# Samuel **Horváth**

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## **Edu**cation

**King Abdullah University of Science & Technology (KAUST)** — *Thuwal, Saudi Arabia*

PHD IN MACHINE LEARNING AND OPTIMIZATION — *1/2019 – Present*

- Supervised by Prof. Peter Richtárik
- GPA: 4.00/4.00

**King Abdullah University of Science & Technology (KAUST)** — *Thuwal, Saudi Arabia*

MSc IN STATISTICS — *8/2017 – 12/2018*

- Supervised by Prof. Peter Richtárik
- GPA: 3.82/4.00

**Comenius University** — *Bratislava, Slovakia*

B.S. IN FINANCIAL MATHEMATICS — *9/2014 – 6/2017*

- GPA 4.00/4.00 # 1
- Thesis: Visualization of Portfolio Optimization with R Shiny

## **Hon**ors & Awards

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|---|---|---|
| 2021 | **Al-Kindi Statistics Research Student Award**, a research award for top Statistics PhD student(s) at KAUST | *Saudi Arabia* |
| 2021 | **Progress Towards PhD Rated as "Outstanding"**, KAUST | *Saudi Arabia* |
| 2020 | **Best Paper Award (+ 1,888 USD cash prize)**, NeurIPS 2020–SpicyFL Workshop | *Online* |
| 2020 | **Best Reviewer Award (Top 10%)**, NeurIPS 2020 | *Online* |
| 2020 | **Progress Towards PhD Rated as "Outstanding"**, KAUST | *Saudi Arabia* |
| 2020 | **MLSS Acceptance**, Machine Learning Summer School (MLSS) 2020, Tübingen (acceptance rate 180/1300+), also accepted to MLSS 2020 Indonesia | *Germany* |
| 2019 | **Top Reviewer Award**, NeurIPS 2019 | *Canada* |
| 2019 | **Progress Towards PhD Rated as "Outstanding"**, KAUST | *Saudi Arabia* |
| 2018 | **157th/4049**, IEEEXtreme 24-Hour Programming Competition 12.0 joint with Dmitry Kovalev | *Saudi Arabia* |
| 2018 | **Best Poster Award (+ 500 EUR cash prize)** , Data Science Summer School, awarded as one of 2 out of total 170 posters presented at DS$^3$ at École Polytechnique | *France* |
| 2017 | **131st/3,350 place**, IEEEXtreme 24-Hour Programming Competition 11.0 joint with Konstantin Mishchenko | *Saudi Arabia* |
| 2017 | **KAUST Fellowship**, A generous fellowship provided for MSc/PhD students at KAUST | *Saudi Arabia* |
| 2017 | **Accepted to 3 MSc Programs in the UK (offers rejected)**, Imperial College London (Statistics), University College London (Data Science) and University of Edinburgh (Statistical Data Science) | *United Kingdom* |
| 2017 | **2nd place**, CFA Institute Research Challenge hosted by CFA Society Czech Republic | *Czech republic* |
| 2017 | **37th place** , Vojtech Jarnik International Mathematical Competition- Category II | *Czech republic* |
| 2017 | **Excellence Scholarship**, Scholarship for top 5% students at Comenius University | *Slovakia* |
| 2016 | **3rd place**, 23rd International Mathematics Competition for university students | *Bulgaria* |
| 2016 | **36th place**, Vojtech Jarnik International Mathematical Competition- Category I | *Czech republic* |
| 2016 | **Excellence Scholarship**, Scholarship for top 5% students at Comenius University | *Slovakia* |
| 2015 | **Excellence Scholarship**, Scholarship for top 5% students at Comenius University | *Slovakia* |
| 2014 | **18th place**, Slovak national round of Mathematical Olympiad for high school students | *Slovakia* |
| 2014 | **1st place**, District round of Mathematical Olympiad for high school students | *Slovakia* |

