Patrick Knöbelreiter

Curriculum Vitae

Personal Data

Name Dipl.-Ing. Patrick Knöbelreiter, BSc

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Employment

01/2018–present **Graz University of Technology**, *Graz*, Austria.
Institute for Computer Graphics and Vision
University Assistant in Vision, Learning and Optimization Group

08/2017–10/2017 **Amazon - Prime Air**, *Graz*, Austria.
PhD Internship as Applied Scientist, Confidential.

09/2014–07/2017 **Graz University of Technology**, *Graz*, Austria.
11/2017–12/2017 Institute for Computer Graphics and Vision
Research Assistant in Vision, Learning and Optimization Group

09/2013–03/2014 **Microsoft Austria - Vexcel Imaging**, *Graz*, Austria.
Software Development Engineer, Photogrammetric Computer Vision Group
Internship: Master's Thesis with Microsoft Austria
C++, C++ AMP

08/2012–09/2012 **Microsoft Austria - Vexcel Imaging**, *Graz*, Austria.
07/2011, 09/2011 Software Development Engineer, Photogrammetric Computer Vision Group
08/2010–09/2010 *Summer Internship:* Implement interactive viewer for aerial images
C++, C#, HLSL and .NET/WPF

07/2007–09/2008 **Military Service**, *Military Band*, Graz, Austria.

07/2006 **RHI AG**, *Veitsch*, Austria.
07/2005 Maintenance Group
07/2004 *Summer Internship:* build of electrical enclosures, repair of electrical machines, wiring

Education

09/2014–present **Doctoral School of Computer Science**, *Graz University of Technology*, Austria.

2012–2014 **Master's Degree Programme in Computer Science**, *Graz University of Technology*, Austria.
Thesis Title: *Interactive Semantic Segmentation on Aerial Images* in cooperation with Microsoft Photogrammetry

2008–2012 **Bachelor's Degree Programme in Computer Science**, *Graz University of Technology*, Austria.
Thesis Title: *Semi-Automatic 3D-Reconstruction from Ortho-Images* in cooperation with Microsoft Photogrammetry

2002–2007 **Matura (school leaving examination)**, *Höhere Technische Lehranstalt Kapfenberg (technical high school)*, Austria.
Matura Project: *Autonomous Robot*

Expertise

Computer Vision	3D Reconstruction, Motion Analysis, Visual Scene Understanding, Image Processing, Video Processing, Machine Learning, Optimization
Computer Graphics	Augmented Reality, Flow Visualization, Volume Rendering, Visual Effects, Motion Blur, Particle Systems
Computing	GPU Programming, Software Development, Algorithm Design
Programming	Python, CUDA, C, C++, C#, .NET/WPF, Java, OpenGL, GLSL, OpenCL, SciPy, OpenCV, Matlab Image Processing Toolbox
Applications	Visual Studio, Eclipse, Matlab, LaTeX, Mathematica, Blender, Office, etc.
Operating Systems	Windows, Linux

Awards

09/2019 **Best Paper Award at GCPR 2019**.
Paper Title: *Learned Collaborative Stereo Refinement*

05/2019 **Best Paper Award at OAGM 2019**.
Paper Title: *Efficient Multi-Task Learning of Semantic Segmentation and Disparity Estimation*

07/2018 **Symposium Paper Award at IGARSS 2018**.
Paper Title: *Self-Supervised Learning for Stereo Reconstruction on Aerial Images*

07/2007 **Hofrat-Loidl-Medaille 2007**.
Award for the best graduate of the technical high school

Teaching

2017–present	Optimization for Computer Science, exercise
2017–present	Image Processing and Pattern Recognition, exercise
2018–present	Convex Optimization, exercise
2020–present	Machine Learning, exercise

Master Students

Robert Harb	Unsupervised Semantic Segmentation with Mutual Information Estimation, 2020
Manuel Rebol	Frame-To-Frame Consistent Semantic Segmentation, 2019
Peter Lorenz	A Deep-Learning Approach for Occlusion Detection, 2019
Aleksander Colovic	Utilizing Conditional Random Fields in Deep Learning Applications to Semantic Segmentation, 2019

Languages

German	mother tongue
English	fluently in written and spoken

Personal Interests

Business	Machine Learning, Optimization, Stereo Reconstruction, Optical Flow, Semantic Segmentation
Private	Soccer, Tennis, Mountain Biking, Skiing, Table Tennis, Technolgy, Music

Additional Qualifications

Scientific Reviewing	Reviewer for major computer vision conferences: CVPR, ICCV, ECCV, BMVC *Outstanding Reviewer:* CVPR'19, BMVC'19
Teaching	Didactic 1 & 2 seminars of Graz University of Technology
Management	Team lead at student projects at university, class representative
Driver's License	Austrian driver's license, class A (motorbike), B (car), C (truck), E (trailer)
First Aid Course	14-hours course

Appendix - Publications

Belief Propagation Reloaded: Learning BP-Layers for Labeling Problems, *Patrick Knöbelreiter, Christian Sormann, Alexander Shekhovtsov, Friedrich Fraundorfer, Thomas Pock*, Conference on Computer Vision and Pattern Recognition (CVPR), 2020.

