

Gábor Sörös

Curriculum Vitae

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Professional experience

- Fields of interest augmented reality, wearable computing, computer vision, image processing, interaction with smart objects, computational photography, computational displays, Internet of things, SLAM, robotics, communication technology, ubiquitous computing
- 2019/07 – present **Research scientist** *Nokia Bell Labs, Budapest, Hungary*,
Keywords: augmented reality, computer vision, machine learning, wearable computing
- 2016/04 – 2019/06 **Research scientist and chief architect (formerly Senior augmented reality engineer)** *Kapanu AG (ETH spin-off), Zurich, Switzerland*, Visual computing for dentistry, lead engineer and architect of our cross-platform mobile AR engine, technology scout. Since 2019/07 as consultant.,
Keywords: embedded computer vision, face tracking, C++, OpenGL ES, iOS Swift, Android
- 2016/07 – 2017/06 **Postdoctoral researcher** *Institute for Pervasive Computing, ETH Zurich, Zurich, Switzerland*, Research focusing on wearable computing, augmented reality, smart environments, Since 2017/07 I am still actively supervising three PhD students
- 2011/03 – 2016/06 **Research and teaching assistant** *Institute for Pervasive Computing, ETH Zurich, Zurich, Switzerland*, Research focusing on blur removal from photos on mobile devices / Human computer interaction / Augmented reality / Gesture recognition / Internet of things, Teaching algorithms and data structures, Java, Android, Ubiquitous computing
- 2011/09 – 2015/02 **Scientific advisor** *Scandit AG, Zurich, Switzerland*, Research on barcode scanning with mobile and wearable devices, Lecturing on various computer vision topics, Keywords: motion blur removal, deconvolution, embedded GPU programming, embedded computer vision
- 2014/06 – 2014/10 **R&D Intern** *Qualcomm Research, Vienna, Austria*, Investigated and developed novel computer vision algorithms to track a wide variety of feature-poor 3D objects using mobile devices, Keywords: mobile AR, 3D object tracking, Vuforia, Android, C++, OpenGL ES
- 2010/03 – 2010/12 **Undergraduate research assistant** *Institute of Computer Graphics and Algorithms, Vienna University of Technology, Vienna, Austria*, Invented augmented visualization using natural feature tracking, Keywords: scientific visualization, volume rendering, augmented reality, planar tracking, video encoding, Java, C++, Android
- 2008/02 – 2010/02 **Undergraduate research assistant** *Cognitive Informatics Research Group, Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA-SZTAKI), Budapest, Hungary*, Designed and implemented various human interfaces for robot control and telemanipulation, Keywords: VR, motion capture, 3D CAVE, Ogre3D engine, Qt, Wii, VirCA
- Summer 2009 **Trainee** *Institute of Information Processing Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany*, Designed and implemented a hardware Ogg-Vorbis decoder on FPGA, Keywords: FPGA, VHDL, Synopsys and Cadence tools
- Summer 2008 **R&D Intern** *Emerging Information Technology in Manufacturing (ITM) Norwegian-Hungarian Joint Laboratory, Budapest, Hungary*, Developed an application for robot control with a motion capture suit in a 3D CAVE, Keywords: C++, Qt, 3D computer graphics, IP networking, *best student paper award*

Summer 2007 **R&D Intern** *Department of Broadband Telecommunications and Electromagnetic Theory, Budapest University of Technology and Economics, Budapest, Hungary*, Developed a digital terrain model for radio wave propagation simulations, Keywords: Matlab, C++, GIS

Education

- 2011/03 – 2016/05 **PhD in Computer Science**
Area: Mobile and wearable computer vision,
Institute for Pervasive Computing, ETH Zurich, Switzerland,
Thesis committee: Friedemann Mattern, Otmar Hilliges, Dieter Schmalstieg
- 2009/02 – 2011/01 **MSc in Electrical Engineering (with highest honors)**
Major in Infocommunication Systems, Minor in Virtual Reality Systems,
Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics (BME), Budapest, Hungary,
Two semesters at the Faculty of Informatics, Vienna University of Technology, Austria
- 2005/09 – 2009/01 **BSc in Electrical Engineering (with highest honors)**
Major in Infocommunication Networks and Applications,
Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics (BME), Budapest, Hungary,
Joint curriculum with the Faculty of Electrical Engineering and Information Technology, Karlsruhe Institute of Technology (KIT), Germany
- 2001/09 – 2005/06 **Matura (with distinction)**
Special mathematics education,
Lovassy László Secondary School, Veszprém, Hungary

