

Tobias Feigl

Ph.D., Friedrich-Alexander University Erlangen-Nuremberg (FAU), Germany
Research Assistant at Fraunhofer Institute for Integrated Circuits (IIS) Nuremberg, Germany
Guest Lecturer at Friedrich-Alexander University Erlangen-Nuremberg (FAU), Germany

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Date: June 13th, 1984
Place: Nuremberg

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ABOUT

Tobias Feigl received his Ph.D. degree in Computer Science from the Friedrich-Alexander-University Erlangen-Nuremberg (FAU) in 2021 and his Masters degree from the University of Applied Sciences Erlangen-Nuremberg, Germany, in 2017. He joined the Machine Learning & Information Fusion lab at the Fraunhofer Institute for Integrated Circuits (IIS) Nuremberg, Germany, in 2017. He switched to the Hybrid Positioning & Information Fusion lab at the IIS Nuremberg, Germany, in 2020. In parallel, since 2017 he is a lecturer at the Computer Science department (Programming Systems lab) at FAU, where he gives courses on machine and deep learning.

His research interests are on AI-driven signal processing, human computer interaction, localization, and model- and data-driven hybrid filter techniques. He focuses on the improved, machine learning-driven mapping of human motion behavior in immersive virtual environments on a large scale with inertia and radio sensors.

EDUCATION

2021	Ph.D., Computer Science Friedrich-Alexander-University Erlangen-Nuremberg, Germany Computer Science Department
THESIS	"Data-driven methods for determining position and orientation in radio- and inertial-based dead reckoning systems"
FOCUS	Long-short-term memory cells to improve pedestrian dead reckoning and recurrent neural networks for orientation and localization
ADVISORS	Prof. Dr. Michael Philippsen, PD Dr.-Ing. habil. Thomas Wittenberg, Prof. Dr. Georg Fischer, and Prof. Dr. Klaus Meyer-Wegener
GRADES	Thesis: 1.0 (summa cum laude) [*]
2017	M.Sc., Computer Science University of Applied Science Erlangen-Nuremberg, Germany Computer Science Department
THESIS	"Immersion-optimized sensor fusion for low-cost realtime locating systems in Virtual Reality applications"
FOCUS	Digital Signal-Processing and Machine Learning to improve Augmented and Virtual Reality and Pedestrian Localization
ADVISORS	Prof. Dr. Timo Götzelmann and Prof. Dr. Friedhelm Stappert
GRADES	Thesis: 1.0 (A, GPA 4.0), total: 1.4 (A, GPA 3.6) [*]
2013	B.Sc., Computer Science University of Applied Science, Erlangen-Nuremberg, Germany Computer Science Department
THESIS	"Conceptual design and implementation of a system configuration tool for a radio-based localization system"
ADVISORS	Prof. Dr. rer. nat. Friedhelm Stappert
GRADES	Thesis: 1.0 (A, GPA 4.0), total: 2.3 (A, GPA 2.7) [*]
2006	German High School Diploma Erlangen, Germany

[*] GRADES range from 1.0 to 4.0, with 1.0 is best and from level A to E, with A is best 10%, B is next 25% and GPA 4.0 to 1.0 with 4.0 is best

ACADEMIC POSITIONS

2021–today	Postdoc (Habilitation candidate), Computer Science Friedrich-Alexander-University Erlangen-Nuremberg, Germany Computer Science Department
PROJECT	”Generalization of AI-based Localization Methods”
ADVISORS	Prof. Dr. Michael Philippsen, PD Dr.-Ing. habil. Thomas Wittenberg, and Prof. Dr.-Ing. habil. Andreas Paul Fröba.
2017–2021	Research Assistant (Ph.D. candidate), Computer Science Friedrich-Alexander-University (FAU) Erlangen-Nuremberg, Germany Computer Science Department - Programming Systems Group
PROJECT	”RuNN - Recurrent Neuronal Networks (RNNs) for Real-Time Estimation of Nonlinear Motion Models”
ADVISORS	Prof. Dr. Michael Philippsen
2015	Research Intern, Computer Science University of Applied Sciences (TH) in Nuremberg, Germany, Reverse Engineering Lab
PROJECT	”Development and publication of the first mobile anti-phishing device for smartphone-based online banking”
ADVISOR	Prof. Dr. Peter Trommler
2013-2015	Visiting Student, Computer Science Friedrich-Alexander-University Erlangen-Nuremberg, Germany Computer Science Department
FOCUS	Machine Learning, Human-Computer-Interaction, Computer Graphics, Reverse Engineering
2007-2009	Visiting Student, Electrical Engineering and Information Technology University of Applied Science in Erlangen-Nuremberg, Germany Electrical Engineering Department
FOCUS	Signal processing, Embedded systems, Hardware reverse engineering

