Nikolay S. Markov

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updated November 2022

Education

Ph.D. student, Northwestern University, Chicago, USA 2022–present
Driskill Graduate Program in Life Sciences

M.S. in Bioinformatics, Newcastle University, Newcastle upon Tyne, UK 2017–2018
With distinction
Dissertation: Evaluation of machine learning strategies for classification and unbiased discovery of the new cell types in the single cell RNA-seq datasets
Advisors:
— Jaume Bacardit, Reader at Newcastle University;
— Alexander Misharin, Assistant Professor at Northwestern University.

Undergraduate coursework in Biology, Moscow State University, Moscow, Russia 2003–2006
Genetics major

Publications

Rogan A. Grant*, Luisa Morales-Nebreda*, **Nikolay S. Markov***, Suchitra Swaminathan, Estefany R. Guzman, Darryl A. Abbott, … Ankit Bharat, Cara J. Gottardi, GR Scott Budinger, Alexander V. Misharin, Benjamin D. Singer, Richard G. Wunderink, The NU SCRIPT Study Investigators

Circuits between infected macrophages and T cells in SARS-CoV-2 pneumonia. *Nature*, 2021; 590, 635–641. https://doi.org/10.1038/s41586-020-03148-w
* equally contributing first co-author

Marc A Sala*, **Nikolay S. Markov***, Yuliya Politanska, Hiam Abdala-Valencia, Alexander V Misharin, Manu Jain

Expression of ACE2–A Key SARS-CoV-2 Entry Factor–Is Not Increased in the Nasal Mucosa of People with Cystic Fibrosis. *American Journal of Respiratory Cell and Molecular Biology*, 2022. https://doi.org/10.1165/rcmb.2021-0341LE
* equally contributing first co-author

L. Sikkema, D. Strobl, L. Zappia, E. Madissoon, **N.S. Markov**, … A.V. Misharin, M.C. Nawijn, M.D. Luecken, F. Theis

An integrated cell atlas of the human lung in health and disease. *bioRxiv*, 2022. https://doi.org/10.1101/2022.03.10.483747

Ankit Bharat, Melissa Querrey, **Nikolay S. Markov**, Samuel Kim, Chitaru Kurihara, Rafael Garza-Castillon, Adwaiy Manerikar, Ali Shilatifard, Rade Tomic, Yuliya Politanska, Hiam Abdala-Valencia, Anjana V. Yeldandi, Jon W. Lomasney, Alexander V. Misharin, G.R. Scott Budinger

Lung transplantation for pulmonary fibrosis secondary to severe COVID-19. *Science Translational Medicine*, 2020. https://doi.org/10.1126/scitranslmed.abe4282

Satoshi Watanabe, **Nikolay S. Markov**, Ziyan Lu, Raul Piseaux Aillon, Saul Soberanes, Constance E. Runyan, Ziyou Ren, Rogan A. Grant, Mariana Maciel, Hiam Abdala-Valencia, Yuliya Politanska, … Richard I. Morimoto, Paul A. Reyfman, G.R. Scott Budinger, Alexander V. Misharin

Resetting proteostasis with ISRIB promotes epithelial differentiation to attenuate pulmonary fibrosis. *PNAS*, 2021; 118 (20) e2101100118. https://doi.org/10.1073/pnas.2101100118

Masahiro Yoshida, Kaylee B. Worlock, Ni Huang, Rik G.H. Lindeboom, … **NU SCRIPT Study Investigators***, … Alexander V. Misharin, Sam M. Janes, Sarah A. Teichmann, Marko Z. Nikolić, Kerstin B. Meyer

Local and systemic responses to SARS-CoV-2 infection in children and adults. *Nature*, 2022; 602 321–327. https://doi.org/10.1038/s41586-021-04345-x
* part of the collective author

Clarissa M. Koch, Andrew D. Prigge, Kishore R. Anekalla, Avani Shukla, Hanh Chi Do-Umehara, Leah Setar, Jairo Chavez, Hiam Abdala-Valencia, Yuliya Politanska, **Nikolay S. Markov**, … Alexander V. Misharin, Karen M. Ridge, Bria M. Coates

Age-related Differences in the Nasal Mucosal Immune Response to SARS-CoV-2. *American Journal of Respiratory Cell and Molecular Biology*, 2021; volume 66 issue 2. https://doi.org/10.1165/rcmb.2021-0292OC

Matthew L. Speir, Aparna Bhaduri, **Nikolay S. Markov**, Pablo Moreno, Tomasz J. Nowakowski, Irene Papatheodorou, Alex A. Pollen, Brian J Raney, Lucas Seninge, W. James Kent, Maximilian Haeussler

UCSC Cell Browser: visualize your single-cell data. *Bioinformatics*, 2021. https://doi.org/10.1093/bioinformatics/btab503

Luisa Morales-Nebreda, Kathryn A. Helmin, **Nikolay S. Markov**, Raul Piseaux, Manuel A. Torres Acosta, Hiam Abdala-Valencia, Yuliya Politanska, Benjamin D. Singer

Aging imparts cell-autonomous dysfunction to regulatory T cells during recovery from influenza pneumonia. *JCI Insight*, 2021. https://doi.org/10.1172/jci.insight.141690

Constance E. Runyan, Lynn C. Welch, Emilia Lecuona, Masahiko Shigemura, Luciano Amarelle, Hiam Abdala-Valencia, Nikita Joshi, Ziyan Lu, Kiwon Nam, **Nikolay S. Markov**, … G. R. Scott Budinger, Jacob I. Sznajder, Alexander V. Misharin

