

# Davide Boscaini, Ph.D.

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## About

I am a tenure-track research scientist at the **Technologies of Vision** research unit of the **Fondazione Bruno Kessler** in Trento, Italy. My research interests are in 3D perception and understanding, with a focus on object 6D pose estimation. According to Google Scholar, I have an h-index of 14 and my papers have been cited more than 5300 times. My Erdős number is 4.

Before joining FBK, I received a PhD in Computational Science from the **Università della Svizzera italiana**

in Lugano, Switzerland, in 2017. During my PhD, under the supervision of prof. **Michael Bronstein**, my research focused on extending deep learning techniques to geometric domains such as 3D shapes and graphs, contributing to the birth of a new research direction called **Geometric Deep Learning**. Prior to that, I obtained an M.S. in Mathematics from the **University of Verona**, Italy, in 2013, and a B.S. in Applied Mathematics from the same institution in 2010.

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## Education

Ph.D. in Computational Science <b>Università della Svizzera italiana</b>	Sep. 2013 – Sep. 2017 <i>Lugano, Switzerland</i>
Dissertation on “Geometric Deep Learning for Shape Analysis”. Advisor: M.M. Bronstein. Co-advisor: J. Masci. Examiners: J. Schmidhuber, M. Ovsjanikov, P. Vandergheynst, K. Hormann	
M.S. in Mathematics <b>University of Verona</b>	Oct. 2010 – Mar. 2013 <i>Verona, Italy</i>
Dissertation on “Spectral Methods for Shape Analysis”. Advisor: G. Orlandi. Co-advisor: U. Castellani	
B.S. in Applied Mathematics <b>University of Verona</b>	Sep. 2007 – Oct. 2010 <i>Verona, Italy</i>
Dissertation on “Existence and multiplicity of the solutions of the Plateau problem”. Advisor: S. Baldo	

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## Awards

“Early-bird winner” of 6D detection of unseen objects	BOP Challenge 2024
“Early-bird winner” of 6D localization of unseen objects	BOP Challenge 2024
“Best method on TUD-L dataset” for the 6D localization of unseen objects	BOP Challenge 2023

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## Publications

<b>3D part segmentation via geometric aggregation of 2D visual features</b> M. Garosi, R. Tedoldi, D. Boscaini, M. Mancini, N. Sebe, F. Poiesi	WACV 2025
<b>Wild Berry image dataset collected in Finnish forests and peatlands using drones</b> L. Riz, S. Povoli, A. Caraffa, D. Boscaini, M.L. Mekhalfi, P. Chippendale, M. Turtiainen, B. Partanen, L.S. Ballester, F.B. Noguera, A. Franchi, E. Castelli, G. Piccinini, L. Marchesotti, M.S. Couceiro, F. Poiesi	ECCV-W 2024
<b>FreeZe: Training-free zero-shot 6D pose estimation with geometric and vision foundation models</b> A. Caraffa, D. Boscaini, A. Hamza, F. Poiesi <i>An enhanced version of this work, FreeZe-v2, is the “early bird winner” in both 6D localization and 6D detection at the BOP Challenge 2024. An early version of this work, PoZe, won the “Best method on TUD-L dataset” award at the BOP Challenge 2023</i>	ECCV 2024
<b>Exploring fine-grained retail product discrimination with zero-shot object classification using Vision-Language Models</b> A. Tur, A. Conti, C. Beyan, D. Boscaini, R. Larcher, S. Messelodi, F. Poiesi, E. Ricci	RTSI 2024
<b>Open-vocabulary object 6D pose estimation</b> J. Corsetti, D. Boscaini, C. Oh, A. Cavallaro, F. Poiesi <i>First open-vocabulary setting for object 6D pose estimation. Highlight poster (acceptance rate 2.8%)</i>	CVPR 2024
<b>Tracciamento 3D della palla da punti di vista multipli nella pallavolo</b> L. Riz, S. Povoli, D. Boscaini, S. Messelodi, F. Poiesi <i>Selected for oral presentation</i>	Ital-IA 2024