Other courses and research visits

- July 2018 **International Computer Vision Summer School**
University of Catania/University of Cambridge, Sicily, Italy
- January 2016 **Invited talk at Dagstuhl Seminar 16042 on Eyewear computing**
Leibniz Centre for Informatics, Schloss Dagstuhl, Germany
- 2015 **CTI Business Concept: Startup course of the Swiss government and ETH Zurich**
- March 2014 **Joint work with MSR Interactive 3D Technologies Group on gesture interaction**
Microsoft Research, Cambridge, UK
- June 2013 **UBI Summer School on Designing Mobile Augmented Reality Interfaces**
University of Oulu, Oulu, Finland
- July 2012 **International Computer Vision Summer School**
University of Catania/University of Cambridge, Sicily, Italy
- July 2011 **Networked Embedded Systems Summer School**
European Network of Excellence CONET, Bertinoro, Italy
- July 2011 **Summer School on Interaction, Visualization and Ubiquitous Computing**
University of Zurich, Zurich, Switzerland
- August 2010 **International Summer School (German language course)**
University of Bremen, Bremen, Germany
- September 2009 **Visit in Stuttgart and Heidelberg, Germany**
Scholarship of Baden-Württemberg for engineering, economics and law students
- August 2009 **Vision and Sports Summer School**
ETH Zurich Computer Vision Laboratory, Zurich, Switzerland
- March 2009 **ATHENS Course on Digital Signal and Image Processing**
Czech Technical University, Prague, Czech Republic
- July 2008 **Virtual Reality and Artificial Intelligence Summer School**
Silesian University of Technology, Gliwice, Poland

2002 – 2005 **Erdős Pál Mathematical Creativity Program**

University of Pannonia, Veszprém, Hungary

2002 – 2004 **Preparative Course for the International Physics Olympiad**

ELTE Radnóti Miklós Secondary School, Budapest, Hungary

Technical skills

computer vision, image processing, augmented and virtual reality systems, wearable computing, mobile computing, communication systems, C/C++, Java, Matlab, OpenCV, OpenGL ES, GPGPU, CMake, Git, Android, iOS, Internet of Things, L^AT_EX, Adobe Creative Suite

Personal skills

analytical thinking, quick learning, solving and concisely presenting problems, cross-cultural teamwork, managing parallel projects, technical presentations

Language skills

English	fluent in reading, writing, and speaking (C2 level)
German	fluent in reading, writing, and speaking (C2 level)
Hungarian	native language

Scholarships, awards, honors

11/2018	3 rd prize at ETH Entrepreneur Club startup pitching event 'From Science to Startup'
10/2018	Invited talk in the Art Museum of Liechtenstein at digitalTag
06/2018	Best poster award at the 16 th ACM International Conference on Mobile Systems, Applications, and Services (MobiSys), Munich, Germany
03/2018	Invited talk at digital Liechtenstein workshop on augmented reality
06/2017	Our startup Kapanu AG got acquired by Ivoclar Vivadent AG
03/2017	We presented our AR technology with great success at IDS 2017, a dental trade show with over 155.000 visitors from 157 countries. Named as most innovative technology at the show. Later also featured in TechCrunch and The Verge
10/2015	I presented our research to the President of ETH and the Vice President of Switzerland
2015	Our work was nominated for the ETH Spark Award as one of the 20 most promising inventions of the year
10/2014	We are featured in Neue Zürcher Zeitung
2014	Our work won the Swisscom ICT Award
2013	One of the two nominees of ETH Zurich for the Google European Doctoral Fellowship
2012	Qualcomm Innovation Fellowship Finalist in Mobile Visual Computing
2009-2011	Scholarship of the Hungarian Republic granted by the Minister of Education and Culture
Summer 2010	DAAD Scholarship for Professional Language Course in Bremen, Germany
Spring 2010	Scholarship of the Peregrinatio Foundation for research in Vienna
2009	Outstanding Student of the University Award, BME
2009	Outstanding Student of the Faculty Award
Summer 2009	DAAD Scholarship for Internship in Karlsruhe, Germany
2009	3 rd prize, XXIX. National Undergraduate Research Competition (OTDK)
2008	1 st prize, Undergraduate Research Competition (TDK), BME
Autumn 2007	Scholarship of Robert Bosch GmbH. for studies in Karlsruhe, Germany
2002–2005	Mathematical and Physical Journal (KöMaL) honorable mentions

