Michela Spagnuolo is currently senior researcher at IMATI Genova. Her research interests are related to computational topology for shape understanding, classification and retrieval, and shape-based approaches to modelling and processing digital shapes.

She authored more than 120 reviewed papers in scientific journals and international conferences, edited a book on 3D shape analysis, and was guest-editor of several special issues. She is currently programme chair of the EG workshop on 3D Object Retrieval and of the IEEE Shape Modelling International 2008 (SMI). She is member of the steering committee of SMI, and was programme chair for the Semantic and digital Media Technology, SAMT'07.

Her current interests include shape analysis techniques, shape similarity and matching, and computational topology. She was responsible for EC and national projects of IMATI and is currently responsible of the research unit on "Advanced techniques for the analysis and synthesis of multidimensional media".

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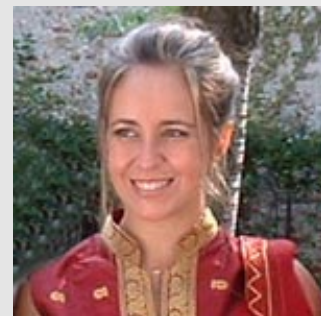
WHO IS WHO

Franca Giannini - *Senior Researcher*

Franca Giannini is a senior researcher at IMATI. She graduated in applied mathematics from the University in Genoa in 1986. Since then, taking into account the evolution of the available technologies and changes in working processes, she has concentrated on different issues for the specification of tools and methodologies for 3D geometric model representation, analysis and synthesis. In particular, her focus is the development of shape processing and modelling tools adaptable to the application needs by exploiting contextual knowledge. She has participated and been responsible for IMATI in several national and international projects carrying on strong collaboration with both international research institutions and companies, such as industrial CAD developers, and end users companies. Since 2001 she is supervising PhD students in co-tutelle with the French Universities INPG and ENSAM. She is currently in charge of the project Multimodal and Multidimensional Content and Media of the Department ICT of CNR. She is co-author of two patented software for automatic feature recognition for hybrid solid representation. The results of her research activity have been published in more than 80 reviewed papers presented in international conferences and journals. Her current research interests include multidimensional media modelling and understanding and related knowledge formalisation in applications contexts.

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Chiara Eva Catalano - *Researcher*

Chiara Eva Catalano is a researcher at IMATI Genoa and joined the group since 1998. She took a degree in Mathematics in 1997 at the University of Parma and got a Ph.D. in Mechanics and Machine Design in May 2004 at the University of Genoa. Her research interests include geometric and feature-based modelling for industrial design and semantics in 3D modelling for applications.

In the first years the research activity focused on different problems of aesthetic engineering, particularly related to an efficient 3D freeform surface manipulation with styling shape constraints. In the PhD thesis, subdivision surfaces have been proposed as an alternative geometric representation in the styling phase, able to overcome some drawbacks of NURBS traditionally used in CAD.

In parallel, the applied nature of her research called for enhancing the pure geometric modelling with the semantics of specific contexts. In the frame of aesthetic engineering, she worked on feature-based approaches to preserve the design intent in the digital model. With the active participation to AIM@SHAPE techniques for knowledge formalisation, such as ontologies, have been studied to encode the contextual knowledge to the geometric description for a more efficient information retrieval and reuse. Lately, she has been strongly involved in the FOCUS K3D project, which has been disseminating the results obtained in AIM@SHAPE in specific applied contexts. Along the years she had the opportunity to collaborate with several well-known research institutes in an interdisciplinary perspective, as the publications show.

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WHO IS WHO

Marco Attene - *Researcher*

Since 1999 Marco Attene has been collaborating with IMATI, and there he is currently a member or the research staff. Marco holds a Laurea degree (M.Sc. equivalent) in Computer Science, a Doctoral degree (Ph.D equivalent) in Electronic and Computer Engineering, and a Research Management Diploma.

