Dmitry Mikushin

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Academic experience

2019–present **Doctoral Assistant**, *University of Lausanne*, Switzerland

Group of Prof. Simon Scheidegger. R&D for computational finance and advanced data analytics (Machine Learning, Gaussian processes). Development of high-dimensional optimization and classification frameworks as GPU-backed cloud services (C++, Fortran, CUDA, Python).

2015–2019 **Research Associate**, *University of Zurich*, Institut für Banking und Finance, Switzerland

Group of Dr. Simon Scheidegger. Computing global solutions to annually calibrated dynamic stochastic general equilibrium models for policy analysis (overlapping generation models or OLG). Given prototypes from economists within the group, developing production code for large hybrid computing systems equipped with NVIDIA or Intel accelerators (CSCS/Piz Daint, NERSC/Cori). Fine-tuning of value function interpolation kernels on a sparse grid with linear or polynomial basis (AVX, CUDA, Intel Thread Building Blocks). Co-authored a journal paper.

2012–2015 **Doctoral Assistant**, *University of Lugano*, Switzerland

Group of Prof. Olaf Schenk. Assisting education and research activities. Worked on manual optimization and designed tools for automatic optimization of stencil codes in seismic and weather prediction models (CUDA, OpenACC). Main author for a conference paper.

2013 **Visiting Scholar**, *Rutgers University*, New Jersey, US

Group of Prof. Eddy Zheng Zhang. Analyzed the efficiency of atomics on different families of NVIDIA GPUs. Tuned GPU kernels optimizations in KernelGen compiler.

2008–2011 **Junior scientist**, *Supercomputer simulation laboratory for climate modeling, Research Computing Center*, Lomonosov Moscow State University, Russia

Numerical and performance evaluation of various mesoscale and regional models. Experimented with porting key model dynamics blocks on Cell Broadband Engine and GPU architectures.

2006–2007 **Contractor**, *Global Energy Problems Lab*, Moscow Energy Institute

Implemented toolbox for Voronoi tesselation and regression analysis in C#.

Industrial experience

2019–present **Support engineer (part time)**, *Luxoft, a DXC Technology Company*

Emergency & technical support for previously developed backpricing service (financial customer).

2018–2019 **System Analyst (part time)**, *REG.RU*

Overseeing the development of Cloud GPU services for scientific and industrial machine learning. Helping with internal GPU-based spin-off products.

2017–2019 **Lead Technical Expert**, *Luxoft Inc.*

GPGPU for high-performance Monte-Carlo backpricing valuation (financial customer). Complete rewrite of Scala code into C++ & CUDA, skip-ahead optimizations for Sobol QRNG. Design and implementation of efficient GPU kernels for lidar simulation (automotive customer).

2014–present **Owner**, *Applied Parallel Computing LLC (CUDA Education & Research in EMEA)*, `http://parallel-computing.pro/`

2011–2012 **CTO**, *Applied Parallel Computing LLC (CUDA Education & Research in EMEA)*, `http://parallel-computing.pro/`

Managing technological aspects in company's GPGPU training and software development business. Created course list on comprehensive CUDA training program, implemented original presentations and hands-ons, later used in CUDA 4.x Handbook in Russian. Served as trainer on events in Germany, Ireland and Russia. Organizing and reviewing work of 7 company's contracted trainers/developers. Responsible for interaction with customers and partners worldwide.

2009–2011 **DevTech Engineer**, *NVIDIA*, Moscow, Russia

Ported parts of numerical weather prediction models onto GPUs: spectral solver benchmark (Russian Met Office), GPU kernels generator for COSMO model (Deutscher Wetterdienst et al). Supported customers and developers on CUDA programming in HPC applications, provided training sessions. PhysX game physics engine: implemented SPU-interacting radix sort for rigid bodies broad phase algorithm on Cell Broadband Engine processor (Sony PlayStation 3), made first experimental Tegra/ARM ports of PhysX engine, helped with Linux port.

Awards

2013 **PhD fellowship**, *Rutgers University, Department of Computer Science*

2011 **CUDA Certificate 016-2011/29.10.2011**, *NVIDIA*, Moscow, Massively parallel processors, CUDA architecture and programming environment

2008 **PhD fellowship**, *Institute of Numerical Mathematics, Russian Academy of Science*

2008 **T-Platforms PowerXCell 8i Programmers Contest, second award**, *Optimization of mathematical modeling package for hydrodynamics "GeoPhyCell"*

2008 **Best Student Diploma, second award**, *Numerical modeling of mesoscale aerosol transfer due to hydrological inhomogeneity of the boundary layer*

Education

2012–2015 **PhD studies**, *University of Lugano*, Institute of Computational Science, Switzerland