# **Pub**lications

### Long-term Outcome in Patients with Takotsubo Syndrome

EDITA POGRAN, ABD EL-RAZEK, LAURA GARGIULO, VALERIE WEIHS, CHRISTOPH KAUFMANN, SAMUEL
HORVÁTH, ALEXANDER GEPPERT, MICHAEL NÜRNBERG, EMIL WESSELY, PETER SMETANA, KURT HUBER

*8/2021*

- `https://link.springer.com/article/10.1007/s00508-021-01925-9`

### A Field Guide to Federated Optimization

WANG ET AL. (50+ AUTHORS, INCLUDING ME)

*7/2021*

- The paper provides guidelines for formulating, designing, evaluating and analyzing federated optimization algorithms.
- `https://arxiv.org/pdf/2107.06917.pdf`

### FedMix: A Simple and Communication-Efficient Alternative to Local Methods in Federated Learning

ELNUR GASANOV, AHMED KHALED, SAMUEL HOVÁTH, PETER RICHTÁRIK

*7/2021*

- International Workshop on Federated Learning for User Privacy and Data Confidentiality (ICML 2021)
- `https://fl-icml.github.io/2021/papers/FL-ICML21_paper_38.pdf`

### FjORD: Fair and Accurate Federated Learning Under Heterogeneous Targets with Ordered Dropout

SAMUEL HORVÁTH, STEFANOS LASKARIDIS, MARIO ALMEIDA, ILIAS LEONTIADIS, STYLIANOS I. VENIERIS,
NICHOLAS D. LANE

*1/2021*

- **Spotlight (Top** 3%**):** Proceedings of the 35$^{th}$ Conference on Neural Information Processing Systems (NeurIPS 2021)
- Federated Learning Workshop (ICML 2021)
- `https://arxiv.org/pdf/2102.13451.pdf`

### Hyperparameter Transfer Learning with Adaptive Complexity

SAMUEL HORVÁTH, AARON KLEIN, PETER RICHTÁRIK, CEDRIC ARCHAMBEAU

*1/2021*

- Proceedings of the 24$^{th}$ International Conference on Artificial Intelligence and Statistics (AISTATS 2021)
- `https://arxiv.org/pdf/2102.12810.pdf`

### Optimal Client Sampling for Federated Learning

WENLIN CHEN, SAMUEL HORVÁTH, PETER RICHTÁRIK

*10/2020*

- Privacy Preserving Machine Learning Workshop (NeurIPS 2020)
- `https://arxiv.org/pdf/2010.13723.pdf`

### Lower Bounds and Optimal Algorithms for Personalized Federated Learning

FILIP HANZELY, SAMUEL HORVÁTH, SLAVOMÍR HANZELY , PETER RICHTÁRIK

*9/2020*

- Proceedings of the 34$^{th}$ Conference on Neural Information Processing Systems (NeurIPS 2020)
- `https://arxiv.org/pdf/2010.02372.pdf`

### A Better Alternative to Error Feedback for Communication-Efficient Distributed Learning

SAMUEL HORVÁTH, PETER RICHTÁRIK

*6/2020*

- **The Best Paper Award:** Workshop on Scalability, Privacy, and Security in Federated Learning (NeurIPS 2020)
- Proceedings of the 9$^{th}$ International Conference on Learning Representations (ICLR 2021)
- Federated Learning One World Online Seminar, one hour talk: `https://www.youtube.com/watch?v=AAXcjq8OLVU`
- `https://openreview.net/pdf?id=vYVI1CHPaQg`

### Adaptivity of Stochastic Gradient Methods for Nonconvex Optimization

SAMUEL HORVÁTH, LIHUA LEI, PETER RICHTÁRIK, MICHAEL I. JORDAN

*2/2020*

- **Spotlight:** Optimization for Machine Learning Workshop (NeurIPS 2020)
- `https://arxiv.org/pdf/2002.05359.pdf`

