NUMERICAL OPTIMIZATION AND COMPUTATIONAL OPTIMAL TRANSPORT

Moscow Institute of Physics and Technology (National Research University)

Degree or qualification is awarded: **PhD (Candidate of Science)**

Language of study: **English**
Mode of study: **full-time**
Duration: **4 years**
Availability of free education: **yes**
Price: **375 000 RUB**

Programme curator: **Denis Ustyuzhaninov**
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Entry requirements:

- Master's degree / equivalent in a related field
- B2 level of English
- Good track record of publications related to the topic of the intended research
- Strong research proposal 1,500 - 3,500 words

Research supervisor:
Pavel Dvurechensky
PhD

Supervisor's research interests:

- Optimization of algorithms.
- Optimal Transport.
- Algorithms for saddle-point problems and variational inequalities.
- Distributed optimization (parallel and decentralized).

Research highlights:

- Research is supported by RFBR, RSF and other scientific foundations.
- Participation in major international conferences on machine learning: ICML, COLT, NeurIPS.
- Collaboration with researchers in Germany, the Netherlands, USA.

Supervisor's specific requirements:

- Mathematical analysis.
- Linear algebra.
- Probability theory.
- Computer Science.
- Matlab/Python.
- Basic knowledge of optimization theory and methods is a bonus.

Main publications:

- Dvurechensky, P., Ostroukhov, P., Safin, K., Shtern, S., and Staudigl, M. Self-concordant analysis of Frank-Wolfe algorithms. International Conference on Machine Learning (2020), PMLR.
- Dvurechensky, P., Gorbunov, E., and Gasnikov, A. An accelerated directional derivative method for smooth stochastic convex optimization. European Journal of Operational Research (2020). https://doi.org/10.1016/j.ejor.2020.08.027

- Nesterov, Y., Gasnikov, A., Guminov, S., & Dvurechensky, P. Primal–dual accelerated gradient methods with small-dimensional relaxation oracle. Optimization Methods and Software (2020). https://doi.org/10.1080/10556788.2020.1731747
- A. Gasnikov, P. Dvurechensky, E. Gorbunov, E. Vorontsova, Daniil Selikhanovych and Cesar A. Uribe Optimal Tensor Methods in Smooth Convex and Uniformly Convex Optimization. Conference on Learning Theory. (2019), pp. 1374–1391 .
- A. Kroshnin, D. Dvinskikh, P. Dvurechensky, A. Gasnikov, N. Tupitsa and C.A. Uribe. On the Complexity of Approximating Wasserstein Barycenter. International Conference on Machine Learning (2019), PMLR, vol 97, pp.3530-3540.
- Dvurechensky, P., Dvinskikh, D., Gasnikov, A., Uribe, C. A., and Nedic, A. Decentralize and randomize: Faster algorithm for Wasserstein barycenters. In Advances in Neural Information Processing Systems 31 (2018), pp. 10783–10793.
- Dvurechensky, P., Gasnikov, A., and Kroshnin, A. Computational optimal transport: Complexity by accelerated gradient descent is better than by Sinkhorn’s algorithm. International Conference on Machine Learning (2018), PMLR, vol. 80, pp. 1367–1376.
- Bogolubsky, L., Dvurechensky, P., Gasnikov, A., Gusev, G., Nesterov, Y., Raigorodskii, A. M., Tikhonov, A., and Zhukovskii, M. Learning supervised pagerank with gradient-based and gradient-free optimization methods. In Advances in Neural Information Processing Systems 29 (2016), pp. 4914–4922.

Specializations within this programme