



Marco Di Benedetto

Curriculum Vitae et Studiorum

Personal

First Name Marco
Last Name Di Benedetto
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Languages

Italian **Native**
English **Fluent**
French **Scholastic**

Education

2007 – 2011 **Dottorato di Ricerca (Ph.D.) in Computer Science,**
Computer Graphics,
Dipartimento di Informatica, Università di Pisa, Italy.
Thesis Title: *Multiresolution Techniques for Real-Time Visualization of Urban Environments and Terrains*

1998 – 2005 **Laurea Specialistica (MS) in Computer Science Technologies,**
Dipartimento di Informatica, Università di Pisa, Italy.
Thesis Title: *An Efficient and Conformal Implementation of OpenGL|ES*
Grade: 110/110 Magna cum Laude

Attended Courses

- 2006 – 2011 Tutorial and Courses at Computer Graphics International Conferences:
- Real time Interactive Massive Model Visualization - Eurographics 2006 Tutorial - September 2006 - Vienna
 - Real-Time Volume Graphics - Eurographics 2006 Tutorial - September 2006 - Vienna
 - Computational Photography - Eurographics 2007 Tutorial - September 2007 - Praga
 - Build Your Own 3D Display - SIGGRAPH 2010 Course - July 2010 - Los Angeles
 - Recent Advances in Real-Time Collision and Proximity Computations for Games and Simulations - SIGGRAPH 2010 Course - July 2010 - Los Angeles
 - Advances in Real-Time Rendering in 3D Graphics and Games - SIGGRAPH 2010 Course - July 2010 - Los Angeles
- 2007 International Computer Vision Summer School, 9–14 July 2007, Scicli (RG) - Italy. The attended courses were focused on a detailed overview of the state of the art in Computer Vision, especially in detection, segmentation and recognition in context.

Job Experiences

- 2013 – **Main Cofounder, R&D Head,** *Transform and Lighting Present S.r.l.*, Pisa.
- 2009 – **Researcher,** *Visual Computing Lab - ISTI - CNR,* Pisa.
Present
- 2011 **IT Consultant,** *Develer S.r.l.*, Firenze.
- 2010 **IT Consultant,** *Navionics S.p.a.*, Massarosa (LU).
- 2008 – 2009 **Team Leader,** *Navionics S.p.a.*, Massarosa (LU).
- 2005 – 2008 **Research Fellow,** *Visual Computing Lab - ISTI - CNR,* Pisa.

2002 – 2005 **Scientific Collaborator**, *STMicroelectronics*, Agrate Brianza (MI).

2000 – 2004 **IT Consultant**, *Netfarm S.r.l.*, Navacchio (PI).

Research Activity

My research activity has been done while I was a Research Fellow and later a Researcher at the Visual Computing Lab - ISTI - CNR, Pisa, Italy.

Computer Graphics

2005 – Present My research is focused on three-dimensional reconstruction of real-world scenarios from sparse and dense data, and on advanced rendering techniques on modern Graphics Processing Units (GPUs). In particular, multiresolution techniques for data representation and real-time rendering of large datasets, resembling both single objects (e.g., 3D scanned models), and large environments, like terrains and urban areas. The related studies and implementations allowed the development of interactive exploration applications that, thanks to streaming techniques and WebGL-based software systems, can be also used on the web platform. The advanced use of the parallel architecture offered by modern GPUs has moreover allowed the creation of photorealistic rendering algorithms for complex materials. More in detail, my research activity has lead to:

-Creation of the *eXploreMap* technique [3] for automatic exploration of unknown virtual environment and efficient navigation in low-end platforms. See the official website at <http://exploremaps.org>

-Creation of the *BlockMap* representation [2, 8, 12] for multiresolution rendering of massive cityscapes. The novel representation allows real-time rendering on off-the-shelf GPUs of urban models, consisting of hundreds of thousands of buildings. BlockMaps represent the state of the art in urban visualization, offering a compact representation that is feasible for network streaming.