Best Paper Award

Learned Collaborative Stereo Refinement, *Patrick Knöbelreiter, Thomas Pock*, German Conference on Pattern Recognition (GCPR), 2019.

Best Paper Award

Efficient Multi-Task Learning of Semantic Segmentation and Disparity Estimation, *Robert Harb, Patrick Knöbelreiter*, Österreichische Arbeitsgemeinschaft für Mustererkennung Workshop (OAGM), 2019.

Learned Energy Based Inpainting for Optical Flow, *Christoph Vogel, Patrick Knöbelreiter, Thomas Pock*, Asian Conference on Computer Vision (ACCV), 2018.

Robot Localisation and 3D Position Estimation Using a Free-Moving Camera and Cascaded Convolutional Neural Networks, *Justinas Miseikis, Patrick Knöbelreiter, Inka Brijacak, Saeed Yahyanejad, Kyrre Glette, Ole Jakob Elle, Jim Torresen*, International Conference on Advanced Intelligent Mechatronics (IAM), 2018.

Symposium Paper Award

Self-Supervised Learning for Stereo Reconstruction on Aerial Images, *Patrick Knöbelreiter, Christoph Vogel, Thomas Pock*, International Geoscience and Remote Sensing Symposium (IGARSS), 2018.

End-to-End Training of Hybrid CNN-CRF Models for Stereo, *Patrick Knöbelreiter, Christian Reinbacher, Alexander Shekhovtsov, Thomas Pock*, Conference on Computer Vision and Pattern Recognition (CVPR), 2017.

Scalable Full Flow with Learned Binary Descriptors, *Gottfried Munda, Alexander Shekhovtsov, Patrick Knöbelreiter, Thomas Pock*, German Conference on Pattern Recognition (GCPR), 2017.

End-to-End Training of Hybrid CNN-CRF Models for Semantic Segmentation using Structured Learning, *Aleksander Colovic, Patrick Knöbelreiter, Alexander Shekhovtsov, Thomas Pock*, Computer Vision Winter Workshop, 2017.

Learning Joint Demosaicing and Denoising Based on Sequential Energy Minimization, *Teresa Klatzer, Kerstin Hammernik, Patrick Knöbelreiter, Thomas Pock*, International Conference on Computational Photography (ICCP), 2016.

Automatic Fly-through Camera Animations for 3D Architectural Repositories, *Patrick Knöbelreiter, Rene Berndt, Torsten Ullrich, Wolf-Dietrich Fellner*, International Conference on Computer Graphics Theory and Applications (GRAPP), 2014.

Appendix - Abstracts of Thesis

Abstracts

Master's Thesis **Interactive Semantic Segmentation on Aerial Images**.

The goal of this work is to create an interactive model for semantic image segmentation. The model should therefore be able to identify both foreground and background objects that are visible on the image with pixel accuracy. In the first step, a user labels e.g. a few pixels showing a car. The labeled pixels are then used directly as a guide in the second step, in which the model learns to distinguish cars from other objects. In the third and final step, the learned model can be used to calculate a semantic segmentation of new images fully automatically. The interactive approach makes it possible to repeat steps 1 to 3, and thus the model can iteratively learn additional new classes and can be updated by correcting incorrectly classified pixels. In summary, this work offers a comfortable and versatile tool for the interactive computation of pixel-wise semantic segmentations of images.

Bachelor's Thesis **Semi-Automatic 3D-Reconstruction from Ortho-Images**.

The aim of this work is the computation of 3D models of buildings from aerial photos. Therefore, the interactive approach enables the user to draw a rough polygon around a building of interest. The system then calculates a full 3D model of the selected building using the user input along with the aerial image and the corresponding depth image. By using the user guidance, color information and depth information together, the 3D model of the selected building can be computed very precisely.

Matura Project **Autonomous Robot**.

The goal of this work is to build an autonomous robot that is suitable for school lessons. The robot consists of several special modules, each module being responsible for a specific task. The first module is the motor module, which takes over the motion control of the robot. By using a stepper motor, it is possible to move the robot very precisely. The second and third modules are responsible for visual navigation. The camera module continuously processes the video stream and can e.g. be used for object detection. The sensor module with mounted ultrasound and infrared sensors is used for collision detection. The individual modules are connected via a CAN bus system and are managed by a subnotebook. This autonomous robot gives students of later classes an interesting and exciting introduction to robotics.