

Konstantin BURLACHENKO

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I have co-created systems for ML, Graphics, Vision, and Physics Simulation, exploiting hardware via DSL and using contemporary areas of Math&CS. My current focus is Federated Learning, a subfield of ML co-invented by my advisor in 2016¹, which becomes a key part of the "US National AI R&D Plan" in 2023. My dissertation is "Optimization Methods and Software for Federated Learning".

EDUCATION

- 2020-Now KSA : Ph.D. candidacy in [CEMSE/CS Program at KAUST](#). Member of Prof. [Peter Richtárik](#)'s Optimization and Machine Learning Lab in [KAUST AI initiative](#) led by [Jürgen Schmidhuber](#). *Transcript* : [Link-1](#). *GPA* : 3.81/4.0
- 2015-2019 [USA, Stanford](#) : Graduate Non-Degree Program. *Transcript* : [Link-2](#), *GPA* : 3.96/4.3, *Total Credits* : 28
- 2015-2018 [USA, Stanford](#) : Data, Models and Optimization Graduate Certificate [Link-3 \(Program\)](#)
- 2016 - 2019 [USA, Stanford](#) : Artificial Intelligence Graduate Certificate [Link-4 \(Program\)](#)
- 2003-2009 Russia, [Bauman Moscow State Technical University](#) : MS in CS. *GPA* : Not Applicable
- Conferences and Summer Schools [ICLR 2024](#); [ACM CoNEXT 2023](#); [Rising Stars in AI Symposium 2024](#) and [2023](#), [EMNLP-2022](#); [ICML-2022](#); [ICML-2021](#); [NeurIPS-2021](#); [ACM CoNEXT 2021](#); [Regularization Methods for ML 2021](#); [The PRAIRIE/MAI AI 2021](#); [Oxford ML-2021](#); [The HSE/MIPT Optimization without Border](#); [ACM SIGGRAPH 2012](#).

EXPERIENCE

- June 2024
September 2024 Internship in Private Federated Learning ML Team, [APPLE](#), Cambridge, UK
Developing innovative approach for memory-efficient on-device fine-tuning of large language models
[Distributed Math Optimization](#) [AI](#) [Federated Learning](#)
- August 2021 Research Scientist Intern (AI) in AI and Systems Co-Design, [META](#), Menlo Park, USA
The internship has not happened due to 15 months process of obtaining J1 VISA to USA
[Distributed Optimization](#) [AI](#) [Federated Learning](#)
- Now
September 2020 CS Ph.D. candidacy and a member of [Prof. Peter Richtárik](#) Optimization and ML Lab², KAUST, KSA
► *Narrow area of research* : Federated Learning, Stochastic Distributed Math Optimization
► *Broad area of interests* : Math Optimization, AI/ML, Compute Optimization, Software Systems, GPGPU, Computer Vision, Computer Graphics, Networks, Cryptography, Control, Physical Simulation
► Sep 2022 - Sep 2023 – Member of [SDAIA-KAUST AI](#) ([invitation letter](#))
► **Awards** : (1) [Dean's Award 2020 KAUST](#); (2) [Grant from Saudi Authority for Data and Artificial Intelligence\(SDAIA\) 2022](#); (3) [Dean's List Award 2023, KAUST](#); (4) [AMD Instinct MI50 from AMD Inc. 2023](#); (5) Winning a grant from Grand Challenge Project Proposal Shaheen III CPU 2024.
[Distributed Optimization](#) [Federated Learning](#) [Applied and Fundamental Math](#) [Computer Vision](#) [Sytems](#) [Cryptography](#)
[C/C++](#) [CUDA](#) [AVX512](#) [Python](#) [CMake](#) [Qt/PyQt](#) [PyTorch](#) [TF](#) [Latex](#) [Git](#) [Google Tests](#) [Bash](#) [NLP](#)
- August 2020
March 2019 Principal Engineer Level 18 | Foundation AI Lab, [HUAWEI](#), Moscow, Russia
► R&D in internal ML Systems middleware for [HUAWEI HiSilicon](#) and [HUAWEI CBG](#)
► Present HiSilicon solutions for engineers, scientists working with ML/AI [OpenTalks.AI](#), [HUAWEI News](#)
► **Awards** : Grade A for a 2019-2020 Year Progress with a one-time payment bonus
[Math Optimization](#) [AI](#) [Custome ISA](#) [C/C++](#) [Python](#) [TVM](#) [Java](#) [Google Protobuf](#) [CMake](#) [Qt](#) [TF](#) [SQL](#)
- March 2019
July 2014 Senior Developer Technology Engineer Level IC3, [NVIDIA](#), Moscow, Russia
► [Driveworks SDK](#) - SDK for self-driving cars adopted by automotive partners. Computer vision, machine learning, calibration, egomotion. Implementation and presentation of the modules internally
► [PhysX/Apex SDK](#) - An industry standard for game physics simulation, graphical special effects. Internal implementation and communication with Blizzard
► [cuDNN/cuBLAS](#) libraries - GPU computation libraries used by more than 1M customers in machine learning and HPC. Implementation, Documentation, and collaboration with Mathworks
► [RAPIDS](#) - GPU based implementation of SkLearn, XgBoost, Pandas. I was resnposible for SkLearn
► **Awards** : Funding support of visiting two NVIDIA GTC conference
[CUDA](#) [GLSL](#) [C++](#) [AARCH64](#) [SSE2/ARM NEON](#) [Linux](#) [Windows](#) [PS4](#) [XBox](#) [OpenGL](#) [Google Tests](#) [GitLab](#)
[Perl](#) [Python](#) [CMake](#) [Make](#) [Qt](#) [Git](#) [TensorFlow](#) [Computer Vision](#) [Graphics](#) [Deep Learning](#) [CppCheck](#)

