Nikolai Poliarnyi

Expert in photogrammetry, 3D computer vision, computational geometry, GPU programming (Vulkan, CUDA, OpenCL), teaching and 'fixing things'. Inventor of breakthrough algorithms published at top-tier venues (ICCV) and presented at international conferences (ISPRS). Passionate about pushing the boundaries of what's possible in computer vision and GPGPU.

Work Experience

- Agisoft Metashape - Since April 2016

Principal Research Engineer (Team Lead)

Computer Vision, Computational Geometry, OpenCL/CUDA/Vulkan, LiDAR, AI/ML

One of the world's leading photogrammetry solutions. Supports Windows, Linux, and macOS, with GPU accelerated computations on NVIDIA, AMD, Intel, and Apple Silicon.
Leading high-impact innovation and performance tuning, mentoring algorithm development at scale, and resolving critical user pain points through deep technical expertise.

- Invented a new GPU-accelerated algorithm for surface reconstruction from depth maps (instead of point cloud), bridging a long-standing gap in quality and performance with industry-leading competitor Reality Capture (Epic) in a critical workflow. The method also enabled processing of city-scale scans on workstations through out-of-core data management. Published a paper at top-tier A* conference ICCV 2021.
- Invented a UAV trajectory-aware reconstruction algorithm that enhances the detail of Digital City Twin models reconstruction from aerial LiDAR scans and makes combined processing from images, aerial LiDAR, and terrestrial LiDAR possible. Presented the report 'LiDAR and Photogrammetry Compared and Combined' at the ISPRS GSW 2023 Conference.
- Invented an OpenCL/CUDA-accelerated depth reconstruction algorithm that solves critical challenges in 3D scanning — such as the reconstruction of thin railings and specular or reflective surfaces. The method also supports Multi-GPU acceleration and builds faster and cleaner results compared to previous methods.
- Invented a novel Vulkan-accelerated texturing algorithm that solves critical challenges: optimizing texture atlas fill ratio, automatically ignoring out-of-focus image regions, and filtering transient objects (e.g., passing cars, pedestrians). The method is out-of-core, making it suitable for consumer-grade PCs.
- Designed and delivered a comprehensive photogrammetry training program to develop and recruit top-tier talents among students (CS Club, CS Center, SPbU, ITMO).
- User-centered roadmap planning via direct community feedback from niche platforms (industry forums, Reddit, GitHub). Monitoring competitor product updates and conducting regular performance benchmarking.
- Developed innovative engineering methodologies to accelerate algorithm development, improve interpretability and maintainability, and simplify debugging. This includes techniques to quickly identify when user-side issues stem from hardware instability rather than software bugs.

- Developed wrappers for OpenCL/CUDA/Vulkan APIs.
- Enhanced cloud performance, achieving 2x faster processing.

- **Transas** - 2014 - 2016 - Mathematician-Programmer

  OpenCV, OpenCL, Python, Cython, Ceres-solver

  Developed a server that produces 3D landscape reconstruction and true orthophoto stitching from UAVs' data.

- **Yandex.Money** - 2014 - Software Developer (Java backend)

- **DevExperts** - 2013 - Software Developer (Java backend)

Skills

- **Computer Vision**: Structure from Motion, Multiple View Geometry, AI/ML, object detection, classification, and segmentation. Developed state-of-the-art algorithms for depth map estimation, surface reconstruction, and texturing, outperforming existing solutions.
- **Vulkan, OpenCL, CUDA, OpenGL, WebGL**: State-of-the-art algorithms of arbitrary complexity. Profiling, accelerating, and adapting algorithms for the GPU. Experienced in working around GPU driver bugs. Explored DeepSeek's fine-grained quantization method, which demonstrated a 2x reduction in training costs in their implementation. Explored algorithms behind Unreal Engine 5 Nanite tech.
- **Computational geometry, CGAL**: computations with absolute accuracy, algorithms and structures like Delaunay triangulation.
- **Teaching**: deep empathy and a talent for making complex topics accessible — both in mentoring teams and teaching at top universities and schools.
- **C++, Python, Java**

Education

- Computer Science Center
- ITMO University, Computer Technologies
- PML №239, mathematical circle, programming contests

Other Activities

- **Photogrammetry course**: developed Photogrammetry course for the Computer Science Club. Teaching it in SPbU and ITMO. Video recordings. Tasks on github.
- **GPGPU course**: developed GPGPU OpenCL course in Computer Science Center. Video recordings. Tasks on github.
- **Conferences**: published a paper on ICCV 2021. Presented the report 'LiDAR and Photogrammetry Compared and Combined' at the ISPRS GSW 2023 Conference. Participated in 3DV 2018 and 3D-ARCH 2019.

- **Public lectures**: GPGPU in CS Space, Science Day in school, Algorithms behind Unreal Engine 5 Nanite tech.
- **Consultant**: provide consulting and project development services to companies and startups on topics related to Computer Vision and GPU acceleration.
- **Open-source**: Vulkan API library. Out-of-core merge sort with GPU acceleration. 96-bit 3D Morton code. OpenCL implementation of EDISON mean shift. Implemented Python bindings for OpenCL algorithms in OpenCV. Contributions to OpenCV, PyOpenCL, jupyter qtconsole and others. GPU monitoring in i3pystatus.
- **Hackathons**: 6 awards at hackathons. Two first places on X-Mas Hack (mission planner for drone swarm). Third place at HackCV (traffic sign recognition), Science Hackday #2 (Startup nomination), Hackday#36 (Autodesk 3D-web nomination), HackEdu by JetBrains (third place). Participation in Junction 2016, 2017.
- **Magister Ludi**: PML №239 programming teacher. Supervise over 20 student game development projects annually.

Contacts

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Updated: June 07, 2025