

# Samuel Horváth

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## Education

### King Abdullah University of Science & Technology

PHD IN MACHINE LEARNING AND OPTIMIZATION

- Supervised by Peter Richtárik
- GPA: 4.00/4.00

Thuwal, Saudi Arabia

Jan. 2019 - Present

### King Abdullah University of Science & Technology

MSc IN STATISTICS

- Supervised by Peter Richtárik
- GPA: 3.82/4.00

Thuwal, Saudi Arabia

Aug. 2017 - Dec. 2018

### Comenius University

B.S. IN FINANCIAL MATHEMATICS

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

Bratislava, Slovakia

Sep. 2014 - Jun. 2017

## Honors & Awards

2021	<b>Progress towards PhD rated as outstanding</b> , KAUST	Saudi Arabia
2020	<b>The Best Paper Award</b> , (1888 USD) NeurIPS 2020–SpicyFL Workshop	Online
2020	<b>Best Reviewer Award (Top 10%)</b> , NeurIPS 2020	Online
2020	<b>Progress towards PhD rated as outstanding</b> , KAUST	Saudi Arabia
2020	<b>MLSS Acceptance</b> , Machine Learning Summer School (MLSS) 2020, Tuebingen (acceptance rate 180/1300+), also accepted to MLLSS 2020 Indonesia	Germany
2019	<b>Top Reviewer Award</b> , NeurIPS 2019	Canada
2019	<b>Progress towards PhD rated as outstanding</b> , KAUST	Saudi Arabia
2018	<b>157<sup>th</sup>/4049</b> , IEEEExtreme 24-Hour Programming Competition 12.0 joint with Dmitry Kovalev	Saudi Arabia
2018	<b>The Best Poster</b> , (500 EUR) Data Science Summer School, awarded as one of two out of total 170 posters presented at DS <sup>3</sup> at Ecole Polytechnique	France
2017	<b>131<sup>th</sup>/3350</b> , IEEEExtreme 24-Hour Programming Competition 11.0 joint with Konstantin Mishchenko	Saudi Arabia
2017	<b>KAUST Fellowship</b> , A generous fellowship provided for MSc/PhD students at KAUST	Saudi Arabia
2017	<b>Universities</b> , Accepted to MSc programmes at Imperial College London (Statistics), University College London (Data Science) and University of Edinburgh (Statistical Data Science)	United Kingdom
2017	<b>2<sup>nd</sup> place</b> , CFA Institute Research Challenge hosted by CFA Society Czech Republic	Czech republic
2017	<b>37<sup>th</sup> place</b> , Vojtech Jarník International Mathematical Competition- Category II	Czech republic
2017	<b>Excellence Scholarship</b> , Scholarship for top 5% students at Comenius University	Slovakia
2016	<b>Third Prize</b> , 23rd International Mathematics Competition for university students	Bulgaria
2016	<b>36<sup>th</sup> place</b> , Vojtech Jarník International Mathematical Competition- Category I	Czech republic
2016	<b>Excellence Scholarship</b> , Scholarship for top 5% students at Comenius University	Slovakia
2015	<b>Excellence Scholarship</b> , Scholarship for top 5% students at Comenius University	Slovakia
2014	<b>18<sup>th</sup> place</b> , Slovak national round of Mathematical Olympiad for high school students	Slovakia
2014	<b>1<sup>st</sup> place</b> , Region round of Mathematical Olympiad for high school students	Slovakia

# Publications

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## 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

Aug. 2021

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

## A Field Guide to Federated Optimization

WANG ET AL.

Jul. 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 HORVÁTH, PETER RICHTÁRIK

Jul. 2021

- the International Workshop on Federated Learning for User Privacy and Data Confidentiality in Conjunction with ICML 2021 (FL-ICML'21)
- [https://fl-icml.github.io/2021/papers/FL-ICML21\\_paper\\_38.pdf](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

Jan. 2021

- Proceedings of the 35<sup>th</sup> Thirty-fourth Conference on Neural Information Processing Systems, **Spotlight (Top 3%)**
- 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

Jan. 2021

- Proceedings of the 24th 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

Oct. 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

Sep. 2020

- Proceedings of the 34<sup>th</sup> Thirty-fourth Conference on Neural Information Processing Systems
- <https://arxiv.org/pdf/2010.02372.pdf>

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

SAMUEL HORVÁTH, PETER RICHTÁRIK

Jun. 2020

- **The Best Paper Award** at NeurIPS 2020 Workshop on Scalability, Privacy, and Security in Federated Learning
- Proceedings of the 9th International Conference on Learning Representations
- Federated Learning One World Online Seminar, one hour talk: <https://www.youtube.com/watch?v=AAxcjq80LVU>
- <https://openreview.net/pdf?id=vYVI1CHPaQg>

## Adaptivity of Stochastic Gradient Methods for Nonconvex Optimization

SAMUEL HORVÁTH, LIHUA LEI, PETER RICHTÁRIK, MICHAEL JORDAN

Feb. 2020

- **Spotlight** at 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

Feb. 2020

- **Oral** at NeurIPS 2020 Workshop on Scalability, Privacy, and Security in Federated Learning
- <https://arxiv.org/pdf/2002.12410.pdf>

## Natural Compression for Distributed Deep Learning

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

May. 2019

- Workshop on AI Systems at Symposium on Operating Systems Principles 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

Apr. 2019

- A poster based on the results of this paper won **the Best Poster** at Control, Information and Optimization Summer School in Voronovo, Moscow, presented by Dmitry 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