1. [Federated Learning : Strategies for Improving Communication Efficiency \[J.Konečný, H.B.McMahan, F.X.Yu, P.Richtarik, A.T.Suresh, D.Bacon, NIPS 2016\]](#)

2. To avoid academic disputes over authorship order and focus on work, the Lab adopts the concept of "Every Author as First Author" [arXiv:2304.01393](#)

July 2014 Senior Developer Engineer | Yandex Video Team, [YANDEX](#), Moscow, Russia

May 2013

- ▶ Text and statistical machine learning features for [Yandex Video Search](#)
- ▶ Infrastructure for storage and analysis of web documents with embedded video on the WWW
- ▶ **Awards** : Two one-time payment bonuses due to the delivery of products in production

C++ Google Protobuf JavaScript Bash Python Computer Science HTML/JS/CSS SVN MapReduce ML

April 2013 Team Lead Physics Engine Developer, FITTING REALITY, Moscow, Russia

March 2012

- ▶ Develop library for clothing simulation in [CUDA](#) and in [OpenCL](#) with facade interface to C++/C#
- ▶ Custom render engine for clothing visualization compatible with OpenGL 1.2
- ▶ Prepare elements of the demo for investors. Carry internal MATH/CS/PHYS training
- ▶ Manage a team of 4 members
- ▶ **Awards** : Funding visit of SIGGRAPH 2012, USA conference

C++ C OpenGL GLSL Qt Posix WinAPI QMake CUDA OpenCL Physics Graphics Ogre C#

March 2012 Software Developer Engineer, [ACRONIS](#), Moscow, Russia

September 2010

- ▶ Key member of GUI team for [Acronis Backup and Recovery 2011 Enterprise](#)
- ▶ Profiling and optimization of the codebase working in user/kernel space for Windows OS

C++ C WinAPI WinDbg VmWare Specialized GUI library SVN SysInternals CppCheck ASM x86 AqTime

September 2010 Senior Software Developer Engineer, CAPITAL RESEARCH, Moscow, Russia

March 2009

- ▶ Developed Firefox plugin to create the three-dimensional HTML view for basic HTML elements

