

Aqib Hasnain

PERSONAL DETAILS

Address UCSB Bioengineering Building, Room 1201B
Phone (832) 875-4514
Email aqib@ucsb.edu
Github <https://github.com/AqibHasnain>
Publications Google scholar profile
Website Personal webpage

EDUCATION

PhD. Mechanical Engineering 2017-Present
University of California, Santa Barbara
Advisor: Enoch Yeung
Specialization: Computational Science, Bioengineering, Dynamics and Control

BSc. Mechanical Engineering 2013-2017
University of Houston
Advisor: Kamran Alba
GPA: 3.84

RECENT EXPERIENCE

Machine Learning Intern, Perturbation Biology Summer 2022
Cellarity – A Flagship Pioneering Company

- Led the development of a novel, latent factor model for predicting optimal drug perturbations to transition diseased cells to healthy cells from time-course single-cell RNA-seq, revealing a set of factors that drive the hematological process of interest.
- Developed software in Python to train and test a suite of machine learning models for predicting diseased cellular response to thousands of drugs.
- Part of a team of data scientists who analyzed and integrated large-scale single-cell multi-modal 'omics datasets (scRNA-seq, scATAC-seq, CITE-seq) for the Open Problems in Single-Cell Analysis Kaggle competition.

Graduate Student Researcher 2018-Present
University of California, Santa Barbara

- Developing novel, joint computational and experimental methods and using dynamical modeling to analyze time-course RNA-seq measurements for:
 - Acceleration of the identification of biomarkers through learning perturbation-inducible cell states (to appear Nature Communications, Github repo)
 - Characterization and control of cell states resulting in antimicrobial resistance (Github repo)
 - Quantification of burden due to heterologous genetic circuitry (published in Biological Circuits and Systems, Github repo)
- Developing graph convolutional networks for integration of microbial mutant fitness and time-course RNA-seq for inference of unseen mutant fitness; application in microbial fitness control using CRISPR (work in progress).

SKILLS

Data Analysis: Time-series analysis, state-space and linear modeling, design of experiments, image processing, modeling of biological systems, high-throughput 'omics, high-dimensional statistics (shrinkage estimation, elastic net, Koopman operator, sparse PCA)

Machine Learning: Unsupervised learning (graph-based and matrix factorization techniques), supervised learning (deep learning, regression), optimization, control theory, dimensionality reduction, dynamic mode decomposition

NGS: Analysis of bulk and single-cell RNA-seq, ATAC-seq, random-barcoded transposon sequencing

Software: Proficient in Python (scikit-learn, scipy, scanpy), PyTorch, PyTorch Geometric, MATLAB, L^AT_EX, R, Git, Saturn Cloud

Experimental biology: Synthetic gene circuit design, RNA-seq (experimental design, assay execution, library preparation, modeling), cloning, flow cytometry, spectrophotometry, microscopy, CRISPRi

Languages: Fluent in English, Hindi, and Urdu. Ability to read Arabic

PEER-REVIEWED PUBLICATIONS

11. S. Balakrishnan, **Aqib Hasnain**, R. Egbert, E. Yeung. *Data-driven Observability Decomposition with Koopman Operators for Optimization of Phenotypes of Biological Systems*. in revision Automatica

10. **Aqib Hasnain**, S. Balakrishnan, D. Joshy, S.B. Haase, E. Yeung. *Learning perturbation-inducible cell states from observability analysis of transcriptome dynamics*. under minor revision in Nature Communications

9. S. Balakrishnan, **Aqib Hasnain**, R. Egbert, E. Yeung. *The Effect of Sensor Fusion on Data-Driven Learning of Koopman Operators*. arXiv preprint arXiv:2106.15091

8. S. Balakrishnan, **Aqib Hasnain**, N. Boddupalli, D. Joshy, E. Yeung. *Prediction of Fitness in Bacteria with Causal Jump Dynamic Mode Decomposition*. 2020 IEEE American Control Conference (ACC)

