Patryk Rygiel

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RESEARCH INTERESTS

PhD Candidate in AI for Science and Health
My research focuses on AI for science and health, with an emphasis on geometric deep learning and neural operators for complex physics simulations, including cardiovascular blood flow and automotive aerodynamics. I am particularly interested in developing methods that generalise in practical settings and scale to large, complex problems, while remaining reliable under limited data through the incorporation of inductive biases such as symmetries and physics-based methods.

EDUCATION

University of Twente **Enschede, The Netherlands**
Department of Applied Mathematics, Technical Medical Center *11.2023 - present*
PhD candidate in AI in EU Horizon VASCUL-AID consortium

Thesis: *Geometric Deep Learning methods for risk assessment of cardiovascular diseases.*
Supervisors: Dr. Jelmer M. Wolterink, Prof. Dr. Christoph Brune, Prof. Dr. Kak Khee Yeung

Wrocław University of Science and Technology **Wrocław, Poland**
Faculty of Information and Communication Technology *03.2022 - 07.2023*
M.Sc in Artificial Intelligence

Thesis: *Estimation of FFR in coronary arteries with deep learning.*
Supervisor: Prof. Dr. Maciej Zięba

Wrocław University of Science and Technology **Wrocław, Poland**
Faculty of Information and Communication Technology *10.2018 - 02.2022*
B.Sc in Algorithmic Computer Science

Thesis: *Artefact removal from 3D coronary artery segmentation from CT via point cloud neural network.*
Supervisor: Prof. Dr. Maciej Zięba

OTHER ACADEMIC POSITIONS

Technical University of Delft **Delft, The Netherlands**
Department of BioMechanical Engineering *09.2026 - present*
Guest Scientific Researcher with Dr. Selene Pirola

University of Manchester **Manchester, Great Britain**
Centre for Computational Imaging and Modelling in Medicine (CIMIM) *05.2026 - present*
Visiting PhD with Prof. Dr. Alejandro Frangi

Amsterdam University Medical Center (UMC) **Amsterdam, The Netherlands**
Department of Surgery *06.2024 - present*
Guest Scientific Researcher in VASCUL-AID project

SUMMER SCHOOLS

Imperial College of London — **London, Great Britain**
London Geometry and Machine Learning (LOGML) Summer School — *07.2025*

KTH Royal Institute of Technology — **Stockholm, Sweden**
Computational Tissue Biomechanics Summer School — *08.2023*

WORK EXPERIENCE

NVIDIA — **Warsaw, Poland**
Visiting student in DALI project. — *05.2023 – 06.2023*

Hemolens Diagnostics — **Wrocław, Poland**
AI Developer & Researcher: geometric deep learning in medical imaging. — *06.2021 – 10.2023*

Hemolens Diagnostics (LifeFlow to 06.2022) — **Wrocław, Poland**
AI Intern: deep learning and computer vision in medical imaging. — *07.2020 – 10.2020*

Asseco Poland SA — **Wrocław, Poland**
Web development intern: Spring Boot + Angular. — *08.2018, 08.2019*

SKILLS

Programming	Python, CUDA C
Deep learning	PyTorch, PyTorch-Lightning, PyTorch-Geometric, MONAI
Numerical methods	SimVascular, OpenFOAM
Languages	Polish (native), English C2, French A2, German A1, Dutch A1

ACTIVITIES

Co-organiser of LOGML 2026 summer school — *2026*
London Geometry and Machine Learning (LOGML) Summer School.

General chair of MISP^2 2025 symposium — *15.01.2025*
Medical Imaging Symposium for Netherlands-based PhDs and Postdocs.

Member of the ML in PL Association — *2024 - present*
- ML in PL 2026 conference: call for contributions team coordinator
- ML in PL 2025 conference: call for contributions team, tutorials coordinator
- ML in PL 2024 conference: call for contributions team
- ML in PL 2024 Utrecht meetup: co-organizer

Student representative on the curriculum board — *09.2022 - 07.2023*
M.Sc. Artificial Intelligence, Wrocław University of Science and Technology

Voluntery LEGO robotics teacher at charity events — *2020 - 2023*

Member of a university's student research group SOLVRO — *10.2019 - 09.2023*
Member of the Machine Learning section and its leader from 09.2021.

SCIENTIFIC OUTPUT

PATENTS

- T Konopczynski, M Zieba, **P Rygiel**, P Pluszka. "A method of training an artificial deep neural network for estimation of hemodynamic parameter, a method of estimation of hemodynamic parameter, computer program products and computer systems". WO Patent WO2024184690A1,

2024/9/12.

- T Konopczyński, **P Rygiel**, M Gajowczyk, P Gródek, Ł Moroz, B Cupiał. "A method of detection of a landmark in a volume of medical images". WO Patent WO2023166330A1, 2023/9/7.