- Development of multiresolution rendering and GPU compressed data management algorithms for the *C-BDAM* technique [4], aimed at real-time rendering of large terrain models. In particular, wavelet-based compression techniques drastically reduced the amount of data to be transferred in a client/server configuration, and the usage of GPU as a general purpose, massive parallel system allowed real-time data decompression.
- Creation, design and development of the *SpiderGL* library [10, 7, 9, 15] for Computer Graphics on the web platform. Written in JavaScript, the library efficiently used the WebGL technology for real-time rendering of 3D models. Widely known among the web community, SpiderGL is being used to implement algorithms for multiresolution, real-time rendering algorithms, dealing with hundreds of millions of triangles. See the official website at <http://spidergl.org>
- Development of novel photorealistic rendering techniques [1] exploiting modern parallel GPU architectures. The simulation of reflection and refraction phenomena in inhomogeneous materials has been implemented using advanced memory-sharing and asynchronous communication techniques, that conform to the current GPU architectures.
- Experimentations on assisted guidance of visually impaired persons [6] with the use of the *Kinect* device. The device range scanner allowed the development of a localization and obstacle detection prototype. This system is the starting point of a guidance device that could compete with state-of-the-art systems.
- Development of data structures and algorithms for the *VCGLib* library, as spatial indexing structures, geometric filters, and optimization algorithms acting on the mesh structure to speed-up their rendering.
- Development of geometric filters and rendering techniques for the widely used *MeshLab* application. See the official website at <http://meshlab.sourceforge.net>

Participation in International Projects

- 2012 – **V-MUST**, *Virtual Museum Transnational Network*, EU FP7, Present Role: Developer.
The project aims to provide the heritage sector with the tools and support to develop virtual museums that are educational, enjoyable, long-lasting and easy to maintain.
- 2011 – **3DCOFORM**, *Tools and Expertise for 3D Collection Formation*, EU FP7 IST IP - 231809, 2008-2012, Role: Developer.
The project aims to establish 3D documentation as an affordable, practical and effective mechanism for long term documentation of tangible cultural heritage.
- 2011 – **INDIGO**, *Innovative Training and Decision Support for Emergency Operations*, EU FP7 Security - 242341, 2010-2013, Present Role: Developer.
The project aims to research, develop and validate an innovative system integrating the latest advances in Virtual Reality and Simulation in order to homogenise and enhance both the operational preparedness and the management of an actual complex crisis.
- 2009 – **V-City**, *The Virtual City*, EU 7FP STREP - ICT-2007.4.3, Present Role: Main Developer.
The project aims to research, develop and validate an innovative system integrating the latest advances in Computer Vision, 3D Modeling and Virtual Reality for the rapid and cost-effective reconstruction, visualization and exploitation of complete, large-scale and interactive urban environments.
- 2005 – 2008 **Crimson**, *The Crisis Simulation System*, EU 6FP SEC4-PR-011500, Role: Main Developer.
The project aims to research, develop and validate an innovative system using the Virtual Reality technologies for the inter-organisational preparation, rehearsal and management of security missions in response to urban crisis.

Scientific Community

- 2005 – Present Reviewing activity for international journals and conferences, like ACM Transaction on Graphics, Computer Graphics Forum, The Visual Computer, ACM Web3D.
- 2013 Member of the International Program Committee of the ACM Web3D 2013 International Conference. Member of the International Program Committee of the Computer Graphics Theory and Applications International Conference - GRAPP 2013.
- 2012 Member of the International Program Committee of the ACM Web3D 2012 International Conference. Winner of the Best Paper Award at Web3D 2012 with the publication [11].

2011 Member of the International Program Committee of the ACM Web3D 2011 International Conference.

Industrial and Academic Activity

Private Experiences in development, project management, and Industry consultant:

- Main Cofounder and Research and Development head at Transform and Lighting S.r.l. (<http://transformandlighting.com>)
- System Architect, Software Engineer and Team Leader for naval cartography data management and visualization (Navionics S.p.a.).
- Teaching on Computer Graphics foundations (Navionics S.p.a.), and consultant on technology transition towards new OpenGL specifications (Develer S.r.l.).
- Technical collaborations for the development of graphics accelerators via the software validation offered by my MS Thesis OpenGL|ES implementation (STMicroelectronics).
- Development of financial software for mobile devices, and for visualization systems based on simulated electro-magnetic fields (Netfarm S.r.l.).

