

# CURRICULUM VITAE

**Bart M.N. Smets**

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Born: October 5, 1984—Neerpelt, Belgium

Nationality: Belgian (Flemish)



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## Previous Occupations

- 2010-2014** Managing director, Delta Warehousing n.v.; active in distribution and logistical services.  
**2007-2010** Warehouse assistant, Delta Warehousing n.v.

## Education

- 2019-2024** PhD. in Applied Mathematics (cum laude), TU Eindhoven.  
Thesis: *Geometric Partial Differential Equations in Deep Learning & Image Processing*.  
Promotor: dr.ir. R. Duits, copromotor: dr. J.W. Portegies.
- 2017-2019** MSc. in Industrial and Applied Mathematics (cum laude), TU Eindhoven.  
Thesis: *Geometric Image Denoising and Machine Learning*.  
Supervisors: dr.ir. R. Duits, dr.ir. E.J. Bekkers, dr. J.W. Portegies.
- 2014-2017** BSc. in Applied Mathematics (cum laude), TU Eindhoven.  
Thesis: *Improving on Vascular Tracking using Sub-Riemannian Geodesics*.  
Supervisors: dr.ir. R. Duits, dr.ir. E.J. Bekkers.

## Academic Interests

Geometry, applied analysis, mathematical image analysis, probability theory, machine learning. Implementation of novel algorithms on modern hardware.

## Reviews

- Journal for Mathematical Imaging and Vision
- International Conference on Scale Space and Variational Methods in Computer Vision
- International Conference on Geometric Science of Information
- Artificial Intelligence Review
- IEEE Transactions on Neural Networks and Learning Systems
- SIAM Journal on Imaging Sciences

## Conferences

- 2024 Workshop on Real-world Applications of Geometry and Algebra (Eindhoven - the Netherlands)
- 2024 Nederlands Mathematisch Congres 2024 (Lunteren - the Netherlands)
- 2023 6<sup>th</sup> International Conference on Geometric Science of Information (Saint-Malo - France)
- 2023 9<sup>th</sup> International Conference on Scale Space and Variational Methods in Computer Vision (Sardinia - Italy)
- 2023 AIM 2<sup>nd</sup> Workshop on A.I. and Mathematics (Enschede - the Netherlands)
- 2022 3<sup>rd</sup> International Conference on New Methods in Finsler Geometry (Eindhoven - the Netherlands)
- 2022 4TU.AMI Summer Event, invited speaker (Eindhoven - the Netherlands)
- 2021 8<sup>th</sup> International Conference on Scale Space and Variational Methods in Computer Vision (online)
- 2019 4TU.AMI Annual Event on Mathematical Deep Learning, invited speaker (Delft, the Netherlands)
- 2019 7<sup>th</sup> International Conference on Scale Space and Variational Methods in Computer Vision (Hofgeismar - Germany)

## Teaching

- 2021-2023 Mathematics of Neural Networks (responsible lecturer, awarded with excellent course evaluation)
- 2019-2022 Differential Geometry for Image Processing (instructor)
- 2019-2021 Advanced Calculus (instructor, awarded with excellent course evaluation)
- 2019-2020 Complex Analysis (instructor)
- 2019-2020 Modeling with Mathematics (instructor)
- 2019-2024 Additionally I have been the daily supervisor of 1 master student and been the cosupervisor of 3 bachelor students and 3 master students.

## Personal Interests

Motorsport, history.

## Skills

Languages: Dutch (native), English (fluent), French (elementary), German (elementary).

Computing:

- Excellent native programming experience in C/C++/CUDA, particularly in the context of deep learning.
- Broad familiarity with many common programming languages and tools: Java, Python, Julia, Git, Linux system administration, virtual machines, SSH, ...
- More specialized tools: Mathematica, MatLab, R, TikZ.

## Publications

BELLAARD, Gijs, Sei SAKATA, **Bart M. N. SMETS**, and Remco DUIJS (2024). "PDE-CNNs: Axiomatic Derivations and Applications". In: arXiv: [2403.15182](https://arxiv.org/abs/2403.15182) [cs.LG].