Teaching experience

ETH Zurich *Informatics 2 for Electrical Engineers* (Spring 2011, 2012, 2013, 2014, 2015, 2016), *Distributed Systems* (Autumn 2011, 2012), *Ubiquitous Computing* (Spring 2012, 2013, 2015), *Seminar 'Interaction in Intelligent Environments'* (Spring 2013, 2014, 2015)

Supervised projects at ETH Zurich

Jing Yang *Multimodal augmented reality (TBD)*, PhD thesis, 2017–
Vincent Becker *Wearable machine learning in interaction with smart objects (TBD)*, PhD thesis, 2016–
Mihai Băce *Wearable eye tracking and egocentric vision (TBD)*, PhD thesis, 2015–
Aimée Montero *Emotion analysis in videos (TBD)*, Lab2, FS 2019 (EPFL)
Felix Pfreundtner *Inside-out Acoustic Head Tracking Using Imaginary Anchor Sources*, Lab, HS2019
Valentin Vasiliu *Coherent rendering with fast and robust photorealistic style transfer*, MSc thesis, HS 2018 (EPFL)
Jonas Wälter *Collaborative augmented reality*, Lab1, HS 2018 (HSR)
Michael Franz *Smartphone camera control with eye gaze*, MSc thesis, HS 2018
Yves Frank *Spatial audio for human-object interactions*, MSc thesis, HS 2018
Shiheng Wang *User-centric rendering for handheld augmented reality*, MSc thesis, HS2017
Andrey Ilnatov *Gaze estimation with convolutional neural networks*, Lab, HS2016
Andreas Hess *Facial augmented reality*, Lab, FS2016
Susanne Keller *Temporal context in human pose estimation*, BSc thesis, FS2016
Pascal Josephy *Visible light communication for smartglasses*, BSc thesis, FS2016
Julia Giger *Real-time solfege hand sign recognition with a wearable camera*, BSc thesis, FS2016
Sander Staal *Gesture recognition with smartwatches*, BSc thesis, FS2016
Luc Humair *Online camera-IMU autocalibration on smartphones*, MSc thesis, FS2015
Mauro Guerini *Wearable shopping assistant*, BSc thesis, FS2015
Marc Fischer *Image processing on mobile GPUs*, BSc thesis, FS2015
Marc Fischer *Coherent rendering for augmented reality*, Seminar, FS2015
Carlo Beltrame *Image processing on mobile GPUs*, Lab, FS2015
Stephan Semmler *Blur removal from document images*, MSc thesis, HS2014
Hermann Schweizer *Smart glasses: technology and applications*, Seminar, FS2014
Severin Mürger *Multiframe visual-inertial blur estimation*, BSc thesis, FS2014
David Chettrit *Designing multi-level visual codes for UAV landing*, BSc thesis, FS2014
Sandro Lombardi *ProFORMA object reconstruction on a smartphone*, BSc thesis, FS2014
Michael Franz *Smart playing cards with Google Glass*, BSc thesis, FS2014
Andy Zimmermann *A biking assistant on Google Glass*, BSc thesis, HS2013
Reto Achermann *Pervasive displays*, Seminar, FS2013
Alexander Grest *Telepresence systems*, Seminar, FS2013
Markus Schalch *A magic lens for visualizing device interactions*, BSc thesis, FS2013
Carlo Beltrame *Motion blur compensation using inertial measurement sensors*, BSc thesis, FS2013
Thomas Knell *Business card recognition with a head-mounted camera*, BSc thesis, FS2013
Ekansh Anand *Price label recognition on mobile phones*, MSc thesis, FS2012
Luc Humair *Credit card recognition on smartphones*, BSc thesis, FS2012
Bram Scheidegger, Claude Barthels *Visualizing network flows in a smart home using a tablet as a magic lens*, Lab, FS2012
Moritz Hoffmann, Claudio Gargiulo *Automatic topology estimation in wireless lamp networks*, Lab, HS2012

