

Christoph Heindl

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Summary

I am currently a research scientist at PROFACTOR and until recently I was a doctoral candidate in the Computational Perception group at the Johannes Kepler University of Linz (JKU). I work at the interface of computer vision and robotics with a focus on probabilistic approaches to create optimized training data for machine learning. Recently, I created a widely used real-time 3D reconstruction software called ReconstructMe¹ and initiated several popular open source projects². Both projects are now used by a variety of research groups worldwide, including Facebook, Google, and Microsoft.

Interests. Machine Learning, Computer Vision, and Robotics.

Education

- 2016–2020 **Dr. techn. (with distinction)**, JKU, Linz, Computational Perception
Visual Perception and Interaction Using Synthetic Data in Manufacturing.
- 2000–2004 **DI(FH)**, FH Upper Austria, Hagenberg, Software Engineering
Pairwise Registration of 3-D Range Data: Analysis and Evaluation of Modern Algorithms

Experience

My professional work experience as a full-time researcher.

- 2016–now **Scientist**, PROFACTOR GmbH, Steyr
Machine Learning for Visual Computing
- 2008–2016 **Senior Research Engineer**, PROFACTOR GmbH, Steyr
Robotics and Adaptive Systems
- 2004–2008 **Research Engineer**, PROFACTOR GmbH, Steyr
3D Computer Vision

Research Projects

A selection of research projects that I have worked on in the past and for which I partly helped to secure funding.

- 2025-2027 **REPIX**, AI-Region Upper Austria, 1.000.000€
AI-assisted programming with light and photochromic coatings.
- 2019–2024 **Medusa**, Innovatives OÖ 2020, 2.000.000€
Leitprojekt Medizintechnik: Creation of an innovative training and planning platform for neurosurgeons with vision-based behavior documentation.
- 2021-2023 **CONCERT**, ICT, 3.000.000€
Multi-modal sensor fusion for configurable robotics on construction sites.

¹<https://www.reconstructme.net/>

²<https://github.com/cheind>

- 2021-2023 **Teaming.AI**, *ICT*, 5.000.000€
Human AI teaming framework that integrates the strengths of both, the flexibility of human intelligence and scale-up capability of machine intelligence.
- 2021-2023 **Hybrid Work Systems**, *FFG*, 1.600.000€
Video-based human motion analysis for optimization of production processes.
- 2017-2021 **Lern4MRK**, *BMVIT*, 2.000.000€
Learn to map human demonstrations onto collaborative robots.
- 2015-2018 **Autoscan**, *FFG*, 1.300.000€
An autonomous sensor system utilizes human activity forecasting for active thermography planning.
- 2015-2017 **SIAM**, *FFG*, 730.000€
Seamless interoperability of assistive modules in the digital factory for automated 3D documentation.
- 2013-2017 **NextFactory**, *ICT*, 4.760.000€
All-in-one manufacturing platform for system in package and micromechatronic systems.
- 2012-2014 **ShowMe**, *FFG*, 560.000€
Assistive system for assembly tasks based spatially correct projections and next step recommendations.
- 2010-2013 **SRS**, *ICT*, 5.000.000€
Semi-autonomous robotic solutions in domestic environments for elderly people support.
- 2008-2010 **AHUMARI**, *FFG*, 400.000€
Fusing robot programming by demonstration with visual tracking.

Awards

- 2025 Best Robotic Paper Award Nomination (ERF2025)
- 2023 Industrial Impact Best Paper Award (ISM2023)
- 2021 Best Demo Honorable Mention (UbiComp2021)
- 2018 2nd place in the classification of acoustic scenes (DCASE2018)
- 2017 Best oral presentation (ICMV2017)
- 2016 BMW AG enGenius award for an autonomous sensor system to detect and localize robot movement positions
- 2012 BMW AG enGenius award for our automated bin-picking system iRobFeeder
- 2011 BMW AG enGenius award for our vision based plug inspection system
- 2007 Hagenberg Software Award
- 2006 State Award for Innovation (Landespreis für Innovation)

Patents

- 2020 Calibration method for a projector - Kalibrierverfahren für einen Projektor (AT522320)
- 2017 Apparatus for detecting a three-dimensional model corresponding to the surface of an object - Vorrichtung zum Erfassen einer Oberfläche eines Objektes entsprechenden dreidimensionalen Modells (AT519447B1)
- 2009 Method for continuously determining a gripping position (WO2011003124A1)

Miscellaneous

- 2019 Host of Workshop (OAGM2019)
- 2019 Reviewer (IJCAI2019, ICRA2021), Session chair (ETF2019)

