Silvia Biasotti, Curriculum Vitae

1 Contact

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2 Current position

Since January 2004: researcher at IMATI – GE (CNR), Genoa and member of the Shape Modelling Group (SMG).

3 Previous positions

- January 2003 December 2003: research assistant at IMATI, Genoa.
- February 2002 December 2002: researcher at IMA, CNR, Genoa.
- September 1999 December 2001: research assistant at IMA, CNR, Genoa.
- September 1998 August 1999: member of the staff of the Geometric Modelling Group at IMA (CNR), Genoa.

4 Education

- 28 April 2008, Doctor of Philosophy in Information and Communication Technologies, University of Genoa; thesis on *Exploring 3D Shapes through Real Functions*, advisors B. Falcidieno and M. Spagnuolo.
- **3 May 2004, Doctorate degree** (PhD equivalent) in Mathematics and Applications, University of Genoa; thesis on *Computational Topology Methods for Shape Modelling Applications*, advisors B. Falcidieno and M. Spagnuolo. This PhD program was certified by the FP6 IST NoE 506766 AIM@SHAPE.
- 16 September 1998, Laurea degree (Master equivalent) in Mathematics, Department of Mathematics, University of Genoa.

• Research interests

Computational topology for shape analysis, matching, classification and retrieval. 3D media analysis and synthesis. 3D reconstruction from contours, topological shape descriptors and best view selection.

• Research activity

Since 1998 Silvia Biasotti has been researching into the field of *computational topology*, with the aim of developing mathematical tools suitable for the many applications related to visual media, computer graphics and simulation that arise in different scientific domains. In particular, she has been addressing 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 addressed in her research activity are multidimensional media analysis and synthesis and 3D content knowledge representation and retrieval. In her research career, she authored more than 50 reviewed scientific papers, published in international journals and conferences, and has being served as committee member of several international conferences. She is the principal investigator of the CNR project "Topology and homology for the analysis of digital shapes" and has been involving in national and international projects where she has been collaborating with research teams in an international scenario. She collaborated to the organization of SHREC 2007 and, currently, she is leading the "Stability on watertight models" track of SHREC 2008.

5 Leadership in research projects

- 2005 present: **proponent** and **leader** of the CNR project: *Topology and Homology for analysing digital shapes*, DG.RSTL.050.004;
- 2005 2006: **leader** of the task: *Skeletal structures and analysis of scalar fields* of the FP6 IST NoE AIM@SHAPE;
- March 2008: **organizer** of the "*Stability on watertight models*" track of the SHape REtrieval Context 2008 of the FP6 IST NoE AIM@SHAPE.

6 Participations in research projects (selected):

- IDE-Univers: Infrastruscture de données spatiales entre Universités et Centres de recherche dans le Mediterranée Occidentale, EC Project funded in the Interrreg IIIB Medocc Programme, 2006 2008;
- SHALOM: SHApe modeLing and reasOning: new Methods and tools, Italy-Israel FIRB project, 2006-2009;
- FP6 IST NoE contract n° 506766 AIM@SHAPE: Advanced and Innovative Models And Tools for the development of Semantic-based systems for Handling, Acquiring, and Processing knowledge Embedded in multidimensional digital objects, 2004-2007
- MACRO-GEO: Algorithmic and Computational Methods for Geometric Object Representation, FIRB project, 2003-2005;
- Research Agreement between GVU/Gatech (Georgia Institute of Technology, Atlanta, USA) and CNR-IMATI-GE, *Surface Analysis*, 2002-2005;
- Research project between IMA-CNR and Monolith Ltd. (Japan) on *High-fidelity digital terrain modelling*, 1998-2002.

7 Main collaborations

- Vision Mathematics Group, Dept. of Mathematics and ARCES, University of Bologna, Italy;
- MIRALab group, University of Geneva, Switzerland;
- Laboratoire des Images and des Signaux, CNRS, Grenoble, France;
- Geometrica Group, INRIA, Nice, France;
- Center for Graphics and Geometric Computing, TECHNION, Haifa, Israel;
- Institute of Information and Computing Sciences, Utrecht University, The Netherlands;
- Geometric Modeling and Computer Graphics Group, Dept. of Computer Science, Univ. of Genoa, Italy.

8 Editorial activity

- Since 2003, editorial assistant of Int. J. of Shape Modelling, World Scientific Publishing;
- Since 2006, member of the *executive committee* of Eurographics Italian chapter;
- Member of the programme committees of the "Workshop towards Semantic Virtual Environments, SVE 2005", Villars, Switzerland, 16-18 Gennaio 2005;
- Since 2006 member of the programme committee of the *International Conference on Shape Modeling and Applications;*
- Since 2007 member of the advisory board of the Eurographics Italian Chapter Conference;
- Member of the *organizing committee* of **3** international conferences;
- Reviewer of numerous and prestigious international journals and conferences. Among them: Computer Aided Design, Elsevier. Int. Journal of Artificial Intelligence, World Scientific Publishing Co. Computer Graphics Forum, Blackwell Publishers. Computers&Graphics, Elsevier. Pattern Recognition, Elsevier. Int. Journal of Image and Graphics, World Scientific Publishing Co. Computer, Springer. Journal of Mathematical Imaging and Vision, Springer.

