

Dileep Kishore

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Education and training

Oak Ridge National Laboratory

Postdoctoral Research Associate

Oak Ridge, USA

Mar 2023–Present

Boston University

Postdoctoral Fellow

Boston, USA

Jan 2023–Mar 2023

Boston University

Ph.D. in Bioinformatics, GPA – 4.00/4.00

Advisor: Dr. Daniel Segrè

Boston, USA

2016–2022

Indian Institute of Technology – Madras

B.Tech (Honors) and M.Tech (Dual Degree) in Biotechnology, GPA – 9.23/10.00

Advisor: Dr. Karthik Raman

Chennai, India

2011–2016

Professional experience

Postdoctoral Research Associate: Oak Ridge National Laboratory

2023 – Present

- Developing a machine learning framework to predict interactions in microbial communities
- Using machine learning for bridging the gap between experiments, data, and mathematical modeling in bacterial communities

Graduate Student Researcher: Boston University

2016 – 2022

- **Thesis:** “Computational approaches for mapping, understanding and modulating interactions in microbial communities”
- Developed *ReLearn*, a reinforcement learning framework for optimal control of microbial communities in bioreactors
- Created *MiCoNE*, a 16S sequencing data analysis pipeline for the inference of co-occurrence networks
- Constructed a pipeline to estimate binding affinities of microbial metabolites for the Aryl Hydrocarbon Receptor (AHR)
- Formulated a mathematical model of the AHR regulatory pathway to study the effects of the binding of microbial metabolites to the AHR
- Assisted in the development of *MIND*, a database and web interface for the visualization and analysis of microbial interaction networks
- Initiated the analysis of metagenomics data from the gut microbiome of ultra centenarians and its inference into co-occurrence networks
- Advanced the development of *pipeliner*, a nextflow pipeline for the analysis of bulk and single-cell RNA sequencing data

Software developer: Open-source software

2018 – Present

- Developed *cayenne*, a Python package for performing stochastic simulations with a Cython backend
- Developed a dashboard for calculating daily carbon footprint using the Julia language
- Developed *mace*, a web application to calculate total carbon emissions of sourcing recipe ingredients

Research Engineer Intern: Biocon Limited

Summer 2014

- Optimized impeller and sparger designs for optimal culture growth in large-scale industrial bioreactors
- Undergraduate Student Researcher:** Indian Institute of Technology – Madras 2015 – 2016
- **Thesis:** “Discovering the design principles of circadian rhythms using GPGPUs”
 - Developed an algorithm for an unbiased search using GPUs to find network topologies capable of oscillations

Publications

Peer-reviewed publications.....

- **Kishore, D.**, Birzu, G., Hu, Z., DeLisi, C., Korolev, K. S., Segrè, D. (2023). Inferring microbial co-occurrence networks from amplicon data: a systematic evaluation. *mSystems*, 8(4). <https://doi.org/10.1128/msystems.00961-22>
- Pacheco, A. R., Pauvert, C., **Kishore, D.**, Segrè, D. (2022). Toward FAIR Representations of Microbial Interactions. *mSystems*, 7(5). <https://doi.org/10.1128/msystems.00659-22>
- Federico, A., Karagiannis, T., Karri, K., **Kishore, D.**, Koga, Y., Campbell, J. D., Monti, S. (2018). Pipeliner: A Nextflow-Based Framework for the Definition of Sequencing Data Processing Pipelines. *Frontiers in Genetics*. <https://doi.org/10.3389/fgene.2019.00614>

Preprints on BioRxiv.....

- Hu, Z., **Kishore, D.**, Wang, Y., Birzu, G., DeLisi, C., Korolev, K., Segrè, D. (2022). A resource for the comparison and integration of heterogeneous microbiome networks. *BioRxiv*, 2022.08.07..07.503059. <https://doi.org/10.1101/2022.08.07.503059>
- **Kishore, D.**, Chandrasekaran, S. (2020). Introducing and benchmarking the accuracy of cayenne: A Python package for stochastic simulations. *BioRxiv*, 2020.10.10.334623. <https://doi.org/10.1101/2020.10.10.334623>

Selected posters and talks

(*presenter)