His research deals mainly with the treatment of 3D simplicial meshes. His earliest studies (1999-2003) were focused on mesh reconstruction from point clouds and parametric representations. Then, he worked on surface re-meshing, with applications to shape analysis and geometry compression (2003-2005). Since 2006, he has been working on segmentation and semantic annotation of 3D shapes, with particular care to the treatment of explicit solid representations.

Marco contributed to the conception and implementation of several projects. Within the scope of the EU FP6 AIM@SHAPE NoE, he coordinated an international team of experts for the definition of metadata to describe 3D shapes currently at the basis of the popular AIM@SHAPE Shape Repository. Marco has managed six sourceforge software projects involving experts from the University of Genova and from the SMG at IMATI, and led the activities of a research contract committed to IMATI by the University of Genova. Marco served as program committee member for several international conferences, and has been member of the organizing board of SMI'01 (IEEE Shape Modelling International Conference), of SAMT'07 (Intnl. Conf. on Semantic and Digital Media Technology 2007) and of the "Stability on watertight models" track of the SHREC 2008 international contest on 3D shape retrieval.

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Marina Monti - *Researcher*

Marina Monti has been graduated in Mathematic at the University of Genoa. Until the end of 1985 she's involved as researcher in the project CADME at the Politecnico of Milano and she is interesting mainly in geometric modelling. Until 1998 she's employed in high tech companies in the R&D department, where she is working mostly in the fields CAD and PDM tools.

In 1998 she starts working at IMA–CNR exploiting her knowledge in product representation in industrial design to the problematic of collaborative and distributed design, working within funded European research projects. She works at the extension of the concept of free form feature for styling by exploring the relationships between product shape and aesthetic character, to extract and formalize this knowledge in order to improve modelling tools for styling.

She actively participates to a research funded by ISPESL-DIPIA for the analysis of PLM models of chemical plants for the identification and evaluation of critical configurations using the HAZOP and checklist approaches. Within the collaboration with ISPESL, she is tutor of a research grant focused on knowledge technology applied to the management of standards, engineering codes and normative which rule design, manufacturing and operations in industry to ensure reliability and safety. She acts as reviewer of several international journals and conferences and as proposal evaluator for the European Commission. She also acted as international expert for the Council of Physical Sciences of the Netherlands Organization for Scientific Research. She is co-author of more than 40 international journals and reviewed conference papers.

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WHO IS WHO

Monica De Martino - *Researcher*

Monica De Martino is a researcher at IMATI where she is leading research activity related to the knowledge technology for Geographic Information Management. She graduated from the Department of Mathematics, University of Genova in 1992. She started her research activity on image processing and surface modelling as guest researcher for almost one year at I.N.R.I.A, Sophia Antipolis, France. Then she has been working at IMATI where she has been involved in National and International Projects working on spatial data processing and analysis and their application. Successively she has been extended her research expertise to the Knowledge Management field: her specific scientific expertises are on Metatada Analysis, Ontology knowledge exploitation, Semantics Analysis. In particular she has contributed in the design and development of innovative methods for semantic similarity and granularity assessment. Currently she is addressing her interest in the study of new approaches to access to distributed metadata employing Semantic Web technology in the Web of Data. Most of her research results has been carried on and validated within European project: recently she has been scientific responsible for IMATI of EU projects related to Geographic Information (INVISIP), to Spatial Data Infrastructure (IDE-UNIVERS and Nature-SDIplus) and she is participating to the eContentplus Thematic Network eSDI-Net+.

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Silvia Biasotti - *Researcher*

Silvia Biasotti got a degree in Mathematics, a PhD in Mathematics and Applications and a PhD in Information and Communication Technologies, all at the University of Genoa. She joined IMATI in 1998; since then, her research activity focuses on computational topology, with the aim of developing mathematical tools for applications related to visual media, computer graphics and simulation arising in different scientific domains. She tackles the problem of finding shape descriptions that are mathematically well-defined and able to keep the salient characteristics of a shape, without forgetting the computational aspects. Main application domains of her research are multidimensional media analysis and synthesis and 3D content knowledge representation and retrieval. In particular, she defined and developed tools applied to: analysis and generalization of DTM; automatic object alignment; 3D shape recognition; and model retrieval from CAD repositories.