### On Biased Compression for Distributed Learning

ALEKSANDR BEZNOSIKOV, SAMUEL HORVÁTH, PETER RICHTÁRIK, MHER SAFARYAN

*2/2020*

- **Oral:** Workshop on Scalability, Privacy, and Security in Federated Learning (NeurIPS 2020)
- `https://arxiv.org/pdf/2002.12410.pdf`

### Natural Compression for Distributed Deep Learning

SAMUEL HORVÁTH, CHEN-YU HO, ĽUDOVÍT HORVÁTH, ATAL SAHU, MARCO CANINI, PETER RICHTÁRIK

*5/2019*

- Workshop on AI Systems at Symposium on Operating Systems Principles (SOSP 2019)
- `https://arxiv.org/pdf/1905.10988.pdf`

### Stochastic Distributed Learning with Gradient Quantization and Variance Reduction

SAMUEL HORVÁTH, DMITRY KOVALEV, KONSTANTIN MISHCHENKO, SEBASTIAN STICH, PETER RICHTÁRIK *4/2019*

- **Best Poster Prize:** Control, Information and Optimization Summer School, Voronovo, Russia, presented by D. Kovalev
- `https://arxiv.org/pdf/1904.05115.pdf`

### Don't Jump Through Hoops and Remove Those Loops: SVRG and Katyusha are Better Without the Outer Loop

DMITRY KOVALEV, SAMUEL HORVÁTH, PETER RICHTÁRIK *1/2019*

- Proceedings of the 31st International Conference on Algorithmic Learning Theory (ALT 2020)
- `https://arxiv.org/pdf/1901.08689.pdf`

### Nonconvex Variance Reduced Optimization with Arbitrary Sampling

SAMUEL HORVÁTH, PETER RICHTÁRIK *9/2018*

- **Best Poster Prize:** Data Science Summer School (DS$^3$), École Polytechnique, Paris, 2018
- Proceedings of the 36th International Conference on Machine Learning (ICML 2019)
- `http://proceedings.mlr.press/v97/horvath19a.html`

# Internships and Research Visits

### Facebook AI Research
*Montreal, CA*

RESEARCH INTERN *8/2021 – 12/2021*

- Research focus: federated learning
- Supervisors: Dr. Michael Rabbat and Dr. Lin Xiao

### Samsung AI Center, Embedded AI Team
*Cambridge, UK*

RESEARCH INTERN *9/2020 – 2/2021*

- Research focus: federated learning
- Supervisors: Prof. Nicholas I. Lane, Stefanos Laskaridis, Dr. Mario Almeida, and Dr. Ilias Leontiadis,
- While on the internship, I was invited to deliver a talk in the Machine Learning Systems lab at the University of Cambridge, led by Nicholas I. Lane.
- Coauthored paper: **FjORD: Fair and Accurate Federated Learning Under Heterogeneous Targets with Ordered Dropout**

### Amazon, AI Core Team
*Berlin, Germany*

APPLIED SCIENTIST INTERN *Summer 2019*

- Research focus: hyperparameter optimization
- Supervisors: Dr. Cédric Archambeau and Dr. Aaron Klein.
- Coauthored paper: **Hyperparameter Transfer Learning with Adaptive Complexity**

### University of California, Berkeley
*Berkeley, California*

VISITING PHD STUDENT *Spring 2019*

- Research focus: nonconvex optimization
- Supervisor: Prof. Michael I. Jordan
- Coauthored paper: **Adaptivity of Stochastic Gradient Methods for Nonconvex Optimization**
- During the visit I attended the "Deep Learning Foundations" workshop at the Simons Institute

### Exponea, Recommendation Team
*Bratislava, Slovakia*

AI INTERN *Summer 2018*

- Focus: sorting and ranking for personalized e-commerce recommendation

### Dell Technologies, Global Tax Automation Team
*Bratislava, Slovakia*

INTERN *6/2016 – 6/2017*

# Conferences

### Federated Learning and Analytics Workshop
*Online*

GOOGLE *11/2021*

- **Invitation only** event organized by Google researchers.
- Topics: federated learning and analytics, distributed optimization, cryptography, algorithmic fairness, differential privacy, and policy.
- I gave a talk and presented a poster based on **FjORD: Fair and Accurate Federated Learning Under Heterogeneous Targets with Ordered Dropout.**