TEACHING EXPERIENCE

Courses

2021	Lecturer (course instructor) CS3856999 Machine Learning: Introduction (B.Sc. [5 ECTS]), FAU. CS3856998 Machine Learning: Advances (M.Sc. [5 ECTS]), FAU. Supervisor, CS3448533 Parallel and Functional Programming, FAU. Supervisor, CS3448488 Algorithms and Data Structures, FAU.
2020	Lecturer (course instructor) CS3856999 Machine Learning: Introduction (B.Sc., [5 ECTS]), FAU. CS3856998 Machine Learning: Advances (M.Sc. [5 ECTS]), FAU. Supervisor, CS3448533 Parallel and Functional Programming, FAU. Supervisor, CS3448488 Algorithms and Data Structures, FAU.
2019	Lecturer (course instructor) Machine Learning course (B.Sc., M.Sc., [5 ECTS]), FAU. Supervisor, CS3448533 Parallel and Functional Programming, FAU. Supervisor, CS3448488 Algorithms and Data Structures, FAU.
2018	Supervisor Machine Learning course (B.Sc., M.Sc., [2.5, 5 ECTS]), FAU. CS3448533 Parallel and Functional Programming, FAU. CS3448488 Algorithms and Data Structures, FAU.

2017 | Supervisor

Machine Learning course (B.Sc., [2.5, ECTS]), FAU.
Machine Learning course (M.Sc., [5 ECTS]), FAU.
CS3448533 Parallel and Functional Programming, FAU.
CS3448488 Algorithms and Data Structures, FAU.

Qualification Theses

- [1] Einfluss verschiedener Inertial- und Funksensordaten auf die Posenschätzung von Menschen mittels Rekurrenter Neuronaler Netze
Andreas Porada
Masters Thesis, Technische Hochschule Nürnberg (TH), 2021, published.
- [2] Radio Localization to Enable Robust People Tracking in High-Resolution Images
Stephanie Mehlretter
Bachelor Thesis, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), 2020, published.
- [3] Einfluss verschiedener Inertial- und Funksensordaten auf die Posenschätzung von Menschen mittels Rekurrenter Neuronaler Netze
Peter Bauer
Masters Thesis, Technische Hochschule Nürnberg (TH), 2020, published.
- [4] Application of Deep Learning Methods to Process Natural Phenomena
Thomas Altstidl
Bachelor Thesis, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), 2019, published.
- [5] Feature Extraction of a Radio Frequency based Localization System Using Beta-VAE
Oskar Herrmann
Bachelor Thesis, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), 2019, published.
- [6] How far is far? Evaluation, Visualization, and Interpretation of RNNs on Physically Correct Movements
Lukas Schmidt
Masters Thesis, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), 2019, published.
- [7] Komplementieren Relativer und Absoluter Eigenlokalisierungsverfahren
Felix Ott
Masters Thesis, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), 2019, published.
- [8] Avatar Synchronisation zur Analyse von Bewegungswahrnehmung der unteren Extremitäten in VR
Lisa Gruner
Bachelor Thesis, Technische Hochschule Nürnberg (TH), 2019, published.
- [9] Eine explorative Untersuchung zu Textverständnis und Lerneffekt im Medium Virtuelle Realität - Lohnt sich der Implementierungsaufwand für die Anwendung im Fraunhofer IIS?
Lea Otte
Bachelor Thesis, Technische Hochschule Nürnberg (TH), 2019, published.
- [10] Evaluation of Distributed Neural Networks for Indoor Radio Positioning Utilizing Efficient Embedded Hardware
Jan Niklas Bauer
Masters Thesis, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), 2019, published.
- [11] Analyse und Evaluierung aktueller MR Tracking Systeme am Beispiel ARKit
Andreas Porada
Bachelor Thesis, Georg-Simon-Ohm Hochschule Nürnberg (GSOHM), 2018, published.
- [12] Einfluss dynamischer Objekttransformationen auf die Bewegungswahrnehmung in VR
Felix Gruber
Bachelor Thesis, Technische Hochschule Nürnberg (TH), 2018, published.
- [13] Robustes Inside-Out Tracking für großflächige Mehrnutzer VR Systeme
Christian Daxer
Masters Thesis, Technische Hochschule Nürnberg (TH), 2018, published.

- [14] Robuste Posenschätzung durch Identifikation von Kalibriermomenten mittels Maschine Learning
Frank Brendel
Masters Thesis, Technische Hochschule Nürnberg (TH), 2018, published.
- [15] Virtual-Reality-optimierte Sensor Fusion für eine langzeitstabile Gestenerkennung der oberen Extremität
Christian Jakob
Masters Thesis, Technische Hochschule Nürnberg (TH), 2018, published.