2008–2011 **PhD (ABD – passed qualification and comprehensive examinations)**, *Institute of Numerical Mathematics, Russian Academy of Science*, Moscow

2003–2008 **Specialist (5-year B.S. + M.S program)**, *Faculty of Computational Mathematics and Cybernetics*, Lomonosov Moscow State University, *Computational Technologies and Modeling*

Master thesis

title *Numerical modeling of mesoscale aerosol transfer due to hydrological inhomogeneity of the boundary layer*

supervisors Dr. Vasily N. Lykossov, Dr. Victor M. Stepanenko

Implemented and analyzed Smolarkiewicz transport scheme, the positive-definite method of Lax–Wendroff class. Resulting source code was incorporated into regional non-hydrostatic model of atmosphere and boundary layer (NH3D) and used to trace passive aerosol. Experiments with real terrains showed significant numerical accuracy improvement both in mass conservation and approximation order over leapfrog and first order transport schemes.

Publications

[1] Johannes Brumm et al. "Scalable high-dimensional dynamic stochastic economic modeling". In: *Journal of Computational Science* 11 (2015), pp. 12–25. ISSN: 1877-7503. DOI: `https://doi.org/10.1016/j.jocs.2015.07.004`. URL: `https://www.sciencedirect.com/science/article/pii/S1877750315300053`.

[2] Nianchuan Jian et al. "A GPU-based phase tracking method for planetary radio science applications". In: *Measurement Science and Technology* 31.4 (Jan. 2020), p. 045902. DOI: `10.1088/1361-6501/ab58e5`. URL: `https://dx.doi.org/10.1088/1361-6501/ab58e5`.

[3] Andrey Kuzmin, Dmitry Mikushin, and Victor Lempitsky. "End-to-End learning of cost-volume aggregation for real-time dense stereo". In: *2017 IEEE 27th International Workshop on Machine Learning for Signal Processing (MLSP)*. 2017, pp. 1–6. DOI: 10.1109/MLSP.2017.8168183.

[4] Dmitry Mikushin and Victor Stepanenko. "The Implementation of Regional Atmospheric Model Numerical Algorithms for CBEA-Based Clusters". In: *Parallel Processing and Applied Mathematics*. Ed. by Roman Wyrzykowski et al. Berlin, Heidelberg: Springer Berlin Heidelberg, 2010, pp. 525–534.

[5] Dmitry Mikushin et al. "KernelGen – The Design and Implementation of a Next Generation Compiler Platform for Accelerating Numerical Models on GPUs". In: *2014 IEEE International Parallel & Distributed Processing Symposium Workshops*. 2014, pp. 1011–1020. DOI: 10.1109/IPDPSW.2014.115.

[6] Simon Scheidegger et al. "Rethinking large-scale Economic Modeling for Efficiency: Optimizations for GPU and Xeon Phi Clusters". In: *2018 IEEE International Parallel and Distributed Processing Symposium (IPDPS)*. 2018, pp. 610–619. DOI: 10.1109/IPDPS.2018.00070.

Selected talks

Dmitry Mikushin, Nikolay Likhogrud, Sergey Kovylov. KernelGen: A Prototype of Auto-parallelizing Fortran/C compiler for NVIDIA GPUs, *HPC Advisory Council 2013*, available online

Active skills

CS/Research	**Explore new environments/software and teach others to use them, design & perform experiments to analyse hardware/software properties and generalize findings into practically useful methods/tools**
HPC/Engineer	**Fluency in full development & support cycle of HPC applications for Linux clusters: programming, parallelization for different architectures, debugging, profiling**
Bitcoin mining	**Basic understanding of SHA256 and Zero-knowledge proof. Optimization of Equihash miner for NVIDIA GPUs. Available on GitHub**
Compilers Dev	**Basic knowledge of compilers internal structure, contributions to LLVM. Designed and developed KernelGen – a prototype of auto-parallelizing Fortran/C compiler for NVIDIA GPUs, targeting numerical modelling code**
GPU low-level	**Experience with NVIDIA GPU binary format and Fermi/Kepler assembler, profiling & optimization**
Numericals	**Practical experience with linear solvers, PDEs and related cache-aware optimizations**
NWP	**Engineer-level experience with numerical weather prediction models: WRF-ARW, COSMO**

Teaching

2014 **Parallel & Distributed Computing**, *University of Lugano*
The fundamentals of concurrent execution. Threading in Java. The basics of OpenMP and MPI.

2013–2014 **Parallel & Distributed Computing Lab**, *University of Lugano*
Configuration & deployment of scientific codes on modern GPU-enabled HPC facilities, by example of SWE tsunami simulation model and CSCS "Tödi" cluster

Languages

English	fluent technical
Russian	native