Teaching Teaching experiences at Università di Pisa:

- Computer Graphics Lessons. In particular, 4 hours in advanced GPU rendering techniques for the course “3D Graphics Foundations” (Laurea in Informatica, A.A. 2010–2011), Dr. Paolo Cignoni, and 2 hours in tools and techniques for Computer Graphics in the Web platform (WebGL) for the course “3D Graphics for Cultural Heritage” (Laurea in Informatica Umanistica, A.A. 2010–2011), Dr. Matteo Dellepiane.
- Supervisor for the MS Thesis “Feature-Preserving Mesh Sampling from Multiple Views” in Information Technologies, Università di Pisa, by Alessandro Giannini, A.A. 2009–2010. The Thesis dealt in view-space, feature-preserving sampling of 3D objects using the GPU.

Technical Skills and Scientific Expertise

Technologies

Programming Languages	Excellent knowledge of C/C++, Java, JavaScript, HTML. Good knowledge of C#, Python, Visual Basic. Assembly foundations.
Operating Systems	Very good knowledge of Windows, Linux, Mac OS, both administratively (installation and maintenance), and as development environments (kernel, SDK, and graphical interfaces).
Frameworks and Libraries	Expert knowledge of the OpenGL Ecosystem and OpenCL, and of widespread frameworks and libraries like Qt, GTK, MFC, VCGLib, and NVIDIA CUDA.
Software Technologies	Direct and constant experience with the most adopted technologies for data representation and access, like HTTP, XML, AJAX, COM, e SQL.
Software Applications	Excellent knowledge of Microsoft Visual Studio and Qt Creator development environments, of 3D modeling software (Maya, 3DStudio Max, Blender), of image editing and processing software (Photoshop, HDR Studio, Pano Tools), and of the Microsoft Office suite and derivatives (Open/Libre Office).
Hardware Technologies	Excellent knowledge of modern CPU and GPU architectures. Amateur knowledge of generic hardware and firmware components.

Development

Concurrent Systems	Developer of multithread systems for the usage of very large datasets. In particular, classical or novel algorithms are developed to fully exploit the power of modern multi and many core architectures.
Data Management	Design and implementation of software architectures for client/server systems, and for platform-independent usage of existing and novel streaming technologies. In particular, multi-level cache systems for out-of-core, real-time rendering of massive 3D datasets.
Software Development	Use of modern <i>agile</i> development strategies, like extreme programming.

Scientific Competencies

Computer Graphics	Specialized in complex real-time rendering techniques on personal computers and mobile devices.
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Parallel Algorithms	Deep knowledge on most diffuse parallel programming patterns, with direct experience on modern CPUs and GPUs.
Networking	Wide knowledge on analysis and design of systems based on network data streaming.
Miscellanea	Knowledge of the most important and diffuse search methods typical of Artificial Intelligence, and of data management techniques of modern Database Management Systems.

Personal and Professional Attitudes

- Steep leaning towards base and applied research, mainly in the field of the multiresolution representation and real-time usage of 3D information.
- Independence in formulation, management, and development of novel objectives and projects for technological improvement.
- Team work enthusiast, with planning, management and teaching competence.
- High attention and availability to proposals, debate, and constructive criticism.

Publications

The following is the list of my publications.

Publications [4, 2, 8, 10, 7, 9, 12] are the result of my Ph.D. Thesis.

International Journals

- [1] Daniele Bernabei, Ajit Hakke Patil, Francesco Banterle, Marco Di Benedetto, Fabio Ganovelli, Sumanta Pattanaik, and Roberto Scopigno. A Parallel Architecture for Interactive Rendering of Scattering and Refraction Effects. *IEEE Computer Graphics and Applications*, 2011. In Press.
- [2] Paolo Cignoni, Marco Di Benedetto, Fabio Ganovelli, Enrico Gobbetti, Fabio Marton, and Roberto Scopigno. Ray-Casted BlockMaps for Large Urban Models Visualization. *Computer Graphics Forum*, 26(3):405–413, September 2007.
- [3] Marco Di Benedetto, Fabio Ganovelli, Marcos balsa Rodriguez, Alberto Jaspe Villanueva, Enrico Gobbetti, and Roberto Scopigno. eXploreMaps: Efficient Construction and Ubiquitous Exploration of Panoramic View Graphcs of Complex 3D Environments. *Computer Graphics Forum*.
- [4] Enrico Gobbetti, Fabio Marton, Paolo Cignoni, Marco Di

Benedetto, and Fabio Ganovelli. C-BDAM – Compressed Batched Dynamic Adaptive Meshes for Terrain Rendering. *Computer Graphics Forum*, 25(3):333–342, September 2006.