INDUSTRIAL POSITIONS

2021–today	Postdoctoral Research Assistant Fraunhofer Institute for Integrated Circuits (IIS) Nuremberg, Germany Hybrid Positioning and Information Fusion Group
TASKS	Administer research and industry projects with strong focus on AI-based localization
2017–2021	Research Assistant Fraunhofer IIS in Nuremberg, Germany Machine Learning and Information Fusion Group
TASKS	Administer research and industry projects with strong focus on AI-based signal processing
2015	Co-Founder HolodeckVR GmbH (Spree), Nuremberg, Germany
TASKS	Data-analytics and development of an immersive low-cost tracking system for virtual reality applications
2009-2017	Working Student Fraunhofer IIS in Nuremberg, Germany Precise Localization and Analytics Department
TASKS	Software development, design of graphical user interfaces, hardware engineering
2001	Working Scholar Weilburger Graphics GmbH, Gerhardshofen, Germany
TASKS	Leading manufacturer in the international graphic industry Office job
2000-2009	Working Scholar RWG Germany GmbH, Dachsbach, Germany
TASKS	Leading manufacturer in the international aviation industry Optimization of sandblasting procedures

HONORS AND AWARDS

2021	Fraunhofer Price (Research).
2020	Schmidt Science Fellows 2021 Nomination. FAU Research Grant: "Pioneering research in the field of AI-based localization for VR".
2019	FAU Research Grant: "Pioneering research in the field of AI-based localization". FAU Award: "Best seminar of the year".
2018	FAU Research Grant: "Pioneering research in the field of AI-driven VR systems".
2017	University of Applied Science Award: "Best thesis of the year".

ACADEMIC SERVICE

2021	Member of Review Committee, Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN). Review Committee, Intl. Symp. on Mixed and Augmented Reality (ISMAR). Review Committee, Intl. Conf. on Virtual Reality and 3D User Interface (IEEE VR). Review Committee, MDPI Sensors Journal (MDPI). Session Chair, Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN). Review Committee, Wireless Communications and Networking Conference (WCNC).
2020	Member of Review Committee Intl. Symp. on Mixed and Augmented Reality (ISMAR). Springer Journal on Virtual Reality (VIRE). IEEE Sensors Journal (IEEE). Intl. Conf. on Virtual Reality and 3D User Interface (IEEE VR). Conf. on Artificial Intelligence (AAAI). IEEE Transactions on Signal Processing (IEEE TSP). MDPI Sensors Journal (MDPI). Conf. on Neural Information Processing Systems (NeurIPS).
2019	Member of Review Committee Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN). Intl. Conf. of Human-Computer Interaction (CHI). European Conf. on Artificial Intelligence (ECAI). Intl. Conf. on Virtual Reality and 3D User Interface (IEEE VR).
2018	Member of Review Committee Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN). Virtual Reality Software and Technology (VRST). Intl. Symp. on Mixed and Augmented Reality (ISMAR).
2017	Member of Review Committee Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN). Special Interest Group on Graphics and Interactive Techniques (SIGGRAPH). Intl. Conf. on Virtual Reality and 3D User Interface (IEEE VR).
2016- today	Member of Verein Deutscher Ingenieure (VDI). Graduate Student Member, Institute of Electrical and Electronics Engineers (IEEE). Graduate Student Member, Association for Computing Machinery (ACM).

ACADEMIC PUBLICATIONS

Articles in Double-blind Peer-reviewed Journals

- [1] PDRNN: Data-driven Pedestrian Dead Reckoning on Loosely Coupled Radio- and Inertial-Signalstreams
Tobias Feigl, Schmidt Lukas, Bauer Peter, Ott Felix, Michael Philippsen, Christopher Mutschler
IEEE Sensors Journal (Jan. 2022) pp. 1–22.

- [2] Datengetriebene Methoden zur Bestimmung von Position und Orientierung in funk- und trägheitsbasierter Koppelnavigation
Tobias Feigl
Friedrich-Alexander-Universität Erlangen-Nürnberg (Sept. 2021). DOI: <https://nbn-resolving.org/urn:nbn:de:bvb:29-opus4-173550>.
- [3] Estimating TOA Reliability with Variational Autoencoders
Maximilian Stahlke, Sebastian Kram, Felix Ott, Tobias Feigl, Christopher Mutschler
IEEE Sensors Journal (Sept. 2021) pp. 1–6. DOI: 10.1109/JSEN.2021.3101933.
- [4] RNN-aided Human Velocity Estimation from a Single IMU
Tobias Feigl, Sebastian Kram, Philipp Woller, Ramiz H. Siddiqui, Michael Philippsen, Christopher Mutschler
Sensors J. 13.4512 (May 2020) pp. 1–31. DOI: 10.3390/s20133656.
- [5] UWB Channel Impulse Responses for Positioning in Complex Environments: A Detailed Feature Analysis
Sebastian Kram, Maximilian Stahlke, Tobias Feigl, Jochen Seitz, Jörn Thielecke
Sensors J. 24.5547 (Dec. 2019) pp. 1–26. DOI: 10.3390/s19245547.
- [6] Sick Moves! Motion Parameters as Indicators of Simulator Sickness
Tobias Feigl, Daniel Roth, Stefan Gradl, Markus Wirth, Marc Erich Latoschik, Björn Eskofier, Michael Philippsen, Christopher Mutschler
Trans. on Visualization and Computer Graphics (TVCG) 25.11 (Aug. 2019) pp. 3146–3157. DOI: 10.1109/TVCG.2019.2932224.