- Detect, Augment, Compose, and Adapt:  
Four steps for unsupervised domain adaptation in object detection** BMVC 2023  
M.L. Mekhalfi, D. Boscaini, F. Poiesi
- Revisiting Fully Convolutional Geometric Features  
for object 6D pose estimation** ICCV-W 2023  
J. Corsetti, D. Boscaini, F. Poiesi
- PatchMixer: Rethinking network design to boost generalization  
for 3D point cloud understanding** IMAVIS, 2023  
D. Boscaini, F. Poiesi  
*Novel network design that is intrinsically effective in generalisation across datasets unseen at training time*
- Supervised tractogram filtering using geometric deep learning** MIA, 2023  
P. Astolfi, R. Verhagen, L. Petit, E. Olivetti, S. Sarubbo, J. Masci, D. Boscaini, P. Avesani
- The MONET dataset: Multimodal drone thermal dataset  
recorded in rural scenarios** CVPR-W 2023  
L. Riz, A. Caraffa, M. Bortolon, M.L. Mekhalfi, D. Boscaini, A. Moura, J. Antunes, A. Dias, H. Silva, A. Leonidou, C. Constantinides, C. Keleshis, D. Abate, F. Poiesi
- Learning general and distinctive 3D local deep descriptors  
for point cloud registration** TPAMI, 2023  
F. Poiesi, D. Boscaini  
*State-of-the-art performance for point cloud registration in the transfer learning setting across 3DMatch, ETH, and KITTI datasets*
- Localisation of defects in volumetric CT scans of valuable wood logs** ICPR-W 2020  
D. Boscaini, F. Poiesi, S. Messelodi, A. Younes, D. Grande  
*Selected for oral presentation*
- Joint supervised and self-supervised learning for 3D real-world challenges** ICPR 2020  
A. Alliegro, D. Boscaini, T. Tommasi  
*Selected for oral presentation (4.4% acceptance rate)*
- Distinctive 3D local deep descriptors** ICPR 2020  
F. Poiesi, D. Boscaini
- Shape consistent 2D keypoint estimation under domain shift** ICPR 2020  
L.O. Vasconcelos, M. Mancini, D. Boscaini, S. Rota Bulò, B. Caputo, E. Ricci
- Novel-view human action synthesis** ACCV 2020  
M. Lakhal, D. Boscaini, F. Poiesi, O. Lanz, A. Cavallaro
- Clustered dynamic graph CNN for biometric 3D hand shape recognition** IJCB 2020  
J. Svoboda, P. Astolfi, D. Boscaini, J. Masci, M.M. Bronstein
- Tractogram filtering of anatomically non-plausible fibers  
with geometric deep learning** MICCAI 2020  
P. Astolfi, R. Verhagen, L. Petit, E. Olivetti, J. Masci, D. Boscaini, P. Avesani
- Self-supervision for 3D real-world challenges** ECCV-W 2020  
A. Alliegro, D. Boscaini, T. Tommasi
- Deciphering interaction fingerprints from protein molecular surfaces** Nature Methods, 2020  
P. Gainza, F. Sverrisson, F. Monti, E. Rodolà, D. Boscaini, M.M. Bronstein, B.E. Correia  
*Advertised on the cover of the Feb 2020 issue of the journal*
- Learning interaction patterns from surface representations of protein structure** NeurIPS-W 2019  
P. Gainza, F. Sverrisson, F. Monti, E. Rodolà, D. Boscaini, M.M. Bronstein, B.E. Correia
- Structured domain adaptation for 3D keypoint estimation** 3DV 2019  
L.O. Vasconcelos, M. Mancini, D. Boscaini, B. Caputo, E. Ricci  
*Selected for oral presentation*
- 3D shape segmentation with geometric deep learning** ICIAP 2019  
D. Boscaini, F. Poiesi  
*Selected for spotlight presentation*