Publications

- [1] **Christoph Heindl**, G Ebenhofer, S Kutlu, F Widmoser, and A Pichler. “SketchGuide+: Enabling Parametric Freehand Robot Programming via Wearable-Assisted Sketching”. In: *ACM Adjunct International Joint Conference on Pervasive and Ubiquitous Computing, Espoo, Finland (to be published)*. 2025.
- [2] **Christoph Heindl**, Gerhard Ebenhofer, Sezgin Kutlu, Fabian Widmoser, and Andreas Pichler. “SketchGuide: A Baseline Vision-Based Model for Rapid Robot Programming via Freehand Sketching on Any Surface”. In: *European Robotics Forum 2025*. Ed. by Marco Huber, Alexander Verl, and Werner Kraus. **Best Robotic Paper Award (Nominated)**. Cham: Springer Nature Switzerland, 2025, pp. 174–179. ISBN: 978-3-031-89471-8.
- [3] Kapil Deshpande, **Christoph Heindl**, Gernot Stübl, Martin J Kollingbaum, and Andreas Pichler. “Novel First Person View for Human 3D Pose Estimation in Robotic Applications Using Fisheye Cameras”. In: *2024 10th International Conference on Automation, Robotics and Applications (ICARA)*. IEEE. 2024, pp. 112–116.
- [4] Alexander Hämmerle, **Christoph Heindl**, Gernot Stübl, Jenish Thapa, Edoardo Lamon, and Andreas Pichler. “Applying grid world based reinforcement learning to real world collaborative transport”. In: *Procedia Computer Science 232 (2024)*. 5th International Conference on Industry 4.0 and Smart Manufacturing (ISM 2023), pp. 388–396. ISSN: 1877-0509. URL: <https://www.sciencedirect.com/science/article/pii/S1877050924000383>.
- [5] **Christoph Heindl**. “py-microdots: Position Encoding in the Euclidean Plane Based on the Anoto Codec”. In: *Intelligent Computing SAI*. Ed. by Kohei Arai. Cham: Springer Nature Switzerland, 2023, pp. 219–235. ISBN: 978-3-031-37963-5.
- [6] Gernot Stübl, **Christoph Heindl**, Gerhard Ebenhofer, Harald Bauer, and Andreas Pichler. “Lessons Learned from Human Pose Interaction in an Industrial Spatial Augmented Reality Application”. In: *Procedia Computer Science 217 (2023)*. 4th International Conference on Industry 4.0 and Smart Manufacturing; **Industrial Impact Best Paper Award**, pp. 912–917. ISSN: 1877-0509. URL: <https://www.sciencedirect.com/science/article/pii/S1877050922023663>.
- [8] Michael Spitzhirn, Martin Benter, **Christoph Heindl**, Noël Scheder, Gerhard Reisinger, Felix Strohmeier, and Wernher Behrendt. “Hybrid work systems—platform-based work planning—designing productive and human-centered work processes”. In: *Zeitschrift für Arbeitswissenschaft* (Dec. 2022). ISSN: 2366-4681. URL: <https://doi.org/10.1007/s41449-022-00342-6>.
- [9] **Christoph Heindl**, Lukas Brunner, Sebastian Zambal, and Josef Scharinger. “BlendTorch: A Real-Time, Adaptive Domain Randomization Library”. In: *1st Workshop on Industrial Machine Learning at International Conference on Pattern Recognition (ICPR2020)*. Milan, Italy: Springer, 2021.
- [10] Thomas Pönitz, Gerhard Ebenhofer, Gernot Stübl, **Christoph Heindl**, and Josef Scharinger. “On the Potential of large-scale Extended Reality Interaction for Industrial Environments”. In: *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2021 ACM International Symposium on Wearable Computers*. Best Demo Honorable Mention. Virtual Conference: ACM, 2021.

