

CONTACT

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SUMMARY

I design and implement **modern computer vision algorithms** for image-based **3D reconstruction** of real-world objects and scenes. My work brings **SOTA research**, including **Deep Learning**, into engineering practice. My research interests lean towards efficient **modeling, capture and reenactment of dynamically changing non-rigid 3D scenes**. Experience in and outside of academia. I love to deliver **clear, spectacular results** with practical **real-world value & impact**. **Engaged & enthusiastic** as a team member. I appreciate **open and uncomplicated communications**, as well as **honest feedback**. Very familiar & comfortable with **Agile/Scrum/Kanban**.

EDUCATION

2018

Master of Science

Computer Science Department, Bauhaus Universität Weimar

Master thesis "*Spatio-Temporal Integration for Real-Time High-Fidelity Reconstruction of 3D Video Avatars*"

2016

Bachelor's degree



Institute of Physics and Technology, NTUU "Igor Sikorsky Kyiv Polytechnic Institute"

Bachelor thesis "*Multi-Fractal Analysis of Steganograms formed through Complex Embedding Methods*"

LANGUAGES

🇬🇧 English C2 CEFR
🇩🇪 German C1 CEFR
🇺🇦 Ukrainian, Russian

ANTON FROLOV

Computer Vision Research Engineer, MSc  

EXPERIENCE

Research associate

2019-Now

Computer Vision in Engineering Research Group

Project "VIGITIA - Networked Intelligent Objects through, on and around Interactive Tables in Everyday Life." Designed and implemented a supervised **Deep Learning**-based approach for **6DoF motion tracking** of rigid objects with highly dynamic appearance (digital screens).

Project "Intelligent Control of Construction Machines and Realistic Training". **Acquisition of multi-resolution 3D videos** at real-world construction sites, as well as in controlled lab conditions. Implemented a **high-end (20 MPx @ 30 Hz) passive stereo RGB-D sensor** based on a pair of PCI-e Ximea cameras. Implemented a **system in hardware & software for continuous on-site image acquisition** with commodity **DSLR** cameras. Designed and implemented an **algorithm for optical focus** (sharpness) localization on the GPU for **on-site image quality evaluation**.

Supervised a semester project "Gigapixels of Perfectly Calibrated Vision". Pixel-perfect **photo-, color- and geometric calibration** of high-end sensors with state-of-the-art methods.

Supervised a Master thesis "Deep Learning based Stereo Matching for High-Resolution Images".

- **C/C++, CUDA, Python, OpenCV, Jupyter, Matlab, Agisoft Metashape**
- **3D Reconstruction: SfM, MVS, RGB-D, real-time stereo-matching**
- **Deep Learning: PyTorch, TorchScript**
- **Kinect Azure, Baumer GigE, Ximea xiB-64, Canon EOS series, Intel RealSense, Z+F laser scanners**

Research associate

2018-2019

Virtual Reality and Visualization Research Group

Introduced further integrations for immersive virtual reality participation within Closed Loop Engine (CLE) of Neurorobotics Platform (NRP). **Real-time (live) streaming of arbitrary textured geometry** reconstructed with a calibrated setup of **Microsoft KinectV2** sensors into **simulated robotic sensor streams**.

Student research associate

2017-2018

Virtual Reality and Visualization Research Group

Conceptualized and implemented integration between the AVANGO framework for immersive virtual reality applications and Neurorobotics Platform (NRP) of the Human Brain Project. **Real-time multi-party bidirectional streaming of scene hierarchies** to and from NRP simulations. Elements of **interactivity and participation**, e.g. **physical interaction** with NRP **simulations**.

Frontend Developer Web & Mobile Freelance

2012-2016

20+ projects with clients in , , . Work in teams of 3-4 people alongside with designers, back-end devs, etc. Occasional PM roles.