### International Conference on Machine Learning (ICML 2021)
*Vienna (online), Austria*

VIRTUAL CONFERENCE *7/2021*

- I presented two posters based on our papers: **FjORD: Fair and Accurate Federated Learning Under Heterogeneous Targets with Ordered Dropout** and **FedMix: A Simple and Communication-Efficient Alternative to Local Methods in Federated Learning.**

### Conference on Neural Information Processing Systems (NeurIPS 2020)
*Online*

VIRTUAL CONFERENCE *12/2020*

- Main conference (1 paper accepted): **Lower Bounds and Optimal Algorithms for Personalized Federated Learning**
- Workshops (**4 papers accepted – Best Paper Award, Oral Presentation, Spotlight Talk and Poster**):
  - Privacy Preserving Machine Learning: **Optimal Client Sampling for Federated Learning** (poster)
  - Optimization for Machine Learning: **Adaptivity of Stochastic Gradient Methods for Nonconvex Optimization** (Spotlight Talk)
  - Workshop on Scalability, Privacy, and Security in Federated Learning: **A Better Alternative to Error Feedback for Communication-Efficient DistributedLearning** (Best Paper Award), **On Biased Compression for Distributed Learning** (Oral Presentation)

### The Machine Learning Summer School (MLSS 2020)
*Tuebingen (online), Germany*

MAX PLANCK INSTITUTE FOR INTELLIGENT SYSTEMS *7/2020*

- I gave a talk about our paper: **Natural Compression for Distributed Deep Learning**.

### KAUST–Tsinghua Workshop on Artificial Intelligence
*Thuwal, Saudi Arabia*

KAUST *11/2019*

- I presented a poster about the paper **Natural Compression for Distributed Deep Learning.**

### Amazon Research Days
*Berlin, Germany*

AMAZON *10/2019*

- Amazon Conference to promote collaboration with academia.

### EMEA Research Internship Colloquium
*Cambridge, United Kingdom*

AMAZON *8/2019*

- Amazon Conference for all theirs interns from the EMEA region.
- I presented a poster about our work **Natural Compression for Distributed Deep Learning.**

### International Conference on Continuous Optimization (ICCOPT)
*Berlin, Germany*

TU BERLIN *8/2019*

- I organized a minisymposium and gave a talk about the paper **Stochastic Distributed Learning with Gradient Quantization and Variance Reduction.**

### 36<sup>th</sup> International Conference on Machine Learning (ICML 2019)
*Long Beach, USA*

### 36th International Conference on Machine Learning (ICML 2019)
*Long Beach, USA*

LONG BEACH CONVENTION CENTER *6/2019*

- We had our paper **Nonconvex Variance Reduced Optimization with Arbitrary Sampling** accepted, which I gave a talk about, and we also presented a poster.

### Deep Learning Boot Camp
*Berkeley, USA*

SIMONS INSTITUTE FOR THEORY AND COMPUTING *5/2019*

- The Boot Camp was intended to acquaint program participants with the key themes of the program such as Generalization, Approximation Power, Adversarial Examples and Over-parametrized Neural Networks.

### Data Science Summer School (DS$^3$)
*Paris, France*

ÉCOLE POLYTECHNIQUE *6/2018*

- The primary focus of the event is to provide a series of courses and practical sessions covering the latest advances in the field of data science
- Speakers: Cédric Villani, Yann Lecun, Suvrit Sra, ...
- I presented a poster poster, which won the **Best Poster Award**, and attracted a cash prize of **500 Euros** as one of two out of total 170 posters presented.

### Optimization and Big Data
*KAUST, Saudi Arabia*

KAUST *2/2018*

- Four days conference aimed at novel optimization algorithms and distributed systems capable of working in the Big Data setting.