- [15] **Christoph Heindl**, Markus Ikeda, Gernot Stübl, Andreas Pichler, and Josef Scharinger. “Enhanced Human-Machine Interaction by Combining Proximity Sensing with Global Perception”. In: *2nd Workshop on Proximity Perception in Robotics at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. KITopen, 2019.
- [18] **Christoph Heindl**, Gernot Stübl, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. “Visual Large-scale Industrial Interaction Processing”. In: *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2019 ACM International Symposium on Wearable Computers*. London, United Kingdom: ACM, 2019, pp. 280–283. ISBN: 978-1-4503-6869-8.
- [19] **Christoph Heindl**, Sebastian Zambal, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. “3D Robot Pose Estimation from 2D Images”. In: *Proceedings of the International Conference on Digital Image & Signal Processing (DISP)*. Corgascience Oxford, 2019. ISBN: 978-1-912532-05-6.
- [20] **Christoph Heindl**, Sebastian Zambal, and Josef Scharinger. “Learning to Predict Robot Keypoints Using Artificially Generated Images”. In: *24th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)*. IEEE, 2019, pp. 1536–1539. ISBN: 978-1-7281-0303-7.
- [22] Thomas Pönitz, **Christoph Heindl**, Andreas Pichler, and Martin Kampel. “Automatic Intrinsic and Extrinsic Projector Calibration with Embedded Light Sensors”. In: *Proceedings of the Joint ARW & OAGM Workshop 2019*. OAGM & GMAR. Verlag der Technischen Universität Graz, 2019, pp. 193–194. ISBN: 978-3-85125-663-5.
- [23] Sebastian Zambal, **Christoph Heindl**, and Christian Eitzinger. “Machine Learning for CFRP Quality Control”. In: *Conference of the Society for the Advancement of Material and Process Engineering (SAMPE)*. Nantes, France: SAMPE, 2019.
- [24] Sebastian Zambal, **Christoph Heindl**, and Christian Eitzinger. “Probabilistic Modelling combined with a CNN for boundary detection of carbon fiber fabrics”. In: *IEEE 17th International Conference on Industrial Informatics (INDIN)*. IEEE, 2019, pp. 1621–1626. ISBN: 978-1-7281-2927-3.
- [25] Sebastian Zambal, **Christoph Heindl**, Christian Eitzinger, and Josef Scharinger. “End-to-end defect detection in automated fiber placement based on artificially generated data”. In: *Fourteenth International Conference on Quality Control by Artificial Vision*. International Society for Optics and Photonics. SPIE, 2019, pp. 371–378. ISBN: 978-1-5106-3054-3.
- [29] **Christoph Heindl**, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. “Large Area 3D Human Pose Detection Via Stereo Reconstruction in Panoramic Cameras”. In: *Proceedings of the OAGM Workshop*. Austrian Association of Pattern Recognition. Verlag der Technischen Universität Graz, 2018, pp. 103–110.
- [32] **Christoph Heindl**, Thomas Pönitz, Gernot Stübl, Andreas Pichler, and Josef Scharinger. “Spatio-thermal depth correction of RGB-D sensors based on Gaussian processes in real-time”. In: *Tenth International Conference on Machine Vision (ICMV)*. Vol. 10696. International Society for Optics and Photonics. SPIE, 2018, pp. 333–340.
- [34] Gernot Stübl, **Christoph Heindl**, Harald Bauer, and Andreas Pichler. “On Quality Assurance of 3D Bust Reconstructions”. In: *Proceedings of the 2nd OAGM-ARW Joint Workshop Vision, Automation and Robotics*. 2017.

- [35] Sharath C. Akkaladevi, Martin Ankerl, **Christoph Heindl**, and Andreas Pichler. “Tracking multiple rigid symmetric and non-symmetric objects in real-time using depth data”. In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2016, pp. 5644–5649. ISBN: 978-1-4673-8026-3.
- [38] **Christoph Heindl**, Sharath C. Akkaladevi, and Harald Bauer. “Capturing Photorealistic and Printable 3D Models Using Low-Cost Hardware”. In: *Advances in Visual Computing*. Springer International Publishing, 2016, pp. 507–518. ISBN: 978-3-319-50835-1.
- [39] Sharath C. Akkaladevi and **Christoph Heindl**. “Action Recognition for Human Robot Interaction in Industrial Applications”. In: *IEEE International Conference on Computer Graphics, Vision and Information Security (CGVIS)*. 2015, pp. 94–99. ISBN: 978-1-4673-7437-8.
- [40] **Christoph Heindl**, Harald Bauer, Martin Ankerl, and Andreas Pichler. “ReconstructMe SDK: a C API for Real-time 3D Scanning”. In: *6th International Conference and Exhibition on 3D Body Scanning Technologies*. 2015. ISBN: 978-3-033-05270-3.

Technical Reports and Posters

- [7] **Christoph Heindl**. *Monte Carlo Integration*. Aug. 2022. URL: <https://doi.org/10.5281/zenodo.7013396>.
- [11] **Christoph Heindl**. *Graph Neural Networks for Node-Level Predictions*. 2020. arXiv: 2007.08649 [cs.LG].
- [16] **Christoph Heindl**, Markus Ikeda, Gernot Stübl, Andreas Pichler, and Josef Scharinger. *Metric Pose Estimation for Human-Machine Interaction Using Monocular Vision*. Poster at Workshop on Factory of the Future at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). 2019.
- [17] **Christoph Heindl** and Josef Scharinger. *Notes on Semi-Supervised Expectation Maximization*. 2019. URL: <https://doi.org/10.5281/zenodo.3484301>.
- [26] Matthias Dorfer, Bernhard Lehner, Hamid Eghbal-zadeh, **Christoph Heindl**, Fabian Paischer, and Gerhard Widmer. *Acoustic Scene Classification with Fully Convolutional Neural Networks and I-Vectors*. 2018.