DMITRY BABICHEV

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EDUCATION & WORK EXPERIENCE

Huawei *October, 2021 - Present*
Lead Researcher at Voice Biometrics Team.

The AI Institute *September, 2019 - August, 2021*
Professor at Machine Learning and Deep Learning (development and teaching of AI course).

ParisTech Telecom *March, 2019 - June 2019*
Postdoctoral researcher (anomaly detection)

École Normale Supérieure - Inria *September, 2015 - February, 2019*
PhD in machine learning (convex optimization, statistics)

CEDAR Audio Ltd *May, 2018 - July, 2018*
Industrial internship in audio restoration techniques

École polytechnique fédérale de Lausanne *May, 2017 - July, 2017*
Academic internship in signal processing techniques

Moscow Institute of Physics and Technology *2012 - 2015*
TA at the Chair of Mathematical Foundation of Control
Subjects: Probability Theory, Stochastic Processes, Discrete Analysis

Moscow Institute of Physics and Technology *September, 2008 - June, 2014*
Bachelor and Master in applied mathematics and physics, GPA: 4.7 out of 5

RESEARCH PROJECTS

Competence: machine learning, mathematical statistics, probability theory, stochastic processes, optimization, discrete analysis, combinatorics

Sublinear multi-class classification: We consider the multi-class classification with k classes, d features and n data-points. We pass to the saddle-point convex-concave problem and use Stochastic Mirror Descent approach with smart sampling techniques for matrix multiplication. As result we obtain complexity $O(d+n+k)$ of one iteration. This result relies on the combination of three ideas: (i) passing to the saddle-point problem with a quasi-bilinear objective; (ii) ad-hoc variance reduction technique based on a non-uniform sampling of matrix multiplication; (iii) the proper choice of the proximal setup in MD type schemes leading to the balance between the stochastic and deterministic error terms.

Stochastic optimization: Stochastic gradient methods enable learning probabilistic models from large amounts of data. We consider generalized linear models, that is, conditional models based on exponential families and propose averaging moment parameters instead of natural parameters for constant-step-size stochastic gradient descent. For finite-dimensional models, we show that this can sometimes (and surprisingly) lead to better predictions than the best linear model. For infinite-dimensional models, it always converges to optimal predictions, while averaging natural parameters never does.

Dimension reduction techniques: We consider non-linear regression problems where we assume that the response depends non-linearly on a linear projection of the covariates. We propose score function extensions to sliced inverse regression problems and show that they provably improve estimation in the population case over the non-sliced versions. We also propose to learn the score function as well, in two steps, i.e., first learning the score function and then learning the effective dimension reduction space, or directly, by solving a convex optimization problem regularized by the nuclear norm.

SKILLS

Coding: Python, R, C++, Matlab
Deep Learning: PyTorch, Keras, TensorFlow
Languages: C1 english, B2 french
Algorithms: leetcode top content creator

AWARDS AND SCOLARSHIPS

2015: GRE math: 98% score
2008: Gold medal at International Mathematical Olympiad (IMO)
2007, 2008: 1st place at Russian Mathematical Olympiad

PUBLICATIONS

D. Babichev, D. Ostrovskii and F. Bach. *Efficient Primal-Dual Algorithms for Large-Scale Multiclass Classification*, arXiv

D. Babichev and F. Bach. *Constant Step Size Stochastic Gradient Descent for Probabilistic Modeling.* UAI 2018, oral presentation

D. Babichev and F. Bach. *Slice inverse regression with score functions.* Electronic Journal of Statistics, 12(1):1507–1543, 2018.

D.S. Babichev, *Circles Touching Sides And The Circumcircle For Inscribed Quadrilaterals.* Journal of Classical Geometry Volume 1 (2012) 1 (2012): 57.

T. Babicheva, D. Babichev, S. Babichev, N. Babicheva, I. Yakovlev, A. Zhogov, M. Podaev, N. Fedotov, *Handbook on Olympiad mathematics. Level A1 (In Russian)*, ISBN 978-5-00058-886-4, MIPT Olympiad Schools, 2018, Moscow