Impaired phagocytic function in CX3CR1^{+} tissue-resident skeletal muscle macrophages prevents muscle recovery after influenza A virus-induced pneumonia in old mice. *Aging Cell*, 2020; 19:e13180. https://doi.org/10.1111/acel.13180

Nikita Joshi, Satoshi Watanabe, Rohan Verma, Renea P. Jablonski, Ching-I Chen, Paul Cheresh, **Nikolay S. Markov**, Paul A. Reyfman, … G.R. Scott Budinger, Alexander V. Misharin

A spatially restricted fibrotic niche in pulmonary fibrosis is sustained by M-CSF/M-CSFR signalling in monocyte-derived alveolar macrophages. *European Respiratory Journal*, 2020; 55 (1) 1900646. https://doi.org/10.1183/13993003.00646-2019

Invited talks

Cellular and molecular biomarkers of successful responses to therapy in severe pneumonia, including COVID-19 — November 2022

CZI Single-Cell Biology 2022 Annual meeting. Recording

Circuits between infected macrophages and T cells in SARS-CoV-2 pneumonia — June 2021

American Thoracic Society Allergy, Immunology and Inflammation (AII) assembly journal club. Recording

Work Experience

Post-Baccalaureate Research Fellow, Division of Pulmonary and Critical Care, Feinberg School of Medicine, Northwestern University, Chicago, USA — 2019–2022

Analyse transcriptomic data from human samples and mouse experiments to gain insights into COVID-19, pulmonary fibrosis, systemic sclerosis and other pulmonary diseases. Analyse clinical data to correlate -omics data to clinical states and effects of treatment. Write manuscripts, support and organize data exchange, data management infrastructure, survey and apply new tools to RNA-seq analysis, develop in-house algorithms, design biological experiments to test hypothesis generated from analysis of transcriptomic data.

Head of maintenance tools development group, Yandex, Moscow, Russia — 2014–2017

Develop, design and support web-services and console tools for system administrators and other employees. Manage a team of developers on these projects: mentor, resolve conflicts, improve performance, code review.

Full-stack software engineer, Yandex, Moscow, Russia — 2007–2014

Develop, design and support web-services and console tools for automating and improving employees' workflows.

Software engineer, Art. Lebedev Studio, Moscow, Russia 2006–2007
Develop and support web-sites and content management system.

Honors and awards

Northwestern Institute on Complex Systems Data Science Fellow 2022

Teaching Experience

Summer Students Program 2022 at Division of Pulmonary and Critical Care 2022
Co-mentored 1 college student in automated imaging analysis of healthy donor and fibrotic lung sections stained with immunohistochemistry and RNAscope assays to detect alveolar macrophage subtypes and their localizations. Helped develop project goals, methodology and results interpretation.

Summer Students Program 2020 at Division of Pulmonary and Critical Care 2020
Oversaw a group of 4 college students on a bioinformatics project of analysis of single-cell bronchial brushing samples in a remote setting during the 4-week Summer Students Program. Contributed to project's design, teaching R programming environment, single-cell RNA-seq experimental technology, single-cell analysis software (Seurat), mentoring and troubleshooting.

Introduction to Python, Introduction to Pandas and Matplotlib 2020
Small introductory lecture series during Data Science Nights at NICO, Northwestern University.

Introduction to Programming, Newcastle University, Newcastle upon Tyne, UK 2017
Unofficial 5-lecture course for fellow students.

Introduction to Computer Science with Python 3, Yandex, Moscow, Russia 2013
High-school students.

Coursework

DGP 440 Immunology, Northwestern University 2020
Auditioned the course

Evaluation of machine learning strategies for classification and unbiased discovery of the new cell types in the single cell RNA-seq datasets 2018
M.S. thesis, Newcastle University.
Advisers:
— Jaume Bacardit, Reader at Newcastle University;
— Alexander Misharin, Assistant Professor at Northwestern University.

We evaluated the possibility of using machine learning methods to rapidly annotate new single cell RNA-seq datasets based on the reference dataset. We assessed the performance of a gradient boosting algorithm `catboost` for predicting cell types in Mouse Cell Atlas dataset and 3 samples of mouse lungs. We explored several strategies to explicitly train our models to detect novel cell types that are absent in the reference dataset. `Catboost` showed good performance, and was able to detect novel cell types while retaining good quality of cell type predictions. This demonstrated the possibility to use machine learning classification for unbiased high-throughput cell type discovery.

Miscalleneous

Open Problems for Single-Cell Analysis Jamboree March 2021
https://openproblems.bio/jamboree/

Contributions to single-cell RNA-seq open-source tools `Seurat` and `CellBrowser`, bioinformatics tool `biopython` 2018–present

Dataset visualisation for Reyfman *et al.*, 2019 for Northwestern University 2018

Create a website with interactive dataset visualisation for single-cell RNA-seq lung datasets from Reyfman *et al.*, 2019 using open-source tools.

Lab system administrator, Polilov lab, Moscow State University, Moscow, Russia 2017–2019
Install and maintain software for connectome proofreading from Janelia Institute. Setup file sharing and backup for lab members.

Programming languages

Python, R, Java, C++, Ruby, Perl. Linux. Latex. HTML, JS.
Github: https://github.com/mxposed

Personal Information

Spanish: basic; French: basic; Japanese: basic
Hobbies: piano, photography
Russian citizenship
Born in 1986