Jan. 2019

- Proceedings of the 31<sup>st</sup> International Conference on Algorithmic Learning Theory, San Diego, California
- <https://arxiv.org/pdf/1901.08689.pdf>

## Nonconvex Variance Reduced Optimization with Arbitrary Sampling

SAMUEL HORVÁTH, PETER RICHTÁRIK

Sep. 2018

- A poster based on the results of this paper won **the Best Poster** at Data Science Summer School in Paris, 2018
- Proceedings of the 36<sup>th</sup> International Conference on Machine Learning, Long Beach, California
- <http://proceedings.mlr.press/v97/horvath19a.html>

## Internships and Research Visits

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### Facebook AI Research

Montreal, CA

RESEARCH INTERN

Aug. 2021 - Dec. 2021

- Intern at Facebook AI Research with a focus on Federated Learning working under the supervision of Michael Rabbat.

### Samsung AI Center

Cambridge, UK

RESEARCH INTERN

Sept. 2020 - Feb. 2021

- Intern at Embedded AI Team with focus on Federated Learning working under the supervision of Nicholas Lane, Stefanos Laskaridis, and Ilias Leontiadis.
- While on the internship, I was invited to talk at the Machine Learning Systems lab at the University of Cambridge, led by Nicholas Lane.

### Amazon

Berlin, Germany

APPLIED SCIENTIST INTERN

Summer 2019

- Intern at AI Core Team with focus on Hyperparameters Optimization supervised by Cedric Archambeau and Aaron Klein.

### University of California, Berkeley

Berkeley, California

VISITING PHD STUDENT

Spring 2019

- Research visit of Prof. Michael Jordan. As part of the visit, I attended Deep Learning Foundations Workshop at Simons Institute.

### Exponea

Bratislava, Slovakia

AI INTERN

Summer 2018

- Intern at Recommendation Team, where I worked on Sorting and Ranking Project for a personalized recommendation for e-commerce.

### Dell Technologies

Bratislava, Slovakia

INTERN

Jun 2016 - Jun 2017

- Intern at the Global Tax Automation team.

## Conferences

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### Federated Learning and Analytics Workshop

Online

GOOGLE

Nov. 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**.

### ICML 2021

Vienna (online), Austria

INTERNATIONAL CONFERENCE ON MACHINE LEARNING

Jul. 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**.

## NeurIPS 2020

Online

CONFERENCE ON NEURAL INFORMATION PROCESSING SYSTEMS

Dec. 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 Distributed Learning** (Best Paper Award), **On Biased Compression for Distributed Learning** (Oral Presentation)

## MLSS 2020

Tuebingen (online), Germany

MAX PLANCK INSTITUTE FOR INTELLIGENT SYSTEMS

Jul. 2020

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

## KAUST - Tsinghua Workshop

Thuwal, Saudi Arabia

KAUST

Nov. 2019

- I presented a poster about our work **Natural Compression for Distributed Deep Learning**.

## Amazon Research Days

Berlin, Germany

AMAZON

Oct. 2019

- Amazon Conference to promote collaboration with academia.

## EMEA Research Internship Colloquium

Cambridge, United Kingdom

AMAZON

Aug. 2019

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

## ICCOPT

Berlin, Germany

TU BERLIN

Aug. 2019

- International Conference on Continuous Optimization
- I organized Minisymposia and gave a talk about our work **Stochastic Distributed Learning with Gradient Quantization and Variance Reduction**.

## ICML 2019

Long Beach, USA

LONG BEACH CONVENTION CENTER

Jun. 2019

- Thirty-sixth International Conference on Machine Learning
- We had our **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

May 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

Paris, France

ÉCOLE POLYTECHNIQUE

Jun. 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 was awarded as **the Best Poster** with **500 Euros** cash prize as one of two out of total 170 posters presented.

## Optimization and Big Data

KAUST, Saudi Arabia

KAUST

Feb. 2018

- 4 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

Jan. 2018

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

# Extracurricular Courses and Activities

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## Seminar co-organizer

Online

FEDERATED LEARNING ONE WORLD SEMINAR SERIES

2020-Present

- together with Peter Richtárik, Virginia Smith, Aurelien 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 '21 '20 '19, AISTATS '20, NEURIPS '20 '19 '18, DISTRIBUTEDML WORKSHOP CoNEXT '20 '21, OPTIMIZATION

2018-Present

METHODS AND SOFTWARE, FL-ICML '21, NFFL '21

## Minisymposia organizer

Berlin, Germany

ICCOPT

2019

- together with Filip Hanzely, we organized a minisymposia on the topic Large-Scale Stochastic First-Order Optimization consisting of 6 talks.

## Nanodegree mentor

Online

UDACITY

2019-2020

- I serve as a mentor providing 1 on 1 meetings, code and project reviews and extra seminars for the students enrolled in 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 great CS Expert 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/S0A/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 Andrew Ng
- Passed with Distinction (100% Grade)

## Skills

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<b>Mathematics</b>	Probability and Statistics, Calculus, Linear Algebra, Statistical Learning, Deep Learning
<b>Programming</b>	Python, PyTorch, MXNet, Tensorflow, Keras, Pandas, Julia, R, R Shiny, Matlab, VBA, SQL
<b>Tools</b>	MS Office, LaTeX, SQL Server, Tableau
<b>Languages</b>	Slovak C2, English C1, German A2

## Hobbies

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### ALL KINDS OF SPORTS

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