Firefox C++ WinAPI HTML/JS/CSS Windows OpenGL GLSL SVN

June 2009 C++ Programming Engineer, FLINT AND CO, Moscow, Russia

December 2006

- ▶ Created several computer games with computer vision and graphics part, hardware drivers
- ▶ Spent time on factory floors to test and analyze the quality of my solutions. Carry trips to customers

C++ SDL Posix WinApi Development Image Library Low-level programming Computer Vision OpenGL SVN

November 2006 C++ Programming Engineer (Part-time work), ASTRASOFT TECHNOLOGY, Moscow, Russia

March 2006

- ▶ Developed visual elements of management system based on Qt and OpenGL

C++ Qt Windows OpenGL SVN

PRESENTATIONS

- MAY-2024 [APPLE Inc, UK, USA, KSA remotely](#) : Research talk for APPLE Inc.
- MAY-2024 [ICLR 2024, Austria](#) : Error Feedback Reloaded
- APR-2024 [NVIDIA Inc, USA and KSA remotely](#) : Research talk for NVIDIA Inc.
- MAR-2024 [MLSS 2024, Japan](#) : Error Feedback Reloaded
- FEB-2024 [AI Symposium, KSA](#) : Unlocking FedNL : Self-Contained Compute-Optimized Implementation
- DEC-2023 [ACM DistributedML2023, France](#) : Federated Learning is Better with Non-Homomorphic Encryption.
- JUN-2023 [SIAM, USA](#) : FL_PyTorch : Optimization Research Simulator for FL
- MAR-2023 [VCC OPEN HOUSE 2023 event, KSA](#) : FedNL. Making Newton-Type Methods Applicable to FL.
- DEC-2022 [EMNLP 2022, Abu Dhabi, UAE](#) : Presenter in KAUST AI Initiative Booth.
- OCT-2022 [CS Ph.D. Proposal Defense, KSA](#) : Dissertation Title : *Optimization Methods and Software for Federated Learning*. Committee members : *Eric Feron, Marco Canini, Peter Richtarik*.
- JUL-2022 [ACM Symposium, Italy](#) : MARINA : Faster non-convex distributed learning with compression.
- MAR-2022 [AI Symposium KAUST, KSA](#) : FL_PyTorch : Optimization Research Simulator for FL
- DEC-2021 [ACM DistributedML2021, Rome](#) : FL_PyTorch : Optimization Research Simulator for Federated Learning.
- JUL-2021 [Spotlight for in ICML-2021, Virtual](#) : MARINA Faster Non-Convex Distributed Learning with Compression.
- APR-2021 [NSF-TRIPODS Workshop, Virtual](#) : MARINA : Faster Non-Convex Distributed Learning with Compression.
- FEB-2020 [OpenTalks.AI conference, Russia](#) : Huawei technologies for AI developers.
- JUL-2019 [Educational Center Sirius, Russia](#) : Deep Learning Course with [D.Kamzolov](#) and [A.V. Gasnikov](#)
- DEC-2018 [MIPT, Russia](#) : Lectures about subtle things around Decision Trees, Gradient Boosting and Random Forest.
- APR-2016 [GTC 2016, USA](#) : Presenter in [Driveworks NVIDIA](#) booth.
- AUG-2012 [ACM SIGGRAPH 2012, USA](#) : Presenter in [CentiLeo](#) booth, and visitor from Fitting Reality.

EVALUATING THE WORK OF OTHERS

1. Reviewer in a peer-reviewed proceeding for [ICML'22](#), [AISTATS'23](#), [JMLR'24](#), [ICML'24 Workshop](#), [ICLR'25](#).
2. Participates in annual review processes for estimating the work of my colleagues in HUAWEI, NVIDIA, and Yandex.