- [5] Frederic Larue, Marco Di Benedetto, Matteo Dellepiane, and Roberto Scopigno. From the Digitization of Cultural Artifacts to the Web Publishing of Digital 3D Collections: an Automatic Pipeline for Knowledge Sharing. *Journal of Multimedia*, 7(2):132–144, May 2012.

International Conferences

- [6] Daniele Bernabei, Fabio Ganovelli, Marco Di Benedetto, Matteo Dellepiane, and Roberto Scopigno. A Low-Cost Time-Critical Obstacle Avoidance System for the Visually Impaired. In *2011 International Conference on Indoor Positioning and Indoor Navigation (IPIN), 21-23 September 2011, Guimaraes, Portugal, 2011*.
- [7] Marco Callieri, Raluca Mihaela Andrei, Marco Di Benedetto, Monica Zoppè, and Roberto Scopigno. Visualization Methods for Molecular Studies on the Web Platform. In *Proceedings of the 15th International Conference on Web 3D Technology, Web3D '10*, pages 117–126, New York, NY, USA, 2010. ACM.
- [8] Marco Di Benedetto, Paolo Cignoni, Fabio Ganovelli, Enrico Gobbetti, Fabio Marton, and Roberto Scopigno. Interactive Remote Exploration of Massive Cityscapes. In *The 10th International Symposium on Virtual Reality, Archaeology and Cultural Heritage VAST (2009)*, pages 9–16. Eurographics, 2009.
- [9] Marco Di Benedetto, Massimiliano Corsini, and Roberto Scopigno. SpiderGL: a Graphics Library for 3D Web Applications. In *Proceedings of 3D-ARCH 2011*, 2011.
- [10] Marco Di Benedetto, Federico Ponchio, Fabio Ganovelli, and Roberto Scopigno. SpiderGL: a JavaScript 3D Graphics Library for Next-Generation WWW. In *Proceedings of the 15th International Conference on Web 3D Technology, Web3D '10*, pages 165–174, New York, NY, USA, 2010. ACM.
- [11] Enrico Gobbetti, Fabio Marton, Marcos Balsa Rodriguez, Fabio Ganovelli, and Marco Di Benedetto. Adaptive quad patches: an adaptive regular structure for web distribution and adaptive rendering of 3d models. In *ACM Web3D 2012. 17th Conference on 3D Web technology*. ACM, 2012.

- [12] Enrico Gobbetti, Fabio Marton, Marco Di Benedetto, Fabio Ganovelli, Matthias Buehler, Simon Schubiger, Matthias Specht, Chris Engels, and Luc Van Gool. Reconstructing and Exploring Massive Detailed Cityscapes. In *The 12th International Symposium on Virtual Reality, Archaeology and Cultural Heritage*, pages 1–9, October 2011.

Books

- [13] Fabio Ganovelli, Massimiliano Corsini, Sumanta Pattanaik, and Marco Di Benedetto. *Introduction to Computer Graphics: a Practical Learning Approach*. Chapman & Hall / CRC Press, 2014.

Chapters in Books

- [14] Marco Di Benedetto, Jason Brownlee, and other developers. *Mobile Game Engines - Interviews with Mobile Game Engine Developers*. MobileGameEngines.com, 2013.
- [15] Marco Di Benedetto, Fabio Ganovelli, and Francesco Banterle. *OpenGL Insights*, chapter Features and Design Choices in SpiderGL. A K Peters, Ltd. / CRC Press, 2012.

Miscellanea

Personal I am an amateur drums player. I really like video games,
Interests motor bikes, and, of course, good food.

I authorize the treatment of my personal data contained within this document.

Pisa, 27 February 2014

Faithfully,

Marco Di Benedetto