# TETIANA PARSHAKOVA

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[parshakova.github.io](parshakova.github.io)

## OBJECTIVE

To develop efficient algorithms for computational problems using techniques from optimization, discrete mathematics and statistics, to analyze and to bring theoretical guarantees about these methods.

## EDUCATION

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|---|---|
| **Stanford University** | USA |
| *Ph.D.* | Computational Mathematics. Advisor *Stephen Boyd* | 2019 – *now* |
| *M.Sc.* | Computational Mathematics | 2022 |
| **Korea Advanced Institute of Science and Technology** | South Korea |
| *M.Sc.* | Electrical Engineering | 2019 |
| *B.Sc.* | Industrial Design | 2017 |

## WORK EXPERIENCE

**Google Research** — 2022
*Student Researcher* | Google Brain Robotics — USA

- Message passing and tree-based algorithms for fast graph field integration, generalization of Fast Multipole Method to discretized manifolds

**Apple Inc.** — 2020, 2021
*Machine Learning Research Intern* | Exploratory Design Group — USA

- Accelerating the training of Neural Networks using Hessian-vector products
- Constructive methods for Neural Networks on elementary functions

**Naver Labs Europe** — 2019
*Machine Learning Researcher* | Natural Language Processing Group — France

- Global Autoregressive Models (GAMs) combine an autoregressive component with a log-linear component, allowing the use of global a priori features to compensate for lack of data
- Different approaches for approximating the normalized distribution given by GAMs for fast inference

## PATENTS

**Interpolation Method and Apparatus for Arithmetic Functions** — Apple Inc, 2022
William C. Athas, Zaid M. Nadeem, Tetiana Parshakova — US 17/085,971

**Methods and Systems for Producing Neural Sequential Models** — Naver Corp, 2022
Tetiana Parshakova, Marc Dymetman, Jean-marc Andréoli — US 17/018,754

## PUBLICATIONS

Krzysztof Choromanski, Arijit Sehanobish, Han Lin, Yunfan Zhao, Eli Berger, <u>Tetiana Parshakova</u> and others. *Efficient Graph Field Integrators Meet Point Clouds*. ArXiv preprint arXiv:2302.00942. 2023

<u>Tetiana Parshakova</u>, Fangzhao Zhang and Stephen Boyd. *An Oracle-Structured Bundle Method for Distributed Optimization*. ArXiv preprint arXiv:2211.01418. 2022

<u>Tetiana Parshakova</u>, Marc Dymetman and Jean-Marc Andreoli. *Distributional Policies for Energy-Based Sequential Models*. NeurIPS Optimization Foundations of Reinforcement Learning Workshop. 2019

<u>Tetiana Parshakova</u>, Jean-Marc Andreoli and Marc Dymetman . *Global Autoregressive Models for Data-Efficient Sequence Learning*. In Proceedings of the SIGNLL Conference on Computational Natural Language Learning, ACL. 2019

Tetiana Parshakova, Francois Rameau, Andriy Serdega, In So Kweon and Dae-Shik Kim. *Latent Question Interpretation Through Variational Adaptation*. Accepted in IEEE/ACM Transactions on Audio, Speech, and Language Processing. 2019

Tetiana Parshakova and Dae-Shik Kim. *Latent Question Interpretation Through Parameter Adaptation Using Stochastic Neuron*. In Proceedings of ICML Workshop, MRC-2018, http://ceur-ws.org/Vol-2134/#paper07. 2018

Tetiana Parshakova and Daniel Saakes. *UMorph: Self-Change Tracker to Reflect Yourself to the Future and Past*. In Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems, ACM. 2018

Tetiana Parshakova, Minjoo Cho, Alvaro Cassinelli, and Daniel Saakes. *Furniture that Learns to Move Itself*. In Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems, ACM. 2017

Tetiana Parshakova, Minjoo Cho, Alvaro Cassinelli, and Daniel Saakes. *Ratchair: Furniture learns to move itself with vibration*. In ACM SIGGRAPH 2016 Emerging Technologies, ACM. 2016

## PROJECTS AND RESEARCH

### Research Rotations
Stanford University

2019 – 2021
USA

- with Prof. Aaron Sidford on hop constrained graph embedding onto a distribution of a dominating trees: minimax principle between probabilistic and distributional distance stretch, randomized algorithms for obtaining embeddings
- with Prof. Stephen Boyd on inverse neighborhood problem: explored different optimization schemes for inverting the operator of geometric random graph.
- with Prof. Tselil Schramm on graph embedding problem: finding minimum dimension of the vertex embedding that preserved information about the existence/absence of an edge.
- with Prof. Amin Saberi on finding optimal strategy for the card guessing game using partially observable Markov decision process.
- with Prof. Andrea Montanari: analysis and comparison of methods that discover causality in linear models using invariance across multiple environments.
- with Prof. Lexing Ying: explored the layerwise Hamiltonian for NNs and Hamilton-Jacobi-Bellman equation to approach the delayed gradient problem to decouple layers during the back propagation.
- with Prof. Eric Darve on deriving bounds for the number of neurons and layers of Relu NN necessary for approximate any analytic function arbitrarily close.