JOURNAL PUBLICATIONS

- Sabrina L.M. Zwetsloot, **VASCUL-AID collaborators**. A Core Outcome Set for Intact Abdominal Aortic Aneurysms Under Surveillance, Annals of Vascular Surgery, 2026, ISSN 0890-5096.
- Telyatnikov, L., Bernardez, G., Montagna, M., Hajij, M., Carrasco, M., Vasylenko, P., Papillon, M., Zamzmi, G., Schaub, M. T., Verhellen, J., Snopov, P., Miquel-Oliver, B., Gil-Sorribes, M., Molina, A., GUALLAR, V., Long, T., Suk, J., **Rygiel, P.**, Nikitin, A. V., … Papamarkou, T. (2025). TopoBench: A Framework for Benchmarking Topological Deep Learning. Journal of Data-Centric Machine Learning Research.
- Dieuwertje Alblas, **Patryk Rygiel**, Julian Suk, Kaj O. Kappe, Marieke Hofman, Christoph Brune, Kak Khee Yeung, Jelmer M. Wolterink, Geometric deep learning for local growth prediction on abdominal aortic aneurysm surfaces, Artificial Intelligence in Medicine, Volume 172, 2026, 103323, ISSN 0933-3657.
- Sobański M, Gajowczyk M, **Rygiel P**, Sobańska M, Korbecki A, Litwinowicz K, Kacała A, Korbecka J, Zdanowicz-Ratajczyk A, Dziadkowiak E, Sebastian M, Wiland P, Trybek G, Sebastian A, Bladowska J. Application of Fully Convolutional Neural Networks in the Assessment of Cerebral White Matter Involvement in Primary Sjögren's Syndrome. Neuroinformatics. 2025 Dec 29;24(1):3. doi: 10.1007/s12021-025-09762-1. PMID: 41460264; PMCID: PMC12748124.
- Nannini, G., Suk, J., **Rygiel, P.**, Saitta, S., Mariani, L., Maragna, R., Baggiano, A., Pontone, G., Wolterink, J. M., & Redaelli, A. (2025). Learning Hemodynamic Scalar Fields on Coronary Artery Meshes: A Benchmark of Geometric Deep Learning Models. https://arxiv.org/abs/2501.09046
- Suk, J., Nannini, G., **Rygiel, P.**, Brune, C., Pontone, G., Redaelli, A., & Wolterink, J. M. (2024). Deep vectorised operators for pulsatile hemodynamics estimation in coronary arteries from a steady-state prior. https://arxiv.org/abs/2410.11920

CONFERENCE PUBLICATIONS

- Perrin, S., **Rygiel, P.**, Ranem, A., de Wilde, B., LEVILLY, S., Wolterink, J. M., & Mouchère, H. (2026). Hemodynamic Neural Field: Continuous Blood Flow Estimation in Vessel Geometries via Global Shape Conditioning. Off-Grid: 1st Workshop on Continuous Representations and Grid-Free Methods in Medical Imaging held with MICCAI 2026.
- Suk, J., Wentzel, J. J., **Rygiel, P.**, Daemen, J., Rueckert, D., & Wolterink, J. M. (2025). GReAT: leveraging geometric artery data to improve wall shear stress assessment. ShapeMI Workshop 2025 held with MICCAI 2025.
- Özer, C., **Rygiel, P.**, de Wilde, B., Öksüz, İ., & Wolterink, J. M. (2025). Beyond Pixels: Medical Image Quality Assessment with Implicit Neural Representations. Machine Learning in Medical Imaging Workshop (MLMI 2025) held with MICCAI 2025.
- **Rygiel, P.**, Suk, J., Yeung, K. K., Brune, C., & Wolterink, J. M. (2025). Active Learning for Deep Learning-Based Hemodynamic Parameter Estimation. Statistical Atlases and Computational Modeling of the Heart (STACOM 2025) held with MICCAI 2025.
- Bernárdez, G., Telyatnikov, L., … **Rygiel, P.**, … (2024). ICML Topological Deep Learning Challenge 2024: Beyond the Graph Domain. https://arxiv.org/abs/2409.05211
- **Rygiel, P.**, Alblas, D., Brune, C., Yeung, K.K, Wolterink, J.M. "Global Control for Local SO(3)-Equivariant Scale-Invariant Vessel Segmentation." Statistical Atlases and Computational Modeling of the Heart (STACOM 2024) held with MICCAI 2024.
- Garzia S., **Rygiel P.**, Dummer S., Cademartiri F., Celi S. & Wolterink J.M. "Neural Fields for Continuous Periodic Motion Estimation in 4D Cardiovascular Imaging." Statistical Atlases and Computational Modeling of the Heart (STACOM 2024) held with MICCAI 2024.