She is principal investigator of the CNR project "Topology and homology for the analysis of digital shapes" and is involved in national and international projects where she collaborates with research teams in an international scenario, among them, the AIM@SHAPE EU FP6 project. She authored more than 50 reviewed scientific papers, published in international journals and conferences, and served as committee member of several conferences. She has been teacher at several master and PhD courses at the Univ. of Genoa and lecturer in international schools.

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WHO IS WHO

Giuseppe Patané - *Researcher*

Giuseppe Patanè is researcher at IMATI (2001–today). He received a Ph.D. in "Mathematics and Applications" from the University of Genova (2005) and a Post–Lauream Degree Master in "Applications of Mathematics to Industry" from the "F. Severi National Institute for Advanced Mathematics" (2000).

From 2001, his research and teaching activities have been focused on the definition of paradigms and algorithms for modelling and analyzing digital shapes and multidimensional data. One of the main aspects underlying his work is the balance between pursuing a mathematically rigorous understanding of continuous models and providing algorithms for shape modelling and analysis. Digital shapes include data that represents a real, virtual, or multidimensional object; in this last case, the multidimensionality is intrinsic to the dimension of the data (i.e., 2D images, 3D shapes, volumetric and time-depending data) and the types of signals and information concurring to the description of a phenomenon or a shape (e.g., spatial coordinates, time-depending shapes and functions). His current activities, which deal with the definition of hierarchical paradigms for modelling and analyzing digital shapes and multidimensional data, are organized along three main avenues.

1. Topological and geometric modelling of digital shapes.

2. High-level and semantic analysis of digital shapes.

3. Definition of a unified paradigm for modelling and analyzing d-dimensional data and their attributes.

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Simone Marini - *Researcher*

Simone Marini is a researcher at the IMATI, Genova. He obtained the degree in Computer Science in December 1999 and the Doctoral degree in Electronic and Computer Engineering in April 2005, both from the University of Genova. He has been member of the European Network of Excellence AIM@SHAPE and he is involved in several international projects and collaborations. His main research interests are 3D shape similarity and ontological representation of scientific concepts related to the domain of 3D shape. The research activity on the similarity, is mainly focused on the investigation and development of methodologies for the comparison of structural representations encoded by graphs. In particular he approached the problem of partial and global matching of 3D shapes by investigating the use of structural representation. He formalized and developed a new methodology that combines geometric and structural information of the matched objects, by quantifying their overall shape similarity and also by providing explicit information on similar and dissimilar sub-parts of the objects. He also investigated the problem of 3D shapes classification through the generation of creative prototypes, that is shape descriptors able to summarize geometric and structural features shared by the members of a given class of 3D objects. Finally, the research activity on the knowledge representation relies on the conceptualization of specific scenarios relevant for the Computer Graphics community.

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WHO IS WHO

Riccardo Albertoni - *Researcher*

Since 2002 Dr. Albertoni has been investigating the issues and applications of metadata analysis to compare and select multidimensional resources. In the early stage of his research activity Dr. Albertoni focused on the geographical metadata analysis to select optimal datasets for users' planning task within the European project INVISIP (IST 2000-29640). Then Dr. Albertoni's research moved toward the exploitation of semantics in metadata analysis. Dr. Albertoni applied his research in the domain of Multidimensional media within the EU-funded Network of excellence AIM@SHAPE (FP6 IST NoE 506766) where he focused on ontology driven metadata to document the acquisition and processing pipeline of multidimensional media. Such a research experience has afterwards turned out in an independent investigation aimed to exploit ontology driven metadata in metadata analysis tools. In particular, he has focused on the context-dependent semantic granularity and similarity assisting the browsing and the comparison of heterogeneous and multidimensional data resources. In 2008 Dr. Albertoni has been selected within the NATO Research Assistant Programme for a grant concerning the adoption of ontology driven metadata at NATO Undersea Research Centre (NURC). In this context, Dr. Albertoni investigated Open Geospatial Consortium specifications and Linked Data technology paving the way for documenting data resources collected during NURC's sea trials. The originality of Riccardo Albertoni's research are attested by about 20 peer reviewed papers and numerous memberships in program committees of international conferences.

