Nicky J. van den Berg

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PROFILE

I am a PhD candidate who specializes in geometric image processing. My research focuses on automatic identification and tracking of vasculature in retinal images. Using techniques to lift the image to the space of positions and orientations and data-driven Cartan connections, I was able to improve the existing tracking models which are important to prevent complications, such as blindness, for diabetic patients among others. I have learned to work together with and combine the work of different researchers, both mathematicians and other scientists. My personal goal is to use image processing techniques to improve the quality of life.

EXPERIENCE

PhD Candidate, Eindhoven University of Technology (TU/e) *Nov. 2021 - present*
Title Thesis: *Geometric Tracking and Grouping of Complex Vasculatures in Medical Images.*
Supervision: Remco Duits, Olga Mula
The research focuses on correctly identifying and tracking the vasculature depicted on retinal images.
Financed by the NWO Talent Programme VICI 2020 Exact Sciences (Duits, Geometric Learning for Image Analysis, VI.C 202–031).

Technical Author, Numworx *Dec. 2019 - June 2020*
Developing mathematics exercises at high school and college level.

Student assistent, TU/e *Sept. 2015 - Aug. 2021*
Supervising tutorials for students from various programs (group size between 8 and 120 students) and correcting homework exercises.

Student mentor, TU/e *Sept. 2015 - Feb. 2017*
Guiding freshmen in the transition to university.

EDUCATION

Eindhoven University of Technology (TU/e) *April 2018 - July 2021*
Master Industrial and Applied Mathematics cum laude
Master Thesis: *Improved Computational Schemes for Geodesic Vessel Tracking in Orientation Scores*
(supervision: Remco Duits, Bart M.N. Smets)

University of Western Ontario (UWO) *Feb. 2020 - June 2020*
Research Internship
Title Research Report: *The Blood Coagulation Process: A Mathematical Model.*
(supervision: Mikko Karttunen, Barry Koren)

Eindhoven University of Technology (TU/e) *Sept. 2014 - March 2018*
Bachelor Applied Mathematics
Followed some Psychology & Technology courses
Bachelor Thesis: *Disease Dynamics in the Framework of Interacting Particle Systems: The Position Dependent SIS-model*
(supervision: Oliver Tse)

Provinciale Secundaire School Voeren (PSS Voeren); High School *Sept. 2008- June 2014*
Modern Languages - Science
Extra-curricular courses in mathematics and science (physics and chemistry)

EXTRA-CURRICULAR ACTIVITIES

Founder and board member, Stichting Ada Alumni *April 2022 - present*
Founding a foundation for the Mathematics and Computer Science department alumni at TU/e and organizing activities for this audience.
Functions: Secretary (April 2022 - Oct. 2022), Treasurer (Oct. 2023 - present).

Committee member, E.P.A. Nexus (PhD association) *April 2023 - present*
Representation Committee (April 2023 - present)
Cash Control Committee (Nov. 2023-present)

Student member Program Committee Mathematics, TU/e *Sept. 2015 - April 2021*
Checking the quality of education. Representing the program committee in various general meetings, accreditations and the ITK (quality assurance institutional assessment, see website NVAO).

Student member Department Counsil, TU/e *Jan. 2018 - Dec. 2019*
Advising the department board.
Focusing on communication, well-being, and education.

Secretary, Study association GEWIS *July 2017 - June 2018*
Responsible for the well-being of the association during the academic year 2017-2018.
Responsible for the member administration, minutes of board and general meetings, and all mail.

Various Committees, Study association GEWIS *Sept. 2014 - Oct. 2021*
Including developing a multi-annual vision, corporate identity, revision of the bylaws and internal regulations, etc.

Activities during High School, PSS Voeren *Sept. 2012 - June 2014*
Chair and member of the student council.
Member of the school council.

OTHER ACTIVITIES

PROOF - PhD Development Sounding Board, TU/e *Sept. 2023 - present*
Improving the experience and offer of PROOF-courses for PhD candidates.

Panel Discussion Research Day, TU/e *June 2023*
On the impact of research.

Organization of CASA day, TU/e *June 2022 - May 2023*
Organization of a day for the cluster where ongoing research is discussed, combined with a skill-session (e.g. workshop presenting skills, or a relevant lecture).

Curriculum Committee, TU/e *Feb. 2022 - July 2022*
Giving feedback on the newly developed curriculum for the bachelor Applied Mathematics.

Research Assessment, TU/e *March 2022*
Part of the PhD candidate representation during interviews with the panel.

PUBLICATIONS

van den Berg, N.J., Smets, B.M.N., Pai, G., Mirebeau, J.-M., Duits, R. Geodesic Tracking via New Data-Driven Connections of Cartan Type for Vascular Tree Tracking. J Math Imaging Vis (2024). https://doi.org/10.1007/s10851-023-01170-x

van den Berg, N.J., Zhang, S., Smets, B.M.N., Berendschot, T.T.J.M., Duits, R. (2023). Geodesic Tracking of Retinal Vascular Trees with Optical and TV-Flow Enhancement in SE(2). In: Calatroni, L., Donatelli, M., Morigi, S., Prato, M., Santacesaria, M. (eds) Scale Space and Variational Methods

in Computer Vision. SSVM 2023. Lecture Notes in Computer Science, vol 14009. Springer, Cham. https://doi.org/10.1007/978-3-031-31975-4_40

Kompanets, A., Duits, R., Leonetti, D., **van den Berg, N.**, Snijder, H.H. (2024). Segmentation Tool for Images of Cracks. In: Skatulla, S., Beushausen, H. (eds) Advances in Information Technology in Civil and Building Engineering. ICCCBE 2022. Lecture Notes in Civil Engineering, vol 357. Springer, Cham. https://doi.org/10.1007/978-3-031-35399-4_8

SUPERVISION

Graduation Project Leanne Vis *Sept. 2023 - present*
Title Thesis: *Connected Components in SE(2) for Edge Detection in Chip Wafers*

Modeling Week Project *Nov. 2023 - Nov. 2023*
Title Report: *Geodesic Tracking of Blood Vessels in Wide-Field Retinal Images* (in SO(3))

Research Topic Leanne Vis *March 2023 - June 2023*
Title Research Report: *Connected Components*

Research Internship Romain Dugast *April 2022- Aug. 2022*
Title Research Report: *Geometric Tracking in SE(2) and PDE-G-CNNs for the Classification of Arteries and Veins*

TEACHING

Tutor for the following courses:

Complex Analysis *2022 - present*
Applied Mathematics students

Calculus *2022 - present*
Built Environment students

Mathematics 1 *2018 - 2021*
Electrical Engineering and Industrial Engineering students

Calculus *2017 - 2019*
Applied Physics students

Data Analytics for Engineers *2017 - 2018*
Electrical Engineering, Applied Mathematics and Psychology & Technology students

Introduction to Modeling: From Problems to Numbers and Back *2016 - 2017*
Psychology & Technology students

Calculus *2015 - 2017*
Mechanical Engineering and Medical Sciences & Technology students