- **Rygiel, P.**, Płuszka, P., Zieba, M., Konopczyński, T. (2023). CenterlinePointNet++: A New Point Cloud Based Architecture for Coronary Artery Pressure Drop and vFFR Estimation. In: Greenspan, H., et al. Medical Image Computing and Computer Assisted Intervention – MICCAI 2023. MICCAI 2023. Lecture Notes in Computer Science, vol 14226. Springer, Cham. https://doi.org/10.1007/978-3-031-43990-2_73
- **Rygiel Patryk**, Zieba Maciej and Konopczynski Tomasz. "Eigenvector Grouping for Point Cloud Vessel Labeling." Proceedings of the First International Workshop on Geometric Deep Learning in Medical Image Analysis, edited by Erik Bekkers et al., vol. 194, PMLR, 2022, pp. 72–84, https://proceedings.mlr.press/v194/rygiel22a.html.
- Gajowczyk Milosz*, **Rygiel Patryk***, Grodek Piotr, Korbecki Adrian, Sobanski Michal, Podgorski Przemyslaw and Konopczynski Tomasz. "Coronary Ostia Localization Using Residual U-Net with Heatmap Matching and 3D DSNT." Machine Learning in Medical Imaging (MLMI 2022) held with MICCAI 2022, edited by Chunfeng Lian et al., Springer Nature Switzerland, 2022, pp. 318–27. (* equal contribution)

OTHER PUBLICATIONS

- **Rygiel, P.**, Suk, J., Yeung, K. K., Brune, C., & Wolterink, J. M. (2026). Symmetry in the Wild: The Role of Equivariance in Neural Fluid Surrogates. https://arxiv.org/abs/2605.18816 (preprint)
- **Rygiel, P.**, Suk, J., Brune, C., Yeung, K. K., & Wolterink, J. M. (2025). Wall Shear Stress Estimation in Abdominal Aortic Aneurysms: Towards Generalisable Neural Surrogate Models. https://arxiv.org/abs/2507.22817 (preprint)
- V. Ayyalasomayajula, S.P.M. Smorenburg, D. Alblas, **P. Rygiel**, L. Rijken, K.O. Kappe, J. Wolterink, K.K. Yeung "The challenge of artificial intelligence - Enhancing clinical decision making in AAA diagnosis and treatment with AI: how can it help with prediction of AAA growth, endoleaks and spinal cord ischemia." A book chapter in Gaetaon Lanza, Andrea Kahlberg "Technological leaps in vascular surgery. A 2024 overview of what is expected to revolutionize historical paradigms". Edited by the Italian Society of Vascular and Endovascular Surgery SICVE, Edizioni Minerva Medica.
- **Rygiel, P.**, Alblas, D., Brune, C., Smorenburg, S., Yeung, K. K., & Wolterink, J. M. (2024). AAA-100: A Curated Dataset of 3D Watertight Abdominal Aortic Aneurysm Models (0.1.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.10932957

GRANTS

- Aneurysm-NL Young Talent Research Grant 2026: "AI-supported in-silico observational study of aneurysmal hemodynamics".
- Computing grant for Dutch supercomputer SNELLIUS no. EINF-10199 - "Longitudinal Study of Hemodynamic in Abdominal Aortic Aneurysms" financed by the Dutch Research Council (NWO), 2024.
- Computing grant for Dutch supercomputer SNELLIUS no. EINF-16639 - "Development of data-efficient geometrical neural surrogates for complex physics simulations" financed by the Dutch Research Council (NWO), 2025.

AWARDS

- Best talk award at Medical Imaging Symposium for PhDs and Postdocs (MISP^2) 2026 "Neural Surrogates for Hemodynamics Estimation in Cardiovascular Diseases"
- Best poster award at STACOM 2024 for paper "Global Control for Local SO(3)-Equivariant Scale-Invariant Vessel Segmentation."
- Best MSc graduate of the Faculty of Information and Communication Technology at Wrocław University of Science and Technology in the academic year 2022/23.
- MICCAI 2023 STudent Author Registration (STAR) Award (declined due to personal reasons)
- Member of the program for talented students 2018-2022 run by Wrocław University of Science and

Technology
- Student Scholarship Program for scientific accomplishments awarded by the council of the city of Wrocław in 2018/19

SUPERVISED STUDENTS

- Felix Terwel, "Evaluation of methods for virtual contrast CT synthesis: Applications to assessment of cardiovascular diseases". BSc in Biomedical Engineering, University of Twente, 2026 (final grade 8.5/10).
- Konstantinos Benjamin Vigos, "CT-2-CFD: CT-based hemodynamics estimation with deep learning methods". BSc in Advanced Technology, University of Twente, 2025 (final grade 9/10).

REVIEWER

- NeurIPS 2026: main track, GDDL workshop
- MICCAI 2024, 2025: main track
- ICML 2024: GRaM workshop
- PP-RAI 2024: Generative Artificial Intelligence track
- Computer Methods in Biomechanics and Biomedical Engineering Journal
- Journal of Endovascular Therapy

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