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Michela Mortara - *Researcher*

Michela Mortara graduated in July 1999 in Computer Science from the University of Genova and since then she is member of the Shape Modeling Group at IMATI Genova. She started her research activities on 2D shape analysis for polygon morphing and surface reconstruction from planar sections, with a particular focus on the structural aspects of shapes. Then she moved to the 3D setting, focusing on morphological analysis, curvature estimation, skeleton extraction and segmentation of 3D objects. In May 2004 she got a Ph.D. in Robotics. From 2004 to 2008 she joined the AIM@SHAPE Network of Excellence working on analysis and structuring of 3D shapes as a mean to devise the semantics (meaning or functionality) of shapes and their parts. In this framework she developed a method to automatically identify human body parts, compute anthropometric measures and locate standard landmarks on human body models which received the 2006 Computers&Graphics best paper award, with further applications in the construction of control skeletons for animation. Recently she started a new activity on semantic rendering and on the automatic selection of the best view of 3D object based on their visible salient features.

Since has been actively involved in the FOCUS K3D project which aims at promoting the adoption of CG and Knowledge technologies in several application domains; since October 2010 she is actively involved in the GaLA Network of Excellence on Serious Games.

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WHO IS WHO

Daniela Giorgi - *Researcher*

Daniela Giorgi graduated cum laude in Mathematics in 2002, then joined the ARCES Centre of Excellence at the University of Bologna. In 2006 she got a PhD in Computational Mathematics from the University of Padova. Since then she has been a member of the SMG at IMATI, Genova. Her research interests concern computational topology techniques for describing and retrieving images and 3D models. Her scientific profile shows her to have strong mathematical expertise (differential geometry, Morse theory, topology) together with in-depth knowledge in computational fields (computer graphics, image and 3D processing). She is the author of 28 peer-reviewed international publications in high-level journals (such as ACM Computing Surveys, Pattern Recognition) and conferences. She has been involved in many international projects, including the French-Italian Galileo project on image recognition (2003-2005) and the FP6 NoE AIM@SHAPE. During the latter, she was in charge of the Watertight Models Track (2007) and the Classification of Watertight Models Track (2008) of the SHREC (SHape REtrieval Contest) event. She has been a lecturer at international schools and conferences. She is a reviewer for international journals, and serves on the Programme Committee of the Eurographics Workshop on 3D Object Retrieval (2009, 2010) and the ACM Multimedia International Workshop on 3D Object Retrieval (2010).

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Francesco Robbiano - *Research assistant*

Francesco Robbiano graduated cum laude in April 2002 in Computer Science from the University of Genova and since then he is member of the Shape Modeling Group at IMATI. He started his research activity with the implementation of a system for recognition and completion of form features in the CAD context. Since 2004, within the AIM@SHAPE Network of Excellence, his focus shifts to 3D object description. His work is mainly devoted to the design of ontologies, with special attention on the Shape Acquisition and Processing domain. These ontologies provide a formal characterization of 3D objects in specific usage domains and are the building blocks of the so-called Digital Shape Workbench. Meanwhile, the development of a Digital Library of scientific references is under his responsibility.