7. **Aqib Hasnain**, N. Boddupalli, S. Balakrishnan, E. Yeung. *Steady state programming of controlled nonlinear systems via deep dynamic mode decomposition*. 2020 IEEE American Control Conference (ACC)

6. **Aqib Hasnain**, S. Sinha, Y. Dorfan, A. Borujeni, Y. Park, P. Maschoff, U. Saxena, J. Urrutia, N. Gaffney, D. Becker, A. Siba, N. Maheshri, B. Gordon, C. Voigt, E. Yeung. *A data-driven method for quantifying the impact of a genetic circuit on its host*. 2019 IEEE Biomedical Circuits and Systems Conference (BioCAS)

5. N. Boddupalli **Aqib Hasnain**, S. Nandanoori, E. Yeung. *Koopman Operators for Generalized Persistence of Excitation Conditions for Nonlinear Systems*. 2019 IEEE Conference on Decision and Control (CDC)

4. **Aqib Hasnain**, N. Boddupalli, E. Yeung. *Optimal reporter placement in sparsely measured genetic networks using the Koopman operator*. 2019 IEEE Conference on Decision and Control (CDC)

3. O. Oladasu, **Aqib Hasnain**, P. Brown, I. Frigaard, K. Alba. *Density-stable displacement flow of immiscible fluids in inclined pipes*. Physical Review Fluids (2019)

2. **Aqib Hasnain**, E. Segura, K. Alba. *Buoyant displacement flow of immiscible fluids in inclined pipes*. Journal of Fluid Mechanics (2017)

1. **Aqib Hasnain** and K. Alba. *Buoyant displacement flow of immiscible fluids in inclined ducts: A theoretical approach*. Physics of Fluids (2017)

SELECTED PRESENTATIONS

9. Aqib Hasnain, S. Balakrishnan, D. Joshy, J. Smith, S. B. Haase, E. Yeung. *Data-driven modal analysis of transcriptome dynamics for discovery of genetic reporters*. Southern California Systems Biology Conference, UCLA (2022)

7. Aqib Hasnain and E. Yeung invited to give talk on: *A data-driven, operator-theoretic approach for understanding genetic circuit burden*. 2020 American Mathematical Society Spring Western Sectional Meeting, California State University (**Canceled due to Covid-19**)

6. Aqib Hasnain, S. Balakrishnan, D. Joshy, E. Yeung. *Towards engineering a microbiome malathion sensor using a data-driven approach*. 2nd International Conference on Microbiome Engineering (ICME 2019), Boston, Massachusetts

5. Aqib Hasnain, S. Sinha, Y. Dorfan, A. Borujeni, Y. Park, P. Maschoff, U. Saxena, J. Urrutia, N. Gaffney, D. Becker, N. Maheshri, B. Gordon, C. Voigt, E. Yeung. *Structured dynamic mode decomposition to quantify the impact of a genetic circuit on its host*. IEEE Biomedical Circuits and Systems Conference (BioCAS 2019), Nara, Japan

3. Aqib Hasnain, N. Boddupalli, E. Yeung. *Optimal reporter placement in sparsely measured networks: A Koopman operator approach*. Darpa Synergistic Discovery and Design (2019), Berkeley, California

AWARDS

- Acquired funding from Institute of Collaborative Biotechnologies to develop genetic temporal encoders (150k/yr for two years) 2021 - 2023
- Received UCSB GSA travel grant to present at CDC 2019 2019
- Received NSF funding to present at ICME 2019 2019
- William A. Brookshire Impact Scholarship 2016, 2017
- Roy and Lillie Cullen Scholarship 2016, 2017
- UH Houston Scholar (nominated by research advisor) Spring 2016
- BP Engineers of the Future Scholarship 2015, 2016
- Summer Undergraduate Research Fellowship 2015, 2016
- American Bureau of Shipping Scholarship 2015
- Provost's Undergraduate Research Scholarship Fall 2015

MENTORSHIP AND COMMUNITY WORK

- Mentored several undergraduates and new graduates in machine learning, numerical methods, and genetic engineering
- Reviewed papers for IEEE Conference on Decision