Konstantin BURLACHENKO
Ph.D. candidacy in Computer Science program, CEMSE division at KAUST

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I have created state-of-the-art systems for Machine Learning, Computer Graphics, Computer Vision, and Computational Physics, exploiting hardware via DSL and using contemporary areas of Applied Math and CS. My current focus is Federated Learning, the branch of ML co-invented by my advisor in 2016 [1] which will be the next big step of Machine Learning. I defended the status of a Ph.D. candidacy on 24 October 2022. My dissertation title is *"Optimization Methods and Software for Federated Learning"*.

🎓 EDUCATION

2020-Now	KSA : Ph.D. program 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. Awards :* (1) Dean's Award 2020, KAUST ; (2) Grant from SDAIA 2022 ;(3) Dean's List Award 2023, KAUST ; (4) AMD Radeon Instinct MI50 from AMD Inc.
2015-2019	USA, Stanford : Graduate Non-Degree Program. *Transcript* : Link-2. *GPA : 3.96/4.3*
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 : Master Degree (Bologn process equivalent) in Computer Science and Control Systems. *GPA : Not Applicable.* (Original scans)
Conferences	Rising Stars in AI Symposium 2023, EMNLP-2022 (Certificate) ; ICML-2022 (Certificate) ; ICML-2021 (Certificate) ; NeurIPS-2021 (Certificate) ; ACM CoNEXT 2021(Certificate); ACM SIGGRAPH 2012.
Summer Schools	Regularization Methods for ML 2021 (Certificate) ; The PRAIRIE/MIAI AI summer school 2021 (Certificate) ; Oxford ML Summer School-2021(Certificate) ; The HSE/MIPT/Sirius Optimization without Border.

✏ SCIENTIFIC PAPERS

ERROR FEEDBACK SHINES WHEN FEATURES ARE RARE   2023
↗ https://arxiv.org/abs/2305.15264

FEDERATED LEARNING WITH REGULARIZED CLIENT PARTICIPATION   2023
↗ https://arxiv.org/abs/2302.03662
Accepted to Federated Learning and Analytics in Practice. Workshop at ICML 2023.

SHARPER RATES AND FLEXIBLE FRAMEWORK FOR NONCONVEX SGD WITH CLIENT AND DATA SAMPLING   2022
↗ https://arxiv.org/abs/2206.02275

FEDERATED OPTIMIZATION ALGORITHMS WITH RANDOM RESHUFFLING AND GRADIENT COMPRESSION   2022
↗ https://arxiv.org/abs/2206.07021
Accepted to Federated Learning and Analytics in Practice. Workshop at ICML 2023.

FASTER RATES FOR COMPRESSED FEDERATED LEARNING WITH CLIENT-VARIANCE REDUCTION   2021
↗ https://arxiv.org/abs/2112.13097
Accepted to SIAM Journal on Mathematics of Data Science (SIMODS).

FL_PYTORCH : OPTIMIZATION RESEARCH SIMULATOR FOR FEDERATED LEARNING   2021
↗ https://arxiv.org/abs/2202.03099   ↗ https://dl.acm.org/doi/abs/10.1145/3488659.3493775/
Accepted for presentation and proceedings to 2nd ACM International Workshop on Distributed Machine Learning

MARINA : FASTER NON-CONVEX DISTRIBUTED LEARNING WITH COMPRESSION   2021
↗ https://arxiv.org/abs/2102.07845   ↗ https://proceedings.mlr.press/v139/gorbunov21a.html
Accepted for presentation and proceedings to Thirty-eighth International Conference on Machine Learning, ICML 2021

PERSONALIZED FEDERATED LEARNING WITH COMMUNICATION COMPRESSION   2021 – 2022
↗ https://arxiv.org/abs/2209.05148

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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]*

✎ Technical Notes

Technical Note. From C++1998 to C++2020   2022

⚙ github.com/burlachenkok/CPP_from_1998_to_2020/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 technical note has been adopted to AMD Inc. internal education web portal.

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.

♟ Presentations

JUNE-2023	SIAM : Conference on Optimization (OP23), USA : Fl_PyTorch : Optimization Research Simulator for Federated Learning (link).
MARCH-2023	VCC OPEN HOUSE 2023 event, KSA : FedNL. Making Newton-Type Methods Applicable to FL. (link).
DEC-2022	EMNLP 2022, Abu Dhabi, UAE : Presenter in KAUST AI Iniative 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*.
JULY-2022	Workshop at ACM Symposium on Principles of Distributed Computing, Italy : MARINA : Faster non-convex distributed learning with compression.
MAR-2022	Rising Stars in AI Symposium KAUST, KSA : FL_PyTorch : Optimization Research Simulator for Federated Learning
DEC-2021	ACM DistributedML2021, Rome : FL_PyTorch : Optimization Research Simulator for Federated Learning.
JULY-2021	Poster and spotlight for in ICML-2021, Virtual : MARINA Faster Non-Convex Distributed Learning with Compression.
APR-2021	Poster at Communication Efficient Distributed Optimization at NSF-TRIPODS Workshop, Virtual : MARINA : Faster Non-Convex Distributed Learning with Compression.
FEB-2020	OpenTalks.AI conference, Russia : Huawei technologies for AI developers.
JULY-2019	Educational center Sirius, Russia. Deep Learning Course with D.Kamzolov.
DEC-2018	Moscow Institute of Physics and Technologies, Russia. Guest lectures about subtle things around CART, Gradient Bossting and Random Forest : Slides : Link. Presentions : Session-#1, Session-#2.
APR-2016	GTC 2016, USA : Presenter in Driveworks NVIDIA booth.
AUG-2012	ACM SIGGRAPH 2012, USA : Presenter in CentiLeo booth. And a visitor from Fitting Reality.