In 2006, he starts his activity as a PhD student in Electronic and Computer Engineering and Telecommunications. He contributes to the developing of the ShapeAnnotator, an interactive software tool which goal is to let the user integrate different techniques for shape segmentation, and annotate the detected parts with concepts expressed in a given ontology. Two publications on major journals arose from this work. In his research activity, he considers more and more important the role of the user in the description phase: by taking into account the context of the user, the description can be tuned to the user needs. He got the PhD in April 2010, with the thesis "Description of 3D objects based on concepts, content and context", a work which is aimed to a tout-court description of 3D objects, centered on the role of the user.

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WHO IS WHO

Sergio Decherchi – *Post-doctoral fellow*

Sergio Decherchi obtained the "Laurea" degree summa cum laude in Electronic Engineering in 2007 from Genoa University, Italy. Since 2005 he started collaborating with the Department of Biophysical and Electronics Engineering of Genoa University, where he completed a PhD in Electronic Engineering on Machine Learning and Data Mining in 2010. His main research area is computational intelligence and in particular statistical learning theory. The main addressed theme during PhD where the role of the hypothesis space in regularized learning algorithms (i.e. kernel methods). Other themes studied are: semi supervised learning, model selection, digital hardware implementation of intelligent systems; applicative domains, among others, include text mining and digit recognition. Other interests are on Biophysics and Number Theory. S. Decherchi published 20 papers in refereed conferences and journals. He is in the program committee of the CISIS conference series (Springer LNCS proceedings), reviewer for several IEEE and Elsevier journals and for the conferences IJCNN and ISCAS both from IEEE.

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UPCOMING EVENTS

Upcoming Events

Computer Graphics Theory and Applications (GRAPP) 2011
Vilamoura, Portugal, March 5 - 7, 2011 - http://www.grapp.visigrapp.org

EG Workshop on 3D Object Retrieval (3DOR 2011)
Llandudno, UK, April 10, 2011 - http://www-rech.telecom-lille1.eu/3dor2011

Eurographics 2011
Llandudno, UK, April 11- 15, 2011 - http://eg2011.bangor.ac.uk

Computer Animation and Social Agents (CASA 2011)
Chengdu, China, May 26 – 28, 2011 - http://www.cad.zju.edu.cn/casa2011

Computer Graphics International 2011
Ottawa, Canada, June 12-15, 2011 - http://cgi2011.site.uottawa.ca

Shape Modeling International (SMI 2011)
Herzliya, Israel, June 22 - 24 2011 - http://www.1.idc.ac.il/SMI2011

Computer Vision and Pattern Recognition (CVPR) 2011
Colorado Springs, USA, June 21 - 23, 2011 - http://cvpr2011.org

Non-Rigid Shape Analysis and Deformable Image Alignment (NORDIA) 2011
Colorado Springs, USA, June 24, 2011 - http://tosca.cs.technion.ac.il/nordia11

ICIAM 2011
Vancouver, Canada, July 18 – 22, 2011 - http://www.iciam2011.com

Symposium on Geometry Processing 2011
Lausanne, Switzerland, July 20 - 22, 2011 - http://sgp2011-lgg.epfl.ch

SIGGRAPH 2011
Vancouver, Canada, August 7 – 11, 2011 - http://www.siggraph.org/s2011

16th Int. Conference on Image Analysis and Processing
Ravenna, Italy, September 14 - 26, 2011 - http://avires.dimi.uniud.it/iciap2011

Pacific Graphics 2011
Kaohsiung, Taiwan, September 21 - 23, 2011 - http://graphics.csie.ncku.edu.tw/PG2011/

Siam/ACM Joint Conference on Geometric and Physical Modeling 2011
Orlando, USA, October 24 - 27, 2011 - http://www.siam.org/meetings/gdspm11

HOW TO REACH US

we are located in CNR's "Research Area of Genova"

Torre di Francia, Via De Marini 6, Genova.

Highway gate GENOVA OVEST (5 mins walking, about 300 m)

Bus number 1, 2, 7, 20, 30 (Via di Francia - WTC stop)

"Genova Piazza Principe" railway station (10 mins by bus 20 or 30)

Genova "Cristoforo Colombo" airport (20 mins by taxi)