PV-TUNING : BEYOND STRAIGHT-THROUGH ESTIMATION FOR EXTREME LLM COMPRESSION	2024
https://arxiv.org/abs/2405.14852 Presentation and proceedings to <i>NeurIPS -2024</i> , [Oral Paper, Top 0.4%]	
UNLOCKING FEDNL : SELF-CONTAINED COMPUTE-OPTIMIZED IMPLEMENTATION	2024
https://arxiv.org/abs/2410.08760 Under a peer-review process	
ERROR FEEDBACK RELOADED : FROM QUADRATIC TO ARITHMETIC MEAN OF SMOOTHNESS CONSTANTS	2024
https://openreview.net/forum?id=Ch7WqGcGmb https://arxiv.org/abs/2402.10774 Presentation and proceedings to <i>ICLR-2024</i> .	
FEDERATED LEARNING IS BETTER WITH NON-HOMOMORPHIC ENCRYPTION	2023
https://dl.acm.org/doi/10.1145/3630048.3630182 https://arxiv.org/abs/2312.02074 Presentation and proceedings to <i>4th ACM International Workshop on Distributed Machine Learning</i>	
ERROR FEEDBACK SHINES WHEN FEATURES ARE RARE	2023
https://arxiv.org/abs/2305.15264 Under a peer-review process	
FEDERATED LEARNING WITH REGULARIZED CLIENT PARTICIPATION	2023
https://icml.cc/virtual/2023/27049 https://arxiv.org/abs/2302.03662 Presentation. Workshop Federated Learning and Analytics in Practice at <i>ICML 2023</i>	
SHARPER RATES AND FLEXIBLE FRAMEWORK FOR NONCONVEX SGD WITH CLIENT AND DATA SAMPLING	2022
https://openreview.net/forum?id=zKgJ6TWAFE https://arxiv.org/abs/2206.02275 Proceedings <i>Transactions on Machine Learning Research (TMLR)</i>	
FEDERATED OPTIMIZATION ALGORITHMS WITH RANDOM RESHUFFLING AND GRADIENT COMPRESSION	2022
https://icml.cc/virtual/2023/27050 https://arxiv.org/abs/2206.07021 Presentation and proceedings to <i>NeurIPS -2024</i> Presentation Workshop Federated Learning and Analytics <i>ICML 2023</i>	
FASTER RATES FOR COMPRESSED FEDERATED LEARNING WITH CLIENT-VARIANCE REDUCTION	2021
https://epubs.siam.org/doi/pdf/10.1137/23M1553820 https://arxiv.org/abs/2112.13097 Proceedings <i>SIAM Journal on Mathematics of Data Science (SIMODS)</i> .	
FL_PYTORCH : OPTIMIZATION RESEARCH SIMULATOR FOR FEDERATED LEARNING	2021
https://dl.acm.org/doi/abs/10.1145/3488659.3493775/ https://arxiv.org/abs/2202.03099 Presentation and proceedings to <i>2nd ACM International Workshop on Distributed Machine Learning</i>	
MARINA : FASTER NON-CONVEX DISTRIBUTED LEARNING WITH COMPRESSION	2021
https://proceedings.mlr.press/v139/gorbunov21a.html https://arxiv.org/abs/2102.07845 Presentation and proceedings to <i>ICML 2021</i>	
PERSONALIZED FEDERATED LEARNING WITH COMMUNICATION COMPRESSION	2021 – 2022
https://openreview.net/pdf?id=dZugyhbNfY https://arxiv.org/abs/2209.05148 Proceedings <i>Transactions on Machine Learning Research (TMLR)</i>	

ENGINEERING EXPERTISE

Programming Languages that I have used	C89/C99, C++20/11/03, C#, Cython, Java ,x86/AArch64, NDA ASM
Scripting Languages that I have used	Python, Bash, Perl, and Cython which is between scripting and compile languages.
DSL Languages that I have used	GL SL, TVM, Google Protobuf, CUDA, OpenCL, Matlab, R, SQL
Frameworks	Qt, CUDA, WinApi, Posix, OpenGL, OpenCL, PyTorch, TensorFlow, CvxPy
Operating Systems	Windows, Linux based, Orbis, Xbox, Android, NDA OS-es
Development Environments	QtCreator, Visual Studio, Eclipse, WinDbg, Android Studio, TexStudio, Nsight
General purpose development tools	SysInternals, AqTime, Cmake, GNU Toolchain, CppCheck, Valgrind, Git, QMake
Typing DSL Languages	Latex, HTML, XML, Markdown
Areas in which I worked	Federated Learning, Stochastic Distributed Math Optimization, Computer Vision, Statistical Learning, System Programming, HPC and GPU Programming, Math Optimization, Computer Graphics, Computational Physics, Distributed Systems.
Sports achievements	The Candidate Master in chess by FIDE. (My FIDE profile). Second Place in the KAUST Chess Tournament in Oct 2022.

