

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 2016¹ 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 <i>Awards and Grants</i> : Dean's Award 2020, KAUST ; Grant from SDAIA-KAUST AI 2022.
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 : <i>Not Applicable/Conversion is needed. (Original scans)</i>
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 <i>Accepted to Federated Learning and Analytics in Practice. Workshop at ICML 2023.</i>	
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 <i>Accepted to Federated Learning and Analytics in Practice. Workshop at ICML 2023.</i>	
SHARPER RATES AND FLEXIBLE FRAMEWORK FOR NONCONVEX SGD WITH CLIENT AND DATA SAMPLING	2022
https://arxiv.org/abs/2206.02275	
FASTER RATES FOR COMPRESSED FEDERATED LEARNING WITH CLIENT-VARIANCE REDUCTION	2021
https://arxiv.org/abs/2112.13097	
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/ <i>Accepted for presentation and proceedings to 2nd ACM International Workshop on Distributed Machine Learning</i>	
MARINA : FASTER NON-CONVEX DISTRIBUTED LEARNING WITH COMPRESSION	2021
https://arxiv.org/abs/2102.07845 https://proceedings.mlr.press/v139/gorbunov21a.html <i>Accepted for presentation and proceedings to Thirty-eighth International Conference on Machine Learning, ICML 2021</i>	
PERSONALIZED FEDERATED LEARNING WITH COMMUNICATION COMPRESSION	2021 – 2022
https://arxiv.org/abs/2209.05148	

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

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 Initiative booth.
OCT-2022	CS Ph.D. Proposal Defense, KSA : Dissertation Title : <i>Optimization Methods and Software for Federated Learning</i> . Committee members : <i>Eric Feron, Marco Canini, Peter Richtarik</i> .
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 Boosting and Random Forest : Slides : Link . Presentations : Session-#1 , Session-#2 .
APR-2016	GTC 2016, USA : Presenter in Driveworks NVIDIA booth.
AUG-2012	ACM SIGGRAPH 2012, USA : Presenter in CentiLeo booth.

EXPERIENCE

Now September 2022	Member of Center of Excellence in Data Science and Artificial Intelligence, SDAIA-KAUST AI, KSA Affiliations are offered to members of the KAUST community who have an outstanding record of achievement in AI related fields with whom center would like to engage in collaboration on specific projects, seminars, workshops. The goal of center is AI research and development of modern technologies in KSA. <div> Distributed Math Optimization Federated Learning Applied Math AI Machine Learning Computer Science </div>
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. <div> Distributed Math Optimization AI Federated Learning </div>
Now September 2020	CS Ph.D. candidacy and a member of prof. Peter Richtárik's Optimization and ML Lab, KAUST, KSA <div> <div>▶ Narrow area of research is Federated Learning(FL), Stochastic Distributed Math Optimization for AI.</div> <div>▶ Broad area of my scientific interests : Math Optimization, AI, FL, Graphics, Vision, Control, and Systems.</div> </div> <div> Distributed Math Optimization Federated Learning Applied Math C/C++ Python Qt PyTorch TF Latex </div> <div> Computer Vision </div>
August 2020 March 2019	Principal Lead Engineer Level 18 Foundation AI Lab, HUAWEI, Moscow <div> <div>▶ R&D in internal classical Machine Learning and Deep Learning middleware for HUAWEI HiSilicon</div> <div>▶ Present HiSilicon solutions for engineers, scientists working with ML/AI. OpenTalks.AI, HUAWEI News</div> <div>▶ R&D in internal projects in Machine Learning HUAWEI Consumer Business Group</div> <div>▶ Obtained high grades in the last annual review in 2020.</div> </div> <div> Math Optimization AI Custom ISA C/C++ Python TVM Java Google Protobuf CMake Qt TF SQL </div>
March 2019 July 2014	Senior Developer Technology Engineer Level IC3, NVIDIA, Moscow <div> <div>▶ Driveworks SDK - SDK for self-driving cars adopted by automotive partners. Computer vision, machine learning, calibration, egomotion. Implementation and presentation of the modules internally.</div> <div>▶ PhysX/Apex SDK - An industry standard for game physics simulation, graphical special effects. Internal implementation and communication with extra customers (Blizzard).</div> <div>▶ cuDNN/cuBLAS libraries - GPU computation libraries used by more than 1M customers in machine learning and HPC. Implementation, Documentation, and collaboration with Mathworks.</div> <div>▶ RAPIDS - GPU based implementation of SkLearn, XgBoost, Pandas. I was responsible for SkLearn.</div> </div> <div> CUDA GLSL C++ AArch64 SSE2/ARM NEON Linux Windows PS4 XBox OpenGL Google Tests GitLab </div> <div> Perl Python CMake Make Qt Git TensorFlow Computer Vision Graphics Deep Learning CppCheck </div>

July 2014 May 2013	Senior Developer Engineer Yandex Video Team, YANDEX, Moscow <ul style="list-style-type: none"> ▶ 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 <ul style="list-style-type: none"> ▶ 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 <ul style="list-style-type: none"> ▶ 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 <ul style="list-style-type: none"> ▶ 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 <ul style="list-style-type: none"> ▶ 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 <ul style="list-style-type: none"> ▶ Developed visual elements of management system based on Qt and OpenGL. C++ Qt Windows OpenGL SVN

SELECTED PERSONAL AND ACADEMIC PROJECTS

MATH OPTIMIZATION RESEARCH STUDIO Project report - Math Optimizaiton Research Studio Description Bitbucket repo CS380 : Math Optimization Research Studio. C++ Linux Windows CUDA CMake Dot Google Test Python Bash	2020
EXPERIMENTAL NEURAL NET FRAMEWORK 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	2019
CONVEX OPTIMIZATION SOLVERS WITH LEVERAGING INTO GPU/CPU POWER FOR AI/ML 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	2018
CONVEX OPTIMIZATION FOR MACHINE LEARNING Poster CS229 - 2017. Presentation Stanford, CS229 : Convex Optimization for Machine Learning C++ Visual Studio Numerical Linear Algebra Convex Optimization Python CMake	2017
PLOTTER++, STANDALONE TOOL FOR PLOT IMAGES, GRAPHS, POINT CLOUDS, TEXT LOGS VIA OBTAINING DATA FROM TCP/IP 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	2017
LANE DETECTION USING FOURIER BASED LINE DETECTOR Report Presentation Lane detection from input videostream. Matlab	2016

github.com/burlachenko/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. It has been provided to AMD Inc. internal education web portal.

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, Cython, Bash, Perl
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).

REFERENCES

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