9 Teaching activity

- Professor of the PhD course in Information and Communication Technologies, *Analysis of discrete surfaces*, University of Genoa, 2006-2007 and 2007-2008;
- Professor of the Master course in Applied Mathematics *Methods of analysis of discrete surfaces and their applications*, University of Genoa, 2005-2006, 2006-2007 and 2007-2008;
- Assistant professor, Master course in Computer Science *Geometric Modelling*, University of Genoa, 2003-2004 and 2004-2005;

- Advisor of the Master Thesis in Applied Mathematics *Comparison of 3D digital shapes* using topological structures, September 2006;
- June 2005 July 2005: Scientific responsible of **1** visiting PhD student;
- 2006 2008: Tutor of 4 Master students of University of Genoa.

10 Invited lectures and seminars (selected)

- Exploring 3D shapes through shape descriptors, Mathematical Problems in Engineering, Aerospace and Sciences, Genoa, 25-27 June 2008.
- Differential topology methods for shape description, 6th Int. Congress on Industrial and Applied Mathematics, Zurich, 16-20 July 2007;
- *Multidimensional Size Theory*, in "Computational and Combinatorial Algebraic Topology", of Deutsche Mathematiker-Vereinigung and Gesellschaft für Didaktik der Mathematik, Berlino, 29-30 March 2007;
- Computational topology tools for shape modelling and reasoning, Computational algebraic geometry and applications, 2-6 June, Nice, 2006;
- Partial Matching by Structural Descriptors, Seminar 06171: Content based retrieval, Schloß Dagsthul, 23-28 April, 2006;
- *3D Shape Descriptions for Matching and Retrieval,* Seminar 06171: Content based retrieval, Schloß Dagstuhl, 23-28 April, 2006;
- Topologia computazionale e analisi della forma, Matematica, Arte e Industria Culturale, Cetraro (CS), Italy, 19-21 May 2005;
- *Applicazioni del grafo di Reeb alla modellazione di forme*, Workshop "Applicazioni della topologia algebrica all'analisi di modelli", Genova, 24-25 October, 2003;
- *Computational topology for shape understanding and characterization,* Winterschool "Digital and Image Geometry, Schloß Dagstuhl, December 2000.

11 Tutorials and plenary lectures

- Shape Understanding via Spectral Analysis Techniques, SMI 2008, New York, June 4-6, 2008 (invited);
- 3D shape description and matching based on properties of real functions, Tutorial of EUROGRAPHICS 2007, Prague, Czech Republic, September 3-7, 2007;
- Geometric and Semantic Methods for Shape Retrieval, Int. Summer School on Shape Modeling and Reasoning, Genoa, June 18-22, 2007 (invited);
- Retrieval of 3D objects, Utrecht Summer School on Multimedia Retrieval, Utrecht, NL, August 20-24, 2007 (invited);
- Skeletal structures for shape representation, Interactive Computer Graphics, Pisa, February 17-18, 2005, (invited);
- Morse Theory and Reeb graphs, Int. Summer School on Computational Methods for Shape Modelling and Analysis, Genoa, June 14-18, 2004, (invited).

• Methods for analyzing discrete surfaces and their applications, On-line tutorial of the FP6 NoE AIM@SHAPE, available at http://www.aimatshape.net/resources/v-lectures/.