Selected publications

- Valentin Vasiliu, **Gábor Sörös** – Coherent rendering of virtual smile previews with fast neural style transfer, *IEEE Symposium on Mixed and Augmented Reality (ISMAR 2019)*, Beijing, China, October 14–18, 2019
- Vincent Becker, Linus Fessler, **Gábor Sörös** – GestEar: Combining Audio and Motion Sensing for Gesture Recognition on Smartwatches, *International Symposium on Wearable Computers (ISWC)*, London, UK, September 11–13, 2019
- Jing Yang, Yves Frank, **Gábor Sörös** – Hearing Is Believing: Synthesizing Spatial Audio from Everyday Objects to Users, *10th Augmented Human International Conference (AH)*, Reims, France, March 2019
- Vincent Becker, Felix Rauchenstein, **Gábor Sörös** – Investigating Universal Appliance Control through Wearable Augmented Reality, *10th Augmented Human International Conference (AH)*, Reims, France, March 2019
- Vincent Becker, Pietro Oldrati, Liliana Barrios, **Gábor Sörös** – TouchSense: Classifying Finger Touches and Measuring their Force with an Electromyography Armband, *22nd International Symposium on Wearable Computers (ISWC)*, Singapore, Singapore, October 2018
- Jing Yang, Shiheng Wang, **Gábor Sörös** – User-Perspective Rendering for Handheld Applications, *International Symposium on Mixed and Augmented Reality (ISMAR) Adjunct*, Munich, Germany, October 2018
- Jing Yang, **Gábor Sörös** – Poster: Spatial audio for human-object interactions in small AR workspaces (**best poster award**), *16th ACM International Conference on Mobile Systems, Applications, and Services (MobiSys)*, Munich, Germany, June 2018
- Mihai Bâce, Sander Staal, **Gábor Sörös** – Wearable eye tracker calibration at your fingertips, *Symposium on Eye Tracking Research and Applications (ETRA)*, Warsaw, Poland, June 2018
- Vincent Becker, Pietro Oldrati, Liliana Barrios, **Gábor Sörös** – Poster: TouchSense: Classifying and measuring the force of finger touches with an electromyography armband, *9th Augmented Human International Conference (AH)*, Seoul, South Korea, February 2018
- Jing Yang, **Gábor Sörös** – Poster: Augmenting smart object interactions with smart audio, *9th Augmented Human International Conference (AH)*, Seoul, South Korea, February 2018
- Vincent Becker, Mihai Bâce, **Gábor Sörös** – Wearable machine learning for recognizing and controlling smart devices, *Workshop on Object Recognition for Input and Mobile Interaction at the 19th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI)*, Vienna, Austria, September 2017
- Mihai Bâce, Philippe Schlattner, Vincent Becker, **Gábor Sörös** – Facilitating object detection and recognition through eye gaze, *Workshop on Object Recognition for Input and Mobile Interaction at the 19th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI)*, Vienna, Austria, September 2017