TECHNICAL NOTES

Technical Note : From C++98 to C++2x

2022-2024

github.com/burlachenkok/Cpp_Technical_Note/blob/main/Cpp-Technical-Note.md [Short Information](#)

The technical note is dedicated for all primary C++ programming language standards : C++03/98/11/14/17/20. The note has been adopted to [AMD Inc.](#) internal education web portal. Also it has been highly assessed by : (i) Marco Foco, Head of the Delegation for Italy ISO C++ JTC1/SC22/WG21; (ii) [Prof. David Keyes](#), Director of [Extreme Compute Research Center at KAUST](#).

Technical Note : Exploring Python3 Language from a Computing Perspective

2023

github.com/burlachenkok/exploring-python3/blob/main/python3-note.md [Short Information](#)

The note contains a language tutorial, a description of several libraries, and a description of several low-level profiling tools for Linux/Posix OS and Windows OS Family. It has been adopted to [Introduction to Data Science workshop series at KAUST](#).

SELECTED PROJECTS

MATH OPTIMIZATION RESEARCH STUDIO

KAUST, 2020

[Project report - Math Optimizaiton Research Studio](#) [Description](#) [Bitbucket repo](#)

CS380 : Math Optimization Research Studio. Self-developed command line interpreter with custom script language with self-developed backend computation in C++/CUDA.

C++ Linux Windows CUDA CMake Dot Google Test Python Bash

EXPERIMENTAL NEURAL NET FRAMEWORK

STANFORD, 2019

[Report.CS230 - 2019](#) [Poster CS230 - 2019](#) [bitbucket repo](#) [Presentation](#)

CS230 : Experimental Neural Net Framework. Wall-clock relative speedup compared to Google Tensor Flow x3.5.

C++ Linux Windows CUDA Python CMake

CONVEX OPTIMIZATION SOLVERS WITH LEVERAGING INTO GPU/CPU POWER FOR AI/ML

STANFORD, 2018

[Poster CS221 - 2018](#) [Bitbucket repo](#)

CS221 : Convex optimization solvers with leveraging into GPU/CPU power for AI/ML. Lasso regression speedup with GPU is x12.6 compared to CPU standard solvers.

C++ Linux Windows CUDA Python CMake Convex Optimization

CONVEX OPTIMIZATION FOR MACHINE LEARNING

STANFORD, 2017

[Poster CS229 - 2017.](#) [Presentation](#)

Stanford, CS229 : Convex Optimization for Machine Learning. Several solvers that work x8 faster than SkLearn.

C++ Visual Studio Numerical Linear Algebra Convex Optimization Python CMake

PLOTTER++. STANDALONE TOOL FOR PLOTTING IMAGES, GRAPHS, POINT CLOUDS. COMMUNICATION:TCP/IP

HOLIDAYS, 2017

github.com/burlachenkok/plotter_plusplus [Presentation](#)

An advanced scientific plotter tool suitable to use in connection with embedded systems.

C++ Linux Windows Embedded Systems Qt Python

HTML REPORT GENERATOR FOR GOOGLE TESTS

HOLIDAYS, 2016

[GitHub](#)

Generate and compare different [Google Test](#) reports. Used by [Hyundai AutoEver](#), and [Hapsoft Consulting](#).

Python HTML XML

REFERENCES

Andrew Ng

Assistant Professor, STANFORD, [LETTER](#)

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