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 and Grants :* 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 : Not Applicable/Conversion is needed.* (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.

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/
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

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 Iniative booth.

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.

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.
Distributed Math Optimization | Federated Learning | Applied Math | AI | Machine Learning | Compuer Science

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 research is Federated Learning(FL), Stochastic Distributed Math Optimization for AI.
- Broad area of my scientific interests : Math Optimization, AI, FL, Graphics and Vision, Control.

Distributed Math Optimization | Federated Learning | Applied Math | C/C++ | Python | Qt | PyTorch | TF | Latex | Computer Vision

August 2020
March 2019

Principal Lead Engineer Level 18 | Foundation AI Lab, HUAWEI, Moscow
- R&D in internal classical Machine Learning and Deep Learning 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 HUAWEI Consumer Business Group
- Obtained high grades in the last annual review in 2020.

Math Optimization | AI | Custome ISA | C/C++ | Python | TVM | Java | Google Protobuf | CMake | Qt | TF | SQL

March 2019
July 2014

Senior Developer Technology Engineer 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

Selected Personal And Academic Projects

Math Optimization Research Studio — 2020

Project report - Math Optimizaiton Research Studio | Description | Bitbucket repo

CS380 : Math Optimization Research Studio.

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 from input videostream.

Matlab

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. 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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