### Graduate Researcher
Brain Reverse Engineering and Imaging Lab, KAIST

2017 – 2018
South Korea

- "Latent Question Interpretation Through Variational Adaptation", a model that learns multiple interpretations of a given question.
- "Visual Question Answering" model with bottom-up, top-down attention and policy gradient to obtain image-aware question representation.
- "Abstractive Text Summarizer", combining Pointer generator with Seq2seq attention, by constructing a hybrid distribution over the vocabulary from which it generates the summary.
- "DDPG with Attention-based LSTM State Encoder", a sequential decision making agent for solving "Angry Birds" using Deep Deterministic Policy Gradient with Attention-based LSTM for state encoding.
- "Opinion Generator", a model for capturing a global "pathway" of an opinion as a response to other statement.

### Undergraduate Researcher
Brain Reverse Engineering and Imaging Lab, KAIST

2016
South Korea

- Machine Learning and Reinforcement Learning basics
- Worked on "Comic style generation using Neural Networks" using Lua and Torch

**Undergraduate Researcher** 2015 – 2016

My Design Lab, KAIST South Korea

- "Ratchair" is a strategy for displacing objects utilizing vibrations, http://mid.kaist.ac.kr/projects/ratchair/. Used: Python, Java, Android, OpenCV, Arduino, Inventor, Processing-Android, Myo Armband, hardware.
- "UMorph" is an unobtrusive self-image capturing system for tracking self changes over time. Used: PyQt, Dragon Board 410c, OpenCV, Dlib, hardware.

## HONORS AND AWARDS

**The Oliger Memorial Fellowship** 2019 – 2022

A stipend during the Ph.D. at Stanford

**Qualcomm-KAIST Innovation Awards 2018** 2018

Paper Competition Awards for Graduate Students

**Featured at Discovery Daily Planet Canada** 2017

"Ratchair: Furniture That Learns to Move Itself" demonstration for Discovery Daily Planet Canada

**KAIST Breakthroughs Newsletter** 2017

"Furniture That Learns to Move Itself" featured in KAIST Breakthroughs Newsletter

**Excellence Award for Bachelor's thesis** 2017

Thesis "UMorph: Self-Change Tracker to Reflect Yourself to the Past and to the Future"

**First prize in Qualcomm-KAIST Innovation Awards** 2016

Embedded Systems Awards

**SIGGRAPH 2016 Emerging Technologies DC EXPO Special Prize** 2016

For "Ratchair: Furniture That Learns to Move Itself With Vibration"

**Undergraduate Research Program Excellence Award** 2016

For Extraordinary Efforts and Research Outcomes

**KAIST International Student Scholarship** 2012 – 2016, 2017 – 2019

A stipend during the B.Sc. and M.Sc. at KAIST

**Kyiv Capital Olympiads in Mathematics** 2009, 2012

Bronze medal

**Regional Mathematics Olympiad** 2009

Silver medal

**Volyn Regional Mathematics Olympiad** 2008

Gold medal

## SKILLS

**Languages**: Ukrainian (native), Russian (native), English (fluent), Korean (elementary)
**Programming**: Python, Matlab, Java, Torch, Tensorflow, PyTorch, Git, LaTeX, OpenCV, Unix
**Prototyping**: Raspberry Pi, Arduino, Processing-Android, Autodesk Inventor, Rhino 5, Adobe Photoshop, Adobe Illustrator, Adobe After Effects, Adobe Premiere Pro

## SERVICE & EXTRA-CURRICULAR

**Reviewer** 2021

Energy Based Models Workshop @ ICLR2021

**Tutor at KAIST EE Co-op Program** 2018

Taught undergraduate students basics of ML, NLP and Tensorflow South Korea

**Tutor in Science Camp and English Camp** 2017, 2018

Prepared schoolchildren for a science competition, taught schoolchildren English South Korea

**Organizer of KAIST EE Promotion in Ukraine** 2017
Helped to organize EE Visit Camp, recruited students South Korea, Ukraine

**Teaching Assistant at KAIST** 2015 – 2016
Intro to Philosophy, English Short Stories, Philosophy of Mathematics, Logic and AI South Korea

**Volunteer at UEFA Euro 2012** 2012
Participated in closing ceremony dance performance in Kyiv Ukraine

**Candidate Master of Sports** 2001 – 2007
Acrobatic gymnastics Ukraine