- *Dileep Kishore, Pankaj Mehta, Daniel Segrè. *Using deep-RL to control bioreactors: The ReLearn framework*. Talk. Kilachand fellowship presentation sponsored by the Multicellular Design Program (May 2022).
- *Dileep Kishore, Gabriel Birzu, Zhenjun Hu, Charles DeLisi, Kirill S. Korolev, and Daniel Segrè. *Inferring microbial co-occurrence networks from 16S data: A systematic evaluation*. Talk and poster. Intelligent Systems for Molecular Biology 2019 (ISMB 2019).
- *Dileep Kishore, Gabriel Birzu, Zhenjun Hu, Charles DeLisi, Kirill S. Korolev, and Daniel Segrè. *MIND: The Microbial Interaction Network Database*. Talk and poster presentation. International Workshop on Bioinformatics and Systems Biology 2018 (IBSB 2018).
- *Tanya Karagiannis, *Kritika Karri, *Dileep Kishore, Joshua D. Campbell, and Stefano Monti. *Pipeliner: A flexible high-throughput sequencing data analysis framework*. Poster presentation. Intelligent Systems for Molecular Biology 2017 (ISMB 2017).
- *Dileep Kishore and Jennifer Reed. *Wild type flux predictions from RB-TnSeq data*. Poster presentation. Student symposium for Khorana, S. N. Bose and Viterbi-India programs 2015.

Technical Skills

Bioinformatics/Genomics: 16S sequence analysis, metagenomic analysis, bulk and single-cell RNA seq analysis, genome annotation, protein-ligand docking

Systems Biology: Metabolic modeling, graph theory, network analysis, kinetic modeling

Statistics: Hypothesis testing, linear/logistic regression, generalized linear models

Machine Learning: supervised (classification/regression), unsupervised, random forest, XGBoost, PCA, network inference

Deep Learning: CNNs, RNNs

Reinforcement Learning: off-policy (DQN), on-policy (A2C, PPO)

Mathematical Modeling: differential equations, stochastic processes, constraint-based modeling

Optimization: global, non-linear, linear programming, combinatorial optimization (network traversal, flow algorithms)

Computer Skills

Bioinformatics and pipelines: nextflow, snakemake, QIIME2, HUMAnN, cobrapy, AutoDock Vina

Python: NumPy, pandas, scikit-learn, SciPy, Keras, pytorch, Numba, PyCUDA, dash, dask, RDKit

Julia: JuMP.jl, Plots.jl, DataFrames.jl, Pluto.jl, Distributions.jl

R: RSTAN, dplyr, ggplot2, igraph, ggraph

Web and Database: HTML/CSS, React, Typescript, Flask, Django, PostgreSQL, MySQL

Cloud computing: Docker, Singularity, AWS, Linode

Other: MATLAB, Linux, git, C, C++, L^AT_EX

Teaching and leadership experience

Boston University.....

Instructor

Bioinformatics Research and Interdisciplinary Training Experience 2018–2022

Organized a series of workshops to introduce basic bioinformatics research to undergraduate researchers and to provide mentorship.

Organizing committee

BU Bioinformatics Student Organized Symposium 2019

Helped organize the annual symposium hosted by the Boston University bioinformatics program. Responsibilities included contacting leading researchers to coordinate talks at the symposium, introducing the speakers, organizing the poster session, and advertising the event to the broader scientific community in Boston.

Teaching assistant and recitation instructor

BF550: Foundations of Programming, Data Analytics, and Machine Learning in Python 2019

Assisted in teaching programming and machine learning concepts to graduate students.

Organizing committee and instructor

Bioinformatics Programming Workshops 2018–2019

Organized a series of workshops that taught basic programming concepts, bioinformatics tools, and tools that help facilitate reproducible research.

Organizing committee and instructor

Bioinformatics in the Cloud Workshop 2018

Organized a series of workshops that taught deployment of large data and complex algorithms to the cloud using the Amazon Web Services (AWS) platform.

Indian Institute of Technology – Madras.....

Teaching assistant

Data Structures and Algorithms for Biology 2015

Assisted in teaching basic bioinformatics data structures and algorithms to undergraduate students.

Teaching assistant

Computational Systems Biology 2015

Assisted in teaching computational biology, network biology and synthetic biology to undergraduate and graduate students.

Awards

Academic Fellowship: Kilachand fellowship sponsored by the multicellular design program 2021
Academic best record: Indian Institute of Technology – Madras, Biotechnology 2016