12 Selected publications

12.1 Refereed international journals

- [RI1] Describing shapes by geometrical-topological properties of real functions, ACM Computing Surveys, in cooperation with L. De Floriani, B. Falcidieno, P. Frosini, D. Giorgi, C. Landi, L. Papaleo and M. Spagnuolo, to appear;
- [RI2] Size functions for comparing 3D models, Pattern Recognition, Elsevier, in cooperation with D. Giorgi, M. Spagnuolo and B. Falcidieno, to appear;
- [RI3] *Multidimensional size functions for shape comparison*, Journal of Mathematical Imaging and Vision, Springer, in cooperation with A. Cerri, P. Frosini, D. Giorgi, C. Landi, to appear;
- [RI4] Reeb Graphs for Shape Analysis and Applications, Theoretical Computer Science, Vol. 392, N. 1-3, pp. 5-22, Elsevier, 2008, in cooperation with D. Giorgi, M. Spagnuolo and B. Falcidieno;
- [RI5] Sub-part Correspondence by Structural Descriptors of 3D Shapes, Computer Aided Design, Vol. 38, N. 9, pp. 1002-1019, Elsevier, 2006, in cooperation with S. Marini, M. Spagnuolo and B. Falcidieno;
- [RI6] Computational Methods for Understanding 3D Shapes, Computers&Graphics, Vol. 30,
 (3) pp. 323-333, Elsevier, 2006, in cooperation with M. Attene, M. Mortara, G. Patané, M. Spagnuolo and B. Falcidieno;
- [RI7] What's in an image? Towards the computation of the "best" view of an object, The Visual Computer, Vol. 21, N. 8-10, pp.840-847, Springer, 2005, in cooperation with O. Polonsky, G. Patané, C. Gotsman and M. Spagnuolo;
- [RI8] 3D object comparison based on shape descriptors. Int. J. Computer Applications in Technology (IJCAT), Vol. 23, N. 2/3/4, pp. 57-69, Inderscience Enterprises, 2005, in cooperation with S. Marini;
- [RI9] Topological coding of surfaces with boundary using Reeb graphs. Computer Graphics and Geometry, Scientific Electronic Library eLibrary.Ru, Vol. 7, N° 1, pp. 31-45, 2005;
- [RI10] Shape understanding by contour-driven retiling, The Visual Computer, Vol. 19, N. 2-3, pp: 127-138, Springer-Verlag, 2003, in cooperation with M. Attene and M. Spagnuolo.

12.2 Refereed books series

[S1] Comparing Sets of 3D Digital Shapes through Topological Structures, Graph-based Representations in Pattern Recognition, Lecture Notes in Computer Science, Vol. 4538, pp. 114-125, Springer, 2007, in cooperation with L. Paraboschi and B. Falcidieno;

- [S2] 3D Classification via Structural Prototypes, Semantic and Digital Media Technologies, Lecture Notes in Computer Science, Vol. 4816, pp. 140-143, Springer, 2007, in cooperation with D. Giorgi, S. Marini, M. Spagnuolo and B. Falcidieno;
- [S3] Analysis and Comparison of Real Functions on Triangulated Surfaces, Curve and Surface Fitting: Avignon 2006, A. Cohen, H.-L. Merrien, L. L. Schumaker (eds.), book series in Modern methods in Mathematics, pp. 41-50, 2007 in cooperation with G. Patané, M. Spagnuolo and B. Falcidieno, Nashboro Press;
- [S4] A Comparison Framework for 3D Object Classification Methods, Multimedia Content Representation, Classification and Security, Lecture Notes in Computer Science, Vol. 4105, pp. 487-496, Springer, 2006, in cooperation with D. Giorgi, S. Marini, M. Spagnuolo and B. Falcidieno;
- [S5] 3D Shape Matching through Topological Structures, Discrete Geometry for Computer Imagery, Lectures Notes in Computer Science 2886, pp. 194-203, Springer, 2003, in cooperation with S. Marini, M. Mortara, G. Patané, M. Spagnuolo and B. Falcidieno;
- [S6] Extended Reeb Graphs for Surface Understanding and Description. Discrete Geometry for Computer Imagery, Lecture Notes in Computer Science, vol. 1953, pp. 185-197, Springer, 2000, in cooperation with B. Falcidieno and M. Spagnuolo.

12.3 Chapters of International books

- [BI1] Skeletal structures, Chapter 5 of "Shape Analysis and structuring", L. De Floriani and M. Spagnuolo (eds), pp. 145-183, Springer, 2007, in cooperation with D. Attali, J-D. Boissonnat, H. Edelsbrunner, G. Elber, M. Mortara, G. Sanniti di Baja, M. Spagnuolo, M. Tanase and R. Veltkamp;
- [BI2] *Morphological Representations of Scalar fields*, Chapter 6 of "Shape Analysis and structuring", L. De Floriani and M. Spagnuolo (eds), pp. 185-213, Springer, 2007, in cooperation with L. de Floriani, B. Falcidieno and L. Papaleo;
- [BI3] Surface Shape Understanding Based on Extended Reeb Graphs. Chapter 6 of "Topological Data Structures for Surfaces: An Introduction to Geographical Information Science", (S. Rana ed.), pp. 87-102, John Wiley&Sons Europe, 2004, in cooperation with B. Falcidieno and M. Spagnuolo;
- [BI4] Shape Abstraction Using Computational Topology Techniques. "From Geometric Modelling to Shape Modeling", U. Cugini, M. Wozny (eds), Kluwer Academic Publishers, Boston, pp. 209-222, in cooperation with B. Falcidieno, M. Spagnuolo.