Articles in Double-blind Peer-reviewed Conferences

- [1] Accuracy-Aware Compression of Channel Impulse Responses using Deep Learning
Thomas Robert Altstidl, Sebastian Kram, Oskar Herrmann, Maximilian Stahlke, Tobias Feigl, Christopher Mutschler
Proc. Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), 2021.
- [2] Robust ToA-Estimation using Convolutional Neural Networks on Randomized Channel Models
Tobias Feigl, Ernst Eberlein, Sebastian Kram, Christopher Mutschler
Proc. Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), 2021.
- [3] Contact Tracing with the Exposure Notification Framework in the German Corona-Warn-App
Steffen Meyer, Thomas Windisch, Adrian Perl, Daniel Dzibela, Robert Marzilger, Nicolas Witt, Justus Benzler, Göran Kirchner, Tobias Feigl, Christopher Mutschler
Proc. Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), 2021.
- [4] Real-Time Gait Reconstruction For Virtual Reality Using a Single Sensor
Tobias Feigl, Lisa Gruner, Christopher Mutschler, Daniel Roth
Proc. Intl. Symp. on Mixed Reality and Augmented Reality (ISMAR), 2020, Pernambuco, Brasil, DOI: 10.1109/ISMAR-Adjunct51615.2020.00037.
- [5] A Sense of Quality for Augmented Reality Assisted Process Guidance
Anes Redzepagic, Christoffer Löffler, Tobias Feigl, Christopher Mutschler
Proc. Intl. Symp. on Mixed Reality and Augmented Reality (ISMAR), 2020, Pernambuco, Brasil, DOI: 10.1109/ISMAR-Adjunct51615.2020.00046.
- [6] ViPR: Visual-Odometry-aided Pose Regression for 6DoF Camera Localization
Felix Ott, Tobias Feigl, Christoffer Löffler, Christopher Mutschler
Proc. Intl. Conf. on Computer Vision and Patter Recognition (CVPR), 2020, Seattle, Washington, DOI: 10.1109/CVPRW50498.2020.00029.
- [7] Localization Limitations of ARCore, ARKit, and Hololens in Dynamic Large-Scale Industry Environments
Tobias Feigl, Andreas Porada, Steve Steiner, Christoffer Löffler, Christopher Mutschler, Michael Philippsen
Proc. Intl. Conf. on Computer Vision, Imaging and Computer Graphics Theory and Applications (GRAPP), 2020, Valletta, Malta, DOI: 10.5220/0008989903070318.
- [8] ViPR: Visual-Odometry-aided Pose Regression for 6DoF Camera Localization
Felix Ott, Tobias Feigl, Christoffer Löffler, Christopher Mutschler
arXiv 1912.08263 cs.CV, 2019.