- Geometric deep learning on graphs and manifolds using mixture model CNNs** CVPR 2017  
 F. Monti\*, D. Boscaini\*, J. Masci, E. Rodolà, J. Svoboda, M.M. Bronstein  
*Selected for oral presentation. First unified framework able to generalize CNN architectures to non-Euclidean domains such as shapes and graphs. Also available as technical report: arXiv:1611.08402. (\* indicates equal contribution)*
- Geometric deep learning** SIGGRAPH Asia Courses 2016  
 J. Masci, E. Rodolà, D. Boscaini, M.M. Bronstein, H. Li
- Learning shape correspondence with anisotropic convolutional neural networks** NeurIPS 2016  
 D. Boscaini, J. Masci, E. Rodolà, M.M. Bronstein  
*Presented also as a poster at the 3D Deep Learning Workshop (3DLL) 2016. Also available as technical report: arXiv:1605.06437*
- Anisotropic diffusion descriptors** CGF, 2016  
 D. Boscaini, J. Masci, E. Rodolà, M.M. Bronstein, D. Cremers  
*Oral presentation at EUROGRAPHICS 2016*
- Geodesic convolutional neural networks on Riemannian manifolds** ICCV-W 2015  
 J. Masci\*, D. Boscaini\*, M.M. Bronstein, P. Vandergheynst  
*Oral presentation at 3DRR 2015. It represents the first intrinsic extension of the popular CNN paradigm to non-Euclidean domains. An early version of this work was published as the technical report: arXiv:1501.06297 on January 2015. (\* indicates equal contribution)*
- Learning class-specific descriptors for deformable shapes using localized spectral convolutional networks** CGF, 2015  
 D. Boscaini, J. Masci, S. Melzi, M.M. Bronstein, U. Castellani, P. Vandergheynst  
*Oral presentation at SGP 2015*
- Shape-from-operator: Recovering shapes from intrinsic operators** CGF, 2015  
 D. Boscaini, D. Eynard, D. Kourounis, M.M. Bronstein  
*Oral presentation at EUROGRAPHICS 2015. First approach able to synthesize the extrinsic geometry of a shape from intrinsic information. An early version of this work was published as the technical report: arXiv:1406.1925 on June 2014*
- Coulomb shapes: Using electrostatic forces for deformation-invariant shape representation** EUROGRAPHICS-W 2014  
 D. Boscaini, R. Girdziusas, M.M. Bronstein  
*Oral presentation at 3DOR 2014. Presented also as a poster at the International Computer Vision Summer School (ICVSS), 2014*
- A sparse coding approach for local-to-global 3D shape description** The Visual Computer, 2014  
 D. Boscaini, U. Castellani  
*Invited paper. Journal extension of the 3DOR 2013 conference paper*
- Local signatures quantization by sparse coding** EUROGRAPHICS-W 2013  
 D. Boscaini, U. Castellani  
*Oral presentation at 3DOR 2013. Presented also as a poster at SGP 2013*
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- Patents**
- US patent application No. 17675011**  
 Clustered dynamic graph convolutional neural network for biometric 3D hand recognition  
*Inventors: J. Svoboda, P. Astolfi, D. Boscaini, J. Masci*
- US patent No. 10210430** Filed Feb. 19, 2019  
 System and a method for learning features on geometric domains (CIP)  
*Inventors: M.M. Bronstein, D. Boscaini, F. Monti • Acquired by Twitter Inc.*
- US patent No. 10013653** Filed Jul. 3, 2018  
 System and a method for learning features on geometric domains  
*Inventors: M.M. Bronstein, D. Boscaini, J. Masci, P. Vandergheynst • Acquired by Twitter Inc.*
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- Invited talks**
- Object 6D pose estimation in the foundation models era** Nov. 22, 2024  
 Master course in “Trends and Applications in Computer Vision”; University of Trento, Italy • Invited by Massimiliano Mancini

Object 6D pose estimation in the foundation models era Politecnico di Torino, Torino, Italy • Invited by Francesca Pistilli	Jun. 6, 2024
3D object understanding on the shoulders of 2D foundation models École Polytechnique, Paris, France • Invited by Maks Ovsjanikov	Mar. 28, 2024
3D deep learning to the test of real-world challenges Ph.D. event “Visions of Tomorrow”; University of Pisa, Italy	Dec. 11, 2020
3D Deep Learning Politecnico di Torino, Italy • Invited by Tatiana Tommasi	Dec. 11, 2019
Geometric deep learning for 3D shape analysis Politecnico di Torino, Italy • Invited by Barbara Caputo	May 13, 2019
Geometric deep learning for shape analysis EUSIPCO 2017, Kos, Greece	Sep. 2, 2017
Geometric deep learning for shape analysis TeV group (FBK), Trento, Italy • Invited by Samuel Rota Bulò and Stefano Messelodi	Apr. 4, 2017
Geometric deep learning for shape analysis IMATI group (CNR), Genoa, Italy • Invited by Michela Spagnuolo	Feb. 13, 2017
Deep learning on geometric data SSSTC RiC big data research workshop, Zurich, Switzerland	Feb. 16, 2016
Deep learning on geometric data Embedded Vision Systems (eVS), Verona, Italy • Invited by Roberto Marzotto	Feb. 8, 2016
Deep learning on geometric data Rainbow group, University of Cambridge, UK • Invited by Flora Tasse	Feb. 4, 2016
Deep learning on geometric data C.A.K.E. seminar, University of Cambridge, UK • Invited by Simone Parisotto	Feb. 3, 2016
Convolutional neural networks on non-Euclidean domains SciCADE 2015, Potsdam, Germany	Sep. 14, 2015
Shape-from-operators: recovering shapes from intrinsic differential operators TUM, Munich, Germany • Invited by Emanuele Rodolà	Nov. 26, 2014
Shape-from-operators: recovering shapes from intrinsic differential operators ICS retreat, Disentis, Switzerland	Aug. 19, 2014

## Teaching experience

### Academic courses

Trends and Applications in Computer Vision	University of Trento, Fall 2023
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### Short courses and tutorials

Functional Maps: A Flexible Representation for Learning and Computing Correspondences	3DV 2018
Geometric Deep Learning	SIGGRAPH Asia 2016
Deep Learning for Shape Analysis	EUROGRAPHICS 2016