- Mihai Bâce, Sander Staal, **Gábor Sörös**, Giorgio Corbellini – Collocated multi-user gestural interactions with unmodified wearable devices, *Journal of Augmented Human Research*, Vol. 2, August 2017
- Mihai Bâce, **Gábor Sörös**, Sander Staal, Giorgio Corbellini – HandshakAR: Wearable augmented reality system for effortless information sharing, *Augmented Human Conference (AH)*, Mountain View, CA, USA, March 16–18, 2017
- **Gábor Sörös**, Marcel Lancelle, Nicolas Degen, Roland Mörzinger – Mobile augmented reality for dentistry: virtual try-on in live 3D, *Demo at the 14th European Conference on Computer Vision (ECCV)*, Amsterdam, The Netherlands, October 8–16, 2016
- **Gábor Sörös**, Julia Giger, Jie Song – Solfège hand sign recognition with smart glasses, *Demo at the 1st Workshop on Egocentric Perception, Interaction, and Computing (EPIC)*, Amsterdam, The Netherlands, October 8, 2016
- Frederik Hermans, Liam McNamara, **Gábor Sörös**, Christian Rohner, Thiemo Voigt, Edith Ngai – FOCUS: Robust visual codes for everyone, *14th Annual International Conference on Mobile Systems, Applications, and Services (MobiSys)*, Singapore, Singapore, June 26–30, 2016
- Marian George, Dejan Mircic, **Gábor Sörös**, Christian Floerkemeier, Friedemann Mattern – Fine-grained product class recognition for assisted shopping, *IEEE International Conference on Computer Vision (ICCV) Assistive Computer Vision and Robotics Workshop*, Santiago, Chile, December 11–18, 2015
- **Gábor Sörös**, Stephan Semmler, Luc Humair, Otmar Hilliges – Fast blur removal for wearable QR code scanners, *19th International Symposium on Wearable Computers (ISWC)*, Osaka, Japan, September 7–11, 2015
- Jie Song, **Gábor Sörös**, Fabrizio Pece, Otmar Hilliges – Estimation of 3D hand position and gestures on unmodified wearable devices, *Extended Abstract at the 28th IEEE Conference on Computer Vision and Pattern Recognition (CVPR) HANDS Workshop*, Boston, MA, USA, June 7–12, 2015
- **Gábor Sörös**, Severin Münger, Carlo Beltrame, Luc Humair – Multiframe visual-inertial blur estimation and removal for unmodified smartphones, *23rd International Conference on Computer Graphics, Visualization and Computer Vision (WSCG)*, Plzen, Czech Republic, June 8–12, 2015
- Jie Song, Fabrizio Pece, **Gábor Sörös**, Marion Koelle, Otmar Hilliges – Joint estimation of 3D hand position and gestures from monocular video for mobile interaction, *ACM SIGCHI Conference on Human Factors in Computing Systems (CHI)*, Seoul, South Korea, April 18–23, 2015