VAN DEN BERG, Nicky J., **Bart M.N. SMETS**, Gautam PAI, Jean-Marie MIREBEAU, and Remco DUIJS (2024). "Geodesic tracking via new data-driven connections of Cartan type for vascular tree tracking". In: Journal of Mathematical Imaging and Vision, 66, pp. 198–230. DOI: [10.1007/s10851-023-01170-x](https://doi.org/10.1007/s10851-023-01170-x).

**SMETS, Bart M.N.**, Peter D. DONKER, Jim PORTEGIES, and Remco DUIJS (2024). "Semiring Activation in Neural Networks". In: arXiv: [2405.18805](https://arxiv.org/abs/2405.18805) [cs.LG].

BELLAARD, Gijs, Daan L.J. BON, Gautam PAI, **Bart M.N. SMETS**, and Remco DUIJS (2023). "Analysis of (sub-) Riemannian PDE-G-CNNs". In: Journal of Mathematical Imaging and Vision, pp. 1–25. DOI: [10.1007/s10851-023-01147-w](https://doi.org/10.1007/s10851-023-01147-w).

VAN DEN BERG, Nicky J., Shuhe ZHANG, **Bart M.N. SMETS**, Tos T.J.M. BERENDSCHOT, and Remco DUIJS (2023). "Geodesic tracking of retinal vascular trees with optical and TV-flow enhancement in  $SE(2)$ ". In: International Conference on Scale Space and Variational Methods in Computer Vision, Springer, pp. 525–537. DOI: [10.1007/978-3-031-31975-4\\_40](https://doi.org/10.1007/978-3-031-31975-4_40).

PAI, Gautam, Gijs BELLAARD, **Bart M.N. SMETS**, and Remco DUIJS (2023). "Functional properties of PDE-based group equivariant convolutional neural networks". In: International Conference on Geometric Science of Information, Springer, pp. 63–72. DOI: [10.1007/978-3-031-38271-0\\_7](https://doi.org/10.1007/978-3-031-38271-0_7).

- SMETS, Bart M.N.** (2023). Mathematics of Neural Networks, Lecture notes 2MMA80 (2021-2023). arXiv: [2403.04807](https://arxiv.org/abs/2403.04807) [[cs.LG](#)].
- SMETS, Bart M.N.**, Jim PORTEGIES, Erik J. BEKKERS, and Remco DUIJS (2022). “PDE-based group equivariant convolutional neural networks”. In: Journal of Mathematical Imaging and Vision, 65.1, pp. 209–239. DOI: [10.1007/s10851-022-01114-x](https://doi.org/10.1007/s10851-022-01114-x).
- DUIS, Remco, **Bart M.N. SMETS**, Erik J. BEKKERS, and Jim PORTEGIES (2021). “Equivariant deep learning via morphological and linear scale space PDEs on the space of positions and orientations”. In: International Conference on Scale Space and Variational Methods in Computer Vision, Springer, pp. 27–39. DOI: [10.1007/978-3-030-75549-2\\_3](https://doi.org/10.1007/978-3-030-75549-2_3).
- DUIS, Remco, **Bart M.N. SMETS**, A.J. WEMMENHOVE, Jim PORTEGIES, and Erik J. BEKKERS (2021). “Recent geometric flows in multi-orientation image processing via a Cartan connection”. In: Handbook of Mathematical Models and Algorithms in Computer Vision and Imaging: Mathematical Imaging and Vision, pp. 1–60. DOI: [10.1007/978-3-030-03009-4\\_101-1](https://doi.org/10.1007/978-3-030-03009-4_101-1).
- SMETS, Bart M.N.**, Jim PORTEGIES, Etienne ST-ONGE, and Remco DUIJS (2021). “Total variation and mean curvature PDEs on the homogeneous space of positions and orientations”. In: Journal of Mathematical Imaging and Vision, 63, pp. 237–262. DOI: [10.1007/s10851-020-00991-4](https://doi.org/10.1007/s10851-020-00991-4).
- DUIS, Remco, Etienne ST-ONGE, Jim PORTEGIES, and **Bart M.N. SMETS** (2019). “Total variation and mean curvature PDEs on the space of positions and orientations”. In: International Conference on Scale Space and Variational Methods in Computer Vision, Springer, pp. 211–223. DOI: [10.1007/978-3-030-22368-7\\_17](https://doi.org/10.1007/978-3-030-22368-7_17).