12.4 Reviewed International Conferences

- [AI1] SHREC08 Entry: Report of the Stability Track on Watertight Models, Int. Conference on Shape Modeling and Applications, IEEE Computer Society, New-York, June 4-6, 2008, in cooperation with M. Attene.
- [AI2] 3D shape description and matching based on properties of real functions, Eurographics 2007, Tutorial Notes, Vol. 2, pp. 1023-1074, Prague, Czech Republic, September 3-7, 2007, in cooperation with B. Falcidieno, P. Frosini, D. Giorgi, C. Landi, S. Marini, G. Patané and M. Spagnuolo;

- [AI3] *k-dimensional Size Functions for Shape Description and Comparison*, 14th Int. Conference on Image Analysis and Processing, pp. 795-800, IEEE Computer Society, September 10-14, 2007, in cooperation with D. Giorgi and A. Cerri;
- [AI4] 3D shape matching and classification via structural prototypes, Israel-Italy Bi-National Conference on "Shape Modeling and Reasoning for Industrial and Biomedical Applications", Haifa, May 7-10, 2007, in cooperation with M. Spagnuolo, D. Giorgi and S. Marini (invited);
- [AI5] *3D scene comparison using topological graphs*, 5th Eurographics Italian Chapter Conference, Trento, pp. 87-93, The Eurographics Association, February 14-16, 2007, in cooperation with L. Paraboschi and B. Falcidieno;
- [AI6] Sub-part correspondence using structure and geometry. 4th Eurographics Italian Chapter Conference, Catania, pp. 23-28, The Eurographics Association, February 22-24, 2006, in cooperation with S. Marini;
- [AI7] Topological, Geometric and Structural Approaches to Enhance Shape Information, 4th Eurographics Italian Chapter Conference, Catania, pp. 7-13, The Eurographics Association, February 22-24, 2006, in cooperation with M. Attene, M. Mortara, G. Patané, M. Spagnuolo and B. Falcidieno;
- [AI8] Size functions for 3D shape retrieval, 4th Eurographics Symposium on Geometry Processing, pp. 239-242, Cagliari, Italia, June 26-28, 2006, in cooperation with D. Giorgi, M. Spagnuolo and B. Falcidieno;
- [AI9] 3D Shape matching and retrieval by structural descriptors, 6th Israel/Korea Bi-National Conference on New Technologies and Visualization Methods for Product Development, Haifa, Israel, November 8-9, 2005, in cooperation with M. Spagnuolo, S. Marini and B. Falcidieno (invited);
- [AI10] Reeb graph representation of surfaces with boundary, Int. Conference on Shape Modeling and Applications, pp. 371-374, IEEE Computer Society, Genoa, June 7-9, 2004;
- [AI11] Animatable Human Body Model Reconstruction from 3D Scan Data using Templates, CapTech Workshop on Modelling and Motion Capture Techniques for Virtual Environments, pp. 1-7, Zermatt, Switzerland, December 2004, in cooperation with L. Moccozet, F. Dellas, N. Magnenat-Thalmann, M. Mortara, B. Falcidieno, P. Min and R. Veltkamp;
- [AI12] An overview on properties and efficacy of topological skeletons in Shape Modelling, Int. Conference on Shape Modeling and Applications, pp. 245-254, IEEE Computer Society, Seoul, South-Korea, May 2003, in cooperation with S. Marini, M. Mortara and G. Patané;
- [AI13] Computational methods for simplification and generalization of Digital Terrain Modelling, European Conf. and forum to link GEO and WATER research, pp. 1-2, Genoa, February 2002, in cooperation with M. Attene, B. Falcidieno and M. Spagnuolo;
- [AI14] *A topology-based approach to shape modelling*, 1st Annual Conference of Eurographics Italian Chapter, pp. 1-5, Milano, July 11-12, 2002, in cooperation with M. Mortara and G. Patané;
- [AI15] Re-meshing Techniques for topological analysis. Int. Conference on Shape Modeling and Applications, pp. 142-151, IEEE Computer Society, Genoa, May 7-11, 2001, in cooperation with M. Attene and M. Spagnuolo;

- [AI16] Topological Techniques for Shape Understanding. 5th Central European Seminar on Computer Graphics, CESCG 2001, Budmerice, Bratislava, pp. 163-172, April 2001;
- [AI17] Surface compression and reconstruction using Reeb graphs and shape analysis, Spring Conference on Computer Graphics, pp. 175-184, B. Falcidieno (ed.), Budmerice, Bratislava, May 2000, in cooperation with M. Mortara and M. Spagnuolo;
- [AI18] Shape Abstraction Using Computational Topology Techniques. 7th Workshop IFIP Working Group 5.2 Worshop on Geometric Modeling, Fundamentals and Applications, pp.155-165, Parma, October 2000, in cooperation with B. Falcidieno and M. Spagnuolo.

13 Patents

• Software "SHREC: SHape characterization and structuring through REeb graph Computation", registered at SIAE, Italy, n° 003653, 12/12/2005.

14 References

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