💼 Experience

August 2021	**Research Scientist Intern (AI) offer, Facebook Inc., USA, Menlo Park**
	After passing competitive interviews I have read several papers that Dr. Hao-Jun Michael Shi has recommended. We had several discussions and we've selected the research topic that is important to the company and at the same time for my Ph.D. The internship has not happened due to the absence of a J1 VISA.
	`Distributed Math Optimization` `AI` `Federated Learning`
Now September 2020	**CS Ph.D. candidacy and a member of prof. Peter Richtárik's Optimization and ML Lab, KAUST, KSA** ▶ *Narrow area of my research :* Federated Learning(FL), Stochastic Distributed Math Optimization for AI. ▶ *Broad areas of my interests :* Math Optimization, AI/ML, Compute Optimization, Software Systems, GPGPU, Computer Vision, Computer Graphics, Networks, Cryptography, Control, Physical Simulation. ▶ During Sep 2022 - Sep 2023 I was a Member of Center of Excellence in Data Science and Artificial Intelligence SDAIA-KAUST AI (invitation letter). During my affilation I have co-initiated a joint project.
	`Distributed Math Optimization` `Federated Learning` `Applied Math` `Computer Vision` `Sytems` `Cryptography` `C/C++` `CUDA` `SSE2` `Python` `CMake` `Qt/PyQt` `PyTorch` `TF` `Latex` `Git` `Google Tests` `Bash`
August 2020 March 2019	**Principal Lead Engineer Level 18	Foundation AI Lab, HUAWEI, Moscow** ▶ R&D in internal Machine Learning/Systems middleware for HUAWEI HiSilicon. ▶ Present HiSilicon solutions for engineers, scientists working with ML/AI. OpenTalks.AI, HUAWEI News. ▶ R&D in internal projects in Machine Learning/Systems HUAWEI Consumer Business Group. ▶ Obtained high grade in the last review, before going back to academia to gain a Ph.D. degree at KAUST.
	`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** ▶ 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 extra customers (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. `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`

July 2014 May 2013	**Senior Developer Engineer | Yandex Video Team, YANDEX, Moscow** ▶ Text and statistical machine learning features for Yandex Video Search. ▶ Infrastructure for storage and analysis of all web documents with embedded video on the WWW ▶ Infrastructure to show plots for internal team's processes `C++` `Google Protobuf` `JavaScript` `Bash` `Python` `Computer Science` `HTML/JS/CSS` `SVN` `MapReduce` `ML`

April 2013 March 2012	**Lead Physics Engine Developer, FITTING REALITY, Moscow** ▶ 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. Demo. ▶ Prepare elements of the demo to investors. Carry internal MATH/CS/PHYS trainings. `C++` `C` `OpenGL` `GLSL` `Qt` `Posix` `WinAPI` `QMake` `CUDA` `OpenCL` `Physics` `Graphics` `gDebugger` `C#`

March 2012 September 2010	**Software Developer Engineer, ACRONIS, Moscow** ▶ 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 March 2009	**Senior Software Developer Engineer, CAPITAL RESEARCH, Moscow** ▶ Developed Firefox plugin to create the three-dimensional HTML view for basics HTML elements. ▶ The startup terminated. CEO Kirill Garanzha can provide information about my work. `Firefox` `C++` `WinAPI` `HTML/JS/CSS` `Windows` `OpenGL` `GLSL` `SVN`

June 2009 December 2006	**C++ Programming Engineer, FLINT AND CO, Moscow** ▶ 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 March 2006	**C++ Programming Engineer (Part time work), ASTRASOFT TECHNOLOGY, Moscow** ▶ Developed visual elements of management system based on Qt and OpenGL. `C++` `Qt` `Windows` `OpenGL` `SVN`

☰ COMPETENCES

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 Cython (between scipting and compiled language)
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 of interest	Federated Learning, Stochastic Distributed Math Optimization, AI, Computer Vision, Statistical/Machine Learning, System Programming, GPU Programming, Convex/Non Convex Math Optimization, Differential Privacy, Computer Graphics, Computational Physics, Datamining, Distributed Systems.
Sport achievements	The Candidate Master in chess by FIDE. (My FIDE profile). Second Place in the KAUST Chess Tournament in Oct, 2022.

💻 Selected Personal And Academic Projects

Math Optimization Research Studio 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 2019
🔗 Report.CS230 - 2019   🔗 Poster CS230 - 2019   🔗 bitbucket repo   🔗 Presentation

CS230 : Experimental Neural Net Framework. Mentor : Steven Z. Chen(stevenzc@stanford.edu)

`C++` `Linux` `Windows` `CUDA` `Python` `CMake`

Convex optimization solvers with leveraging into GPU/CPU power for AI/ML 2018
🔗 Poster CS221 - 2018   🔗 Bitbucket repo

CS221 : Convex optimization solvers with leveraging into GPU/CPU power for AI/ML. Mentor : Steven Diamond

`C++` `Linux` `Windows` `CUDA` `Python` `CMake` `Convex Optimization`

Convex Optimization for Machine Learning 2017
🔗 Poster CS229 - 2017.   🔗 Presentation

Stanford, CS229 : Convex Optimization for Machine Learning

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

Plotter++. Standalone tool for plot images, graphs, point clouds, text logs via obtaining data from TCP/IP 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`

Lane detection using Fourier based line detector 2016
🔗 Report   🔗 Presentation

Lane detection using Fourier based line detector

`Matlab`

HTML report generator for Google Tests 2016
🔗 GitHub

Project goal is to generate and compare different Google Test reports from several launches. Project is used by Hyundai AutoEver, and Hapsoft Consulting.

`Python` `HTML` `XML`

66 References

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