- Simon Mayer, Yassin N. Hassan, **Gábor Sörös** – A magic lens for revealing device interactions in smart environments, *ACM SIGGRAPH Asia 2014 Symposium on Mobile Graphics and Interactive Applications (MGIA)*, Shenzhen, China, December 3–6, 2014
- Jie Song, **Gábor Sörös**, Fabrizio Pece, Sean Ryan Fanello, Shahram Izadi, Cem Keskin, Otmar Hilliges – In-air gestures around unmodified mobile devices, *27th ACM User Interface Software and Technology Symposium (UIST)*, Honolulu, Hawaii, October 5–9, 2014
- Jie Song, **Gábor Sörös**, Fabrizio Pece, Sean Ryan Fanello, Shahram Izadi, Cem Keskin, Otmar Hilliges – In-air gestures around unmodified mobile devices, *Demo at the 13th European Conference on Computer Vision (ECCV)*, Zurich, Switzerland, September 6–12, 2014
- Simon Mayer, **Gábor Sörös** - User Interface Beaming – Seamless interaction with smart things using personal wearable computers, *2014 International Conference on Wearable and Implantable Body Sensor Networks (BSN) Workshop on Glass and Eyewear Computers*, Zurich, Switzerland, June 16–20, 2014
- **Gábor Sörös** – GPU-accelerated joint 1D and 2D barcode localization on smartphones, *39th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Florence, Italy, May 4–9, 2014
- **Gábor Sörös**, Christian Flörkemeier – Blur-resistant joint 1D and 2D barcode localization for smartphones, *12th International Conference on Mobile and Ubiquitous Multimedia (MUM)*, Lulea, Sweden, December 2–5, 2013
- **Gábor Sörös**, Florian Daiber, Tomer Weller – Cyclo, A personal bike coach through the Glass, *ACM SIGGRAPH Asia 2013 Symposium on Mobile Graphics and Interactive Applications (MGIA)*, Hong Kong, November 19–22, 2013
- Simon Mayer, Markus Schalch, Marian George, **Gábor Sörös** – Device recognition for intuitive interaction with the Web of Things, *Poster at the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing (Ubicomp)*, Zurich, Switzerland, September 8–12, 2013
- **Gábor Sörös**, Christian Flörkemeier – Towards next generation barcode scanning, *Poster at the 11th ACM International Conference on Mobile and Ubiquitous Multimedia (MUM)*, Ulm, Germany, December 4–6, 2012
- Simon Mayer, Christian Beckel, Bram Scheidegger, Claude Barthels, **Gábor Sörös** – Uncovering device whispers, *Demo at the 11th ACM International Conference on Mobile and Ubiquitous Multimedia (MUM)*, Ulm, Germany, December 4–6, 2012
- **Gábor Sörös**, Peter Rautek, Hartmut Seichter, Eduard Gröller – Augmented visualization with natural feature tracking, *10th ACM International Conference on Mobile and Ubiquitous Multimedia (MUM)*, Beijing, China, December 7–9, 2011
- Péter Galambos, András Róka, **Gábor Sörös**, Péter Korondi – Visual feedback techniques for telemanipulation and system status sensualization, *8th IEEE International Symposium on Applied Machine Intelligence and Informatics (SAMII)*, Herlány, Slovakia, January 28–30, 2010
- **Gábor Sörös**, Barna Reskó, Péter Baranyi – Cognitive supervision system for industrial robots, *2nd IEEE International Conference on Human System Interaction (HSI)*, Catania, Italy, May 21–23, 2009
- Program committee member for conferences: ETRA'19
- Reviewer for conferences: Ubicomp'13, MUM'13, UIST'14, ISMAR'15, Ubicomp'15, ISWC'15, CHI'16, ISMAR'16, UIST'16, MobileHCI'16, Ubicomp'16, Ubicomp'17, ISMAR'17, ETRA'18, ISMAR'18, ETRA'19, CHI'19, EPIC'19, ISMAR'19, ISWC'19
- Reviewer for journals: the IEEE Transactions on Pattern Analysis and Machine Intelligence, the IEEE Transactions on Multimedia, the IEEE Transactions on Computational Imaging, the Elsevier Signal Processing: Image Communication, the Elsevier Image and Vision Computing, the Hindawi Advances in Human-Computer Interaction, the Computer Science and Information Systems (ComSIS), the SPIE Journal of Electronic Imaging, and the ACM Interactive, Multimedia, Wearable and Ubiquitous Technologies (IMWUT)

Patent applications

- Marcel Lancelle, Roland Mörzinger, Nicolas Degen, **Gábor Sörös**, Nemanja Bartolovic – Computer implemented method for modifying a digital three-dimensional model of a dentition, *Europe 18157574.7-1126*, 20.02.2018
- Marcel Lancelle, Roland Mörzinger, Nicolas Degen, **Gábor Sörös**, Nemanja Bartolovic – Method for aligning a three-dimensional model of a dentition of a patient to an image of the face of the patient recorded by a camera, *Europe 18157809.7-1126*, 21.02.2018
- Marcel Lancelle, Roland Mörzinger, Nicolas Degen, **Gábor Sörös**, Nemanja Bartolovic – Dental model attributes transfer, *Europe 18197688.7-1126*, 28.09.2018
- Marcel Lancelle, Roland Mörzinger, Nicolas Degen, **Gábor Sörös**, Nemanja Bartolovic – Rendering a dental model in an image, *Europe 18197645.7-1230*, 28.09.2018
- Marcel Lancelle, Roland Mörzinger, Nicolas Degen, **Gábor Sörös**, Nemanja Bartolovic – Rendering of dental models *Europe 18197524.4-1126*, 28.09.2018