### Applied Machine Learning Days
*Lausanne, Switzerland*

EPFL *1/2018*

- Two days of hands-on workshops on Machine Learning and two days of conference with speakers such as Christopher Bishop from Microsoft Research.

# **Ext**racurricular Courses and Activities

### Seminar co-organizer
*Online*

FEDERATED LEARNING ONE WORLD SEMINAR SERIES
*2020 – Present*

- together with Peter Richtárik, Virginia Smith, Aurélien Bellet and Dan Alistarh, we organize Federated Learning One World (FLOW) seminar, `https://sites.google.com/view/one-world-seminar-series-flow`

### Volunteer
*Online*

ICML 2020
*2020*

### Reviewer

ICML 2021, 2020, 2019 — AISTATS 2020 — NeurIPS 2020, 2019, 2018 — DistributedML Workshop at CoNEXT

2020, 2021 — Optimization Methods and Software — FL-ICML 2021 — NFFL 2021
*2018 – Present*

### Minisymposium organizer
*Berlin, Germany*

ICCOPT
*2019*

- Together with Filip Hanzely, we organized a minisymposium on the topic "Large-Scale Stochastic First-Order Optimization" consisting of 6 talks

### Nanodegree mentor
*Online*

UDACITY
*2019 – 2020*

- I served as a mentor providing 1-on-1 meetings, code and project reviews and extra seminars for the students enrolled in the Deep Learning Nanodegree

### Seminar Organizer
*KAUST, Saudi Arabia*

ALL HANDS MEETINGS ON BIG DATA OPTIMIZATION
*2018*

- Organizer of a group seminar, gave 6 talks given the time period

### Teaching Assistant
*KAUST, Saudi Arabia*

SPECIAL TOPICS IN DATA SCIENCE
*2018*

- I was teaching assistant for PhD level course, which covers a mathematically rigorous introduction to the field of big data optimization.

### Entrepreneurship program
*Saudi Arabia*

CORNELL UNIVERSITY
*2018*

- 7-days course covers the basic process of how to move from generating a new business idea to turning that idea into a real business
- taught by Cornell professors Chad Carlos, Wesley Sine, Thomas Kurz

### Deep Learning Nanodegree
*Online*

UDACITY
*2018*

- Topics covered: Keras and TensorFlow, convolutional and recurrent networks, deep reinforcement learning, and GANs
- Taught by authorities such as Sebastian Thrun, Ian Goodfellow, and Andrew Trask

### Divide and Conquer, Sorting and Searching, and Randomized Algorithms
*Online*

COURSERA/STANFORD UNIVERSITY
*2018*

- Taught by Prof. Tim Roughgarden
- Passed with Distinction (98% Grade)

### Statistical Learning
*Online*

STANFORD UNIVERSITY
*2017*

- Topics covered: Linear Regression, Classification, Tree-based Methods, SVM, Unsupervised Learning
- Based on the book "An Introduction to Statistical learning, with Applications in R"
- Passed with Distinction (100% Grade)
- `https://verify.lagunita.stanford.edu/SOA/7e92a12167684ec7ba2fd1313b96fb5d/`

### Machine Learning
*Online*

COURSERA/STANFORD UNIVERSITY
*2017*

- Topics covered: Linear and Logistic Regression, Neural Networks, SVM, Unsupervised Learning, Recommend Systems, ...
- Taught by Machine Learning Expert Dr. Andrew Ng
- Passed with Distinction (100% Grade)

# Skills

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|---|---|
| **Mathematics** | Probability and Statistics, Calculus, Linear Algebra, Statistical Learning, Deep Learning |
| **Programming** | Python, PyTorch, MXNet, Tensorflow, Keras, Pandas, Julia, R, R Shiny, Matlab, VBA, SQL |
| **Languages** | Slovak C2, English C1, German A2 |

# Hobbies

ALL KINDS OF SPORTS

- Football - used to play the regional league (over 200 matches), now just a hobby
- Fitness, Volleyball, Badminton