- **CSS/SCSS, Javascript, C/C++, Java, Android SDK & NDK, React,**

SKILLS

Software Eng & Tools 11+ years

Git, SVN, Docker, Sublime, VSCode, JetBrains IDEs,
Eclipse, Vim, LaTeX, Markdown
Linux, Raspberry Pi, Arduino
Agisoft Metashape, QGIS

CPU 7+ years

C/C++, Python, OpenCV,
Colmap, Ceres, Matlab, Java

GPU 5+ years

CUDA, OpenGL, OpenCL

ML & DL 4+ years

PyTorch, Jupyter, TensorBoard,
TorchScript, Detectron,
TensorFlow, scikit-learn,
XGBoost, Keras

Mobile 5+ years

Android SDK & NDK,
OpenGL ES

Web 11+ years

Node.js, React, Three.js,
WebGL, CSS/SCSS, PHP

Cameras & Sensors 5+ years

Kinect v2 & Kinect Azure,
Intel RealSense, Baumer GigE,
Ximea xiB-64, Canon, Sony,
Z+F PROFILER 9012A, IMAGER
5016

PUBLICATIONS

- [1] A. Frolov, G. Rendle, A. Kreskowski, M. Kaisheva, B. Froehlich, and V. Rodehorst, "Towards free-viewpoint video capture in challenging environments for collaborative & immersive analysis," *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. XLIII-B2-2021, pp. 419–426, 2021. DOI: 10.5194/isprs-archives-XLIII-B2-2021-419-2021.
- [2] C. Matthes, T. Weissker, E. Angelidis, *et al.*, "The collaborative virtual reality neurorobotics lab," in *2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, 2019, pp. 1671–1674. DOI: 10.1109/VR.2019.8798289.

PROJECTS

Master Thesis

Dec 2018

Computer Vision / VR / Computer Graphics

"Spatio-Temporal Integration for Real-Time High-Fidelity Reconstruction of 3D Video Avatars". Conceptualized and implemented a **volumetric spatio-temporal (4D) integration** pipeline in the spirit of the principles proposed in **Fusion4D** (Dou et al., 2016). Multiple hybrid **RGB-D** sensor streams (**Microsoft KinectV2**) were merged into a continuous volumetric representation after the problem of **non-rigid alignment** has been solved numerically via a trust-region method on the **GPU**.

- C/C++, OpenCV, CUDA
- Optical Flow, Non-rigid Alignment with ED graphs, Non-linear Least Squares, Gauss-Newton, Levenberg-Marquardt, real-time online 3D reconstruction with TSDF Volumes, Kinect v2, Calibration & Sync

Semester Project "Terabytes of Textures for Immersive Virtual Environments"

2018

Virtual Reality and Visualization Research Group

Implemented a highly performant **Virtual Texturing** system to facilitate **output-sensitive level-of-detail texturing** in **virtual reality**. The system was capable of efficiently rendering over **1Tb of texture data** using a **single GPU**.

- C/C++, OpenGL, GLSL, Virtual Texturing

Course Project "Direct Volume Rendering (DVR) on Android"

2017

Virtual Reality and Visualization Research Group

Implemented & deployed a proof-of-concept **raycasting** engine implementing **DVR** to run natively on an Android tablet.

Semester Project "Visual Provenance"

2017

Virtual Reality and Visualization Research Group

Implemented a proof-of-concept interactive multi-resolution **quality assurance engine** for **point-based sparse (SfM) and dense (MVS) 3D reconstructions**.

- C/C++, OpenGL, GLSL, SfM, MVS, Colmap, octree, kd-tree

Course Project "Bike Patrol"

2017

Mobile Information Systems

Designed & implemented a proof-of-concept mobile application for community traffic policing implementing **license plate recognition (LPR)** and **optical character recognition (OCR)**.

Bachelor Thesis

Jun 2016

Steganalysis / Information Forensics

"Multi-Fractal Analysis of Steganograms formed through Complex Embedding Methods". Designed & implemented **steganography detection model** using Multi-Fractal Detrended Fluctuation Analysis (MF-DFA).

- Python, OpenCV, scikit-learn, Matlab, SVMs, HPC with AWS EC2