### Teaching Assistantships

Computer Vision and Pattern Recognition	Università della Svizzera italiana, Spring 2017
Computer Vision and Pattern Recognition	Università della Svizzera italiana, Spring 2016
Large Scale Optimization	Università della Svizzera italiana, Spring 2016
Computer Graphics	Università della Svizzera italiana, Fall 2014
Geometric Image Processing and Computer Vision	Università della Svizzera italiana, Spring 2014
Calculus	Università della Svizzera italiana, Fall 2013
Mathematical Analysis 1, Mathematical Analysis 2	University of Verona, 2012–2013
Mathematical Analysis 1, Mathematical Analysis 2	University of Verona, 2011–2012
Mathematical Analysis 1	University of Verona, 2010–2011

## Student supervision

Jaime Corsetti, PhD student at FBK and University of Trento	Nov. 2023–present
Role: PhD coadvisor	
Mattia Nardon, Master student at University of Trento	Mar. 2024–present
Role: Internship and Master thesis advisor · Project: AI-powered visual monitoring of Lego assembly tasks	
Alice Fasoli, Master student at University of Trento	Mar. 2024–present
Role: Internship and Master thesis advisor · Project: Retrieval-driven 6D pose estimation of unseen objects	
Matteo Minardi, Master student at University of Trento	Mar.–Oct. 2024
Role: Internship and Master thesis advisor · Projects: Eye-gaze estimation using smart glasses, Study of the vision encoder role in VLMs	
Jaime Corsetti, Master student at University of Trento	2022–Oct. 2023
Projects: Open-vocabulary and Supervised object 6D pose estimation for RGBD images	
Safa Abbes, Master student at University of Trento	2022–2023
Role: Masther thesis coadvisor · Project: Self-supervised domain adaptation for RGB images	
Antonio Alliegro, PhD student at Politecnico di Torino	2020–2021
Project: Self-Supervised domain adaptation for 3D point clouds	
Pietro Astolfi, PhD student at FBK, UniTN, and IIT	2019–2021
Role: PhD coadvisor · Project: Geometric Deep Learning for brain structure analysis	
Levi O. Vasconcelos, PhD student at UniTN and IIT	2019–2020
Project: Structured domain adaptation	
Antonio Alliegro, Master student at Politecnico di Torino	2019–2020
Role: Masther thesis coadvisor	
Piero Cavalcanti, Master student at Politecnico di Torino	2019–2020
Role: Masther thesis coadvisor	
Myriam Bronstein, Master student at Università della Svizzera italiana	2016
Project: Machine learning methods on manifolds and graphs	
Fatemeh Chegini, Master student at Università della Svizzera italiana	2014–2015
Project: Spectral methods for cross-modal retrieval	

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## Academic service

### Conferences revision activity

International Conference on Robotics and Automation (ICRA)	2022, 2020
International Conference on Pattern Recognition (ICPR)	2022, 2020
Symmetry and Geometry in Neural Representations (NeurIPS Workshops)	2022
International Conference on Image Analysis and Processing (ICIAP)	2022
International Conference on Machine Learning, Optimization, and Data Science (LOD)	2022
Symposium On Applied Computing (SAC)	2022
International Conference on 3D Vision (3DV)	2021, 2020, 2019, 2018
International Conference on Machine Learning, Optimization, and Data Science (LOD)	2021
International Conference on Machine Vision Applications (MVA)	2021, 2019
EUROGRAPHICS	2019, 2017, 2015
The British Machine Vision Conference (BMVC)	2018
Computer Vision and Pattern Recognition (CVPR)	2017
International Symposium on Vision, Modeling and Visualization (VMV)	2016
Neural Information Processing Systems (NeurIPS)	2016

### Journal revision activity

Robotics and Automation Letters (RAL)	2022
Computer Graphics Forum (CGF)	2022

IEEE Transactions on Image Processing (TIP)	2022, 2021
IEEE Transactions on Transactions on Knowledge and Data Engineering (TKDE)	2022, 2021
Neural Processing Letters (NEPL)	2022
IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)	2021, 2020
IEEE Transactions on Visualization and Computer Graphics (TVCG)	2020, 2018, 2017
Computers and Graphics	2019
Computer Vision and Image Understanding (CVIU)	2019, 2015
International Journal of Machine Learning and Cybernetics (JMCL)	2019
Pattern Recognition Letters	2019
The Visual Computer Journal (TVCJ)	2018, 2017, 2016
Computer Aided Geometric Design (CAGD)	2018
Computer-Aided Design (CAD)	2018
Sensors	2018
IPSJ Transactions on Computer Vision and Applications	2017

#### **Area chair**

British Machine Vision Conference (BMVC)	2024
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#### **Program committee**

Graph Models for Learning and Recognition (GMLR)	2022
Organized within the 37th ACM Symposium on Applied Computing, Brno (Czech Republic)	

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