- [9] A Bidirectional LSTM for Estimating Dynamic Human Velocities from a Single IMU
Tobias Feigl, Sebastian Kram, Philipp Woller, Ramiz H. Siddiqui, Michael Philippsen, Christopher Mutschler
Proc. Intl. Conf. Indoor Positioning and Indoor Navigation (IPIN), 2019, Pisa, Italy, DOI: 10.1109/IPIN.2019.8911814.
- [10] A Social Interaction Interface Supporting Affective Augmentation Based on Neuronal Data
Daniel Roth, Larissa Brübach, Franziska Westermeier, Christian Schell, Tobias Feigl, Marc Erich Latoschik
Proc. Symp. on Spatial User Interaction (SUI), 2019, New Orleans, USA, DOI: 10.1145/3357251.3360018.
- [11] A Framework for Location-Based VR Applications
Jean-Luc Lugin, Florian Kern, Constantin Kleinbeck, Daniel Roth, Christian Daxer, Tobias Feigl, Christopher Mutschler, Marc Erich Latoschik
Virtuelle und Erweiterte Realität: 16. Workshop der GI-Fachgruppe VR/AR (Berichte aus der Informatik), 2019, Fulda, Germany.
- [12] Brain 2 Communicate: EEG-based Affect Recognition to Augment Virtual Social Interactions
Daniel Roth, Franziska Westermeier, Larissa Brübach, Tobias Feigl, Christian Schell, Marc Erich Latoschik
Mensch und Computer - Workshopband, 2019, Hamburg, Germany, DOI: 10.18420/muc2019-ws-571.
- [13] Supervised Learning for Yaw Orientation Estimation
Tobias Feigl, Christopher Mutschler, Michael Philippsen
Proc. Intl. Conf. Indoor Positioning and Indoor Navigation (IPIN), 2018, Nantes, France, DOI: 10.1109/IPIN.2018.8533811.
- [14] Recurrent Neural Networks on Drifting Time-of-Flight Measurements
Tobias Feigl, Thorsten Nowak, Michael Philippsen, Thorsten Edelhäuser, Christopher Mutschler
Proc. Intl. Conf. Indoor Positioning and Indoor Navigation (IPIN), 2018, Nantes, France, DOI: 10.1109/IPIN.2018.8533813.
- [15] A Location-Based VR Museum
Jean-Luc Lugin, Florian Kern, Ruben Schmidt, Constantin Kleinbeck, Daniel Roth, Christian Daxer, Tobias Feigl, Christopher Mutschler, Marc Erich Latoschik
Proc. Intl. Conf. Virtual Worlds for Serious Applications (VS-Games), 2018, Würzburg, Germany, DOI: 10.1109/VS-Games.2018.8493404.
- [16] Head-to-Body-Pose Classification in No-Pose VR Tracking Systems
Tobias Feigl, Christopher Mutschler, Michael Philippsen
Proc. Intl. Conf. Virtual Reality and 3D User Interfaces (IEEE VR), 2018, Tuebingen/Reutlingen, Germany, DOI: 10.1109/VR.2018.8446495.
- [17] Human Compensation Strategies for Orientation Drifts
Tobias Feigl, Christopher Mutschler, Michael Philippsen
Proc. Intl. Conf. Virtual Reality and 3D User Interfaces (IEEE VR), 2018, Tuebingen/Reutlingen, Germany, DOI: 10.1109/VR.2018.8446300.
- [18] Beyond Replication: Augmenting Social Behaviors in Multi-User Social Virtual Realities
Daniel Roth, Constantin Kleinbeck, Tobias Feigl, Christopher Mutschler, Marc-Erich Latoschik
Proc. Conf. Virtual Reality and 3D User Interfaces (IEEE VR), 2018, Tuebingen/Reutlingen, Germany, DOI: 10.1109/VR.2018.8447550.
- [19] Acoustical manipulation for redirected walking
Tobias Feigl, Eliise Köre, Christopher Mutschler, Michael Philippsen
Proc. Intl. Symp. on Virtual Reality Software and Technology (VRST), 2017, Gothenburg, Sweden, DOI: 10.1145/3139131.3141205.
- [20] Social Augmentations in Multi-User Virtual Reality: A Virtual Museum Experience
Daniel Roth, Constantin Kleinbeck, Tobias Feigl, Christopher Mutschler, Marc-Erich Latoschik
Proc. Intl. Symp. on Mixed and Augmented Reality (ISMAR), 2017, Nantes, France, DOI: 10.1109/ISMAR-Adjunct.2017.28.

Patents

- [1] Methods and Apparatuses for Positioning in a Wireless Communications Network
Mohammad Alawieh, Ernst Eberlein, Tobias Feigl, Thomas Grün
WO/2021/089258, Patent Cooperation Treaty, 2021, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=W02021089258>.

- [2] Methods and Apparatuses for Positioning in a Wireless Communications Network
 Mohammad Alawieh, Ernst Eberlein, Tobias Feigl, Thomas Grün
 EP3819657, European Patent Office, 2021, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=EP323759835>.
- [3] Method to Determine a Present Position of an Object, Positioning System, Tracker and Computer Program
 Stephan Otto, Tobias Feigl, Christian Daxer, Alexander Bruckmann, Christoffer Loeffler, Christopher Mutschler, Marc Faßbinder
 US20200371226, United States of America Patent Office, 2020, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=US311580591>.
- [4] Method for Predicting a Motion of an Object, Method for Calibrating a Motion Model, Method for Deriving a Predefined Quantity and Method for Generating a Virtual Reality View
 Tobias Feigl, Christopher Mutschler
 EP3732549, European Patent Office, 2020, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=EP310552140>.
- [5] Method to Determine a Present Position of an Object, Positioning System, Tracker and Computer Program
 Stephan Otto, Tobias Feigl, Christian Daxer, Alexander Bruckmann, Christoffer Loeffler, Christopher Mutschler, Marc Faßbinder
 EP3724744, European Patent Office, 2020, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=EP309422132>.
- [6] Method for Predicting a Motion of an Object, Method for Calibrating a Motion Model, Method for Deriving a Predefined Quantity and Method for Generating a Virtual Reality View
 Tobias Feigl, Christopher Mutschler
 US20200334837, United States of America Patent Office, 2020, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=US309415935>.
- [7] Method to Determine a Present Position of an Object, Positioning System, Tracker and Computer Program
 Stephan Otto, Tobias Feigl, Christian Daxer, Alexander Bruckmann, Christoffer Loeffler, Christopher Mutschler, Marc Faßbinder
 CN111512269, Chinese Patent Office, 2020, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=CN302932485>.
- [8] Method for Predicting a Motion of an Object, Method for Calibrating a Motion Model, Method for Deriving a Predefined Quantity and Method for Generating a Virtual Reality View
 Tobias Feigl, Christopher Mutschler
 CN111527465, Chinese Patent Office, 2020, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=CN302978646>.
- [9] Apparatuses and Methods for Correcting Orientation Information from one or more Inertial Sensors
 Tobias Feigl, Christopher Mutschler
 US20190346280, United States of America Patent Office, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=US276400006>.
- [10] Apparatuses and Methods for Correcting Orientation Information from one or more Inertial Sensors
 Tobias Feigl, Christopher Mutschler
 EP3568801, European Patent Office, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=EP276893927>.
- [11] Vorrichtung und Verfahren zur Effizienten Zustandsbestimmung und Lokalisierung zwischen mobilen Plattformen
 Christopher Mutschler, Sebastian Kram, Christian Nickel, Tobias Feigl Seitz, Niels Hadaschik
 WO/2019/197006, Patent Cooperation Treaty, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=W02019197006>.
- [12] Apparatuses and Methods for Correcting Orientation Information from one or more Inertial Sensors
 Tobias Feigl, Christopher Mutschler
 CN250178436, Chinese Patent Office, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=CN250178436>.
- [13] Method for Predicting a Motion of an Object, Method for Calibrating a Motion Model, Method for Deriving a Predefined Quantity and Method for Generating a Virtual Reality View
 Tobias Feigl, Christopher Mutschler

WO/2019/129355, Patent Cooperation Treaty, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=W02019129355>.

- [14] Method for Setting a Viewing Direction in a Representation of a Virtual Environment
Christopher Mutschler, Tobias Feigl, Christian Daxer, Stephan Otto, Bercea Cosmin-Ionut
US243321209, United States of America Patent Office, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=US243321209>.
- [15] Method to Determine a Present Position of an Object, Positioning System, Tracker and Computer Program
Stephan Otto, Tobias Feigl, Christian Daxer, Alexander Bruckmann, Christoffer Loeffler, Christopher Mutschler, Marc Faßbinder
WO/2019/114925, Patent Cooperation Treaty, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=W02019114925>.
- [16] Method for Setting a Viewing Direction in a Representation of a Virtual Environment
Christopher Mutschler, Tobias Feigl, Christian Daxer, Stephan Otto, Bercea Cosmin-Ionut
EP3458935, European Patent Office, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=EP239836478>.
- [17] Method for Setting a Viewing Direction in a Representation of a Virtual Environment
Christopher Mutschler, Tobias Feigl, Christian Daxer, Stephan Otto, Bercea Cosmin-Ionut
CN237677091, Chinese Patent Office, 2019, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=CN237677091>.
- [18] Vorrichtung und Verfahren zur Effizienten Zustandsbestimmung und Lokalisierung zwischen mobilen Plattformen
Tobias Feigl, Christopher Mutschler
DE223815006, Deutsches Patent- und Markenamt (DPMA), 2018, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=DE223815006>.
- [19] Apparatuses and Methods for Correcting Orientation Information from one or more Inertial Sensors
Tobias Feigl, Christopher Mutschler
WO/2018/130446, Patent Cooperation Treaty, 2018, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=W02018130446>.
- [20] Verfahren zum Einstellen einer Blickrichtung in einer Darstellung einer virtuellen Umgebung
Christopher Mutschler, Tobias Feigl, Christian Daxer, Stephan Otto, Bercea Cosmin-Ionut
DE206581508, Deutsches Patent- und Markenamt (DPMA), 2017, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=DE206581508>.
- [21] Method for Setting a Viewing Direction in a Representation of a Virtual Environment
Christopher Mutschler, Tobias Feigl, Christian Daxer, Stephan Otto, Bercea Cosmin-Ionut
WO/2017/198441, Patent Cooperation Treaty, 2017, URL: <https://patentscope.wipo.int/search/en/detail.jsf?docId=W02017198441>.

ACADEMIC TALKS

- 2021** **Machine Learning for Indoor Localization: Special Session**
Tobias Feigl et al.
Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), Nantes, France.
- Machine Learning for Sensor Fusion: Special Session**
Tobias Feigl et al.
Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), Nantes, France.
- Robust ToA-Estimation using Convolutional Neural Networks on Randomized Channel Models**
Tobias Feigl et al.
Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), Nantes, France.
- Datengetriebene Methoden zur Bestimmung von Position und Orientierung in funk- und trägheitsbasierter Koppelnavigation**
Tobias Feigl et al.
Friedrich-Alexander-Universität (FAU), Erlangen, Germany.
- 2020** **Real-Time Gait Reconstruction For Virtual Reality Using a Single Sensor**
Tobias Feigl et al.
Symp. on Mixed and Augmented Reality (ISMAR), Pernambuco, Brasil.
- A Sense of Quality for Augmented Reality Assisted Process Guidance**
Tobias Feigl et al.
Symp. on Mixed and Augmented Reality (ISMAR), Pernambuco, Brasil.
- Localization Limitations of ARCore, ARKit, and Hololens in Dynamic Large-Scale Industry Environments**
Tobias Feigl et al.
Intl. Conf. on Computer Graphics Theory and Applications, Valletta, Malta.
- 2019** **Machine learning for positioning**
Tobias Feigl et al.
Symp. on Big Data Allianz, Stuttgart, Germany.
- Sick Moves! Motion Parameters as Indicators of Simulator Sickness**
Tobias Feigl et al.
Intl. Symp. on Mixed and Augmented Reality (ISMAR), Beijing, China.
- Challenges of data-driven Localization**
Tobias Feigl et al.
ADA Lovelace Center for Analytics, Data and Applications, Nuremberg, Germany.
- A Bidirectional LSTM for Estimating Dynamic Human Velocities from a Single IMU**
Tobias Feigl et al.
Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), Pisa, Italy.
- Generative models for the detection of destructive radio environments**
Tobias Feigl et al.
Intl. Symp. on Horizon 2020 - ICT-52, Valencia, Spain.

- 2018** | **Human Compensation Strategies for Orientation Drifts**
Tobias Feigl et al.
Intl. Conf. on Virtual Reality and 3D User Interfaces (IEEE VR), Tuebingen/Reutlingen, Germany.
- Head-to-Body-Pose Classification in No-Pose VR Tracking Systems**
Tobias Feigl et al.
Intl. Conf. on Virtual Reality and 3D User Interfaces (IEEE VR), Tuebingen/Reutlingen, Germany.
- Recurrent Neural Networks on Drifting Time-of-Flight Measurements**
Tobias Feigl et al.
Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), Nantes, France.
- Supervised Learning for Yaw Orientation Estimation**
Tobias Feigl et al.
Intl. Conf. on Indoor Positioning and Indoor Navigation (IPIN), Nantes, France.
- Machine learning methods for human-centered multisensory localization**
Tobias Feigl et al.
Workshop on Machine Learning, Bilkent University, Ankara, Turkey.
- 2017** | **Hacking human sensors - Augmented Reality, Mixed Reality, Virtual Reality optimized visualization**
Tobias Feigl et al.
Eingebettete Systeme für Sport, Fitness und Gesundheit (ESI), Nuremberg, Germany.
- Acoustical manipulation for redirected walking**
Tobias Feigl et al.
Intl. Symp. on Virtual Reality Software and Technology (VRST), Gothenburg, Sweden.

RESEARCH FUNDING

List of accompanied inter/national research proposals in Germany and Europe **):

2021	<p>BMBF-6G-Hub - 6G-RIC Generalization of unsupervised Channel Charting for robust localization Task lead, (accepted).</p> <p>STMWI-LuFo VI - A²D Advancing Autonomous Drones Task lead, (rejected).</p> <p>BMBF 2020/21 "InnoPush" - 5G-Sentinel Six-G Enablers: Flexible Networks, THz Technology and Integration, Non-Terrestrial Networks, SidElink, and Localization Task lead, (accepted).</p> <p>BMBF-2876 - TRAICT Trusted Resource Aware Information and Communication Technology Task lead, (accepted).</p> <p>STMWI-LuFo VI - D4I4 Autonomous swarms of drones for Industry 4.0 Task lead, (rejected).</p> <p>BMBF 2020/21 "InnoPush" - TEN-G Technology Enablers for Disaggregated Networks Task lead, (accepted).</p>
2020	<p>BMBF-2912 - REKOVAR Responsive interactive sensor fusion using DL Technical lead, (rejected).</p> <p>BMBF-2912 - MuViK Development of a multi-user VR environment with multi-sensory access to barrier-free cultural participation Technical lead, (rejected).</p> <p>BMBF-3068 - KEOTGOI Artificial generation and optimization of training data for the extraction of location information from inertial data Consortium lead, (rejected).</p> <p>BMBF-3068 - DyKoSKIS Dynamically configured simulation models for AI-based signal processing Consortium lead, (rejected).</p> <p>H2020-ICT-52-5GPPP - KAIROS Smart Connectivity Beyond 5G Task lead, (rejected).</p>

2019	<p>BMBF-1624 - Writing Trainer Handwriting training and writing digitization using context-sensitive pens Consortium lead, (accepted).</p> <p>BMBF-2022 - AI3oT AI Industrial IoT Artificial intelligence for self-positioning and communication in the industrial IoT context Consortium lead, (rejected).</p> <p>BayWi-1353 - Movement Analytics AI-based process analysis and optimization using mixed reality Technical lead, (rejected).</p>
2018	<p>BMBF-1566 - EsReal Essential reality through selective information filtering with immersive media in the tender “Interactive systems in virtual and real spaces Technical lead, (rejected).</p>
2017	<p>BMBF-1353 - HoloCare Mixed reality assistance system for care Consortium lead, (accepted).</p>

**) Supervisor: Dr.-Ing. Christopher Mutschler
Bundesministerium für Bildung und Forschung (BMBF)
Bayerisches Wirtschaftsministerium (BayWi)
Horizont 2020 (H2020).

CONSULTING AND SIGNIFICANT PROJECTS

2021-2022	<p>HUAWEI GmbH AI-based Positioning. Project lead, Research assistant.</p> <p>IMBUS GmbH Qualitative and quantitative interpretability of AI in the wild. Scientific lead, Supervisor.</p> <p>Elektrobit GmbH AI-based sensor fusion and hybrid positioning. Scientific lead, Supervisor.</p>
2020-2022	<p>STABILO International GmbH AI-based letter recognition Technical lead, Research assistant.</p>
2019	<p>Deutsche Bundeswehr AI-based localization Research assistant.</p>
2018	<p>ROOQ GmbH AI-based motion recognition Technical lead, Research assistant.</p>
2017	<p>Holodeck VR GmbH Development and launch of the start-up company Co-founder, senior data-scientist.</p> <p>ESI Fitness Immersive AI-based human motion visualization in VR</p>

	Task lead, Research assistant.
2016	Spree Interactive GmbH AI-based large scale tracking for VR Co-founder, senior data-scientist.
2015-2017	Fraunhofer Holodeck VR Immersive large scale localization in VR Technical lead, Research assistant.
2014	RedFIR (JOGMO GmbH) Human-sport-event-observer application Working student.
2013	ORAL-B GmbH Application programming interface for a smart tooth brush Working student.
2009-2012	RedFIR (JOGMO GmbH) Event-based graphical user interface for real-time sports tracking applications Working student.

SKILLS AND INTERESTS

Skills

Coding +10 years	objective-C/C/C++/C#, MATLAB, Qt, boost C++, OpenCV, IDA disassembler, java/script, batch, bash/shell, iOS, macOS, unix (Ubuntu), ..								
+5 years	Python, scikit-learn, TensorFlow, PyTorch, Theano, Keras, ROS, Unity3D, Unreal Engine, Android, JDK, NDK, swift, IDA/Ghidra/Hopper disassembler, arduino, assembler (x86, arm32, arm64, amd64, x86_64), OCaml, ruby, coq, Haskell, Lua, php, perl, ..								
git /OSS	(+100k loc) eyeTVCamd, OSCam, iDirStat, ..								
Languages	<table> <tr> <td>German</td> <td>Native speaker;</td> <td>Latin</td> <td>Independent user, B2;</td> </tr> <tr> <td>English</td> <td>Proficient user, C2;</td> <td>Spanish</td> <td>Basic user, A1.</td> </tr> </table>	German	Native speaker;	Latin	Independent user, B2;	English	Proficient user, C2;	Spanish	Basic user, A1.
German	Native speaker;	Latin	Independent user, B2;						
English	Proficient user, C2;	Spanish	Basic user, A1.						

Interests

Professional	Time- and context-sensitive algorithms, support vector machines, recurrent and convolutional neural networks, variational autoencoder, human-computer-interaction, social-interaction and -behavior, virtual- and augmented-reality, simulator sickness, sensor fusion, digital signal processing, localization, and positioning.
Private	Family and friends, music, nutrition, and fitness/cardio sports.

CIVIL SERVICE

2006–2007	Community Service Blaukreuz Haus Rauschenberg in Dachsbach, Germany
TASKS	Supervision of the IT infrastructure; driver assistant for hospital trips

THESES

- | | |
|---------|---|
| 2021 | Data-driven methods for determining position and orientation in radio- and inertial-based dead reckoning systems
Tobias Feigl
Ph.D. Thesis, Friedrich-Alexander-University Erlangen-Nuremberg, Germany |
| ADVISOR | Prof. Dr. Michael Philippsen |
| 2017 | Immersion-optimized sensor fusion for low-cost realtime locating systems in Virtual Reality applications
Tobias Feigl
Masters Thesis, University of Applied Science Erlangen-Nuremberg, Germany |
| ADVISOR | Prof. Dr. Timo Götzelmann |
| 2013 | Conceptual design and implementation of a system configuration tool for a radio-based localization system
Tobias Feigl
Bachelor Thesis, University of Applied Science Erlangen-Nuremberg, Germany |
| ADVISOR | Prof. Dr. rer. nat. Friedhelm Stappert |
| 2011 | Analysis of a radio system configuration framework
Tobias Feigl
Studienarbeit, University of Applied Science Erlangen-Nuremberg, Germany |
| ADVISOR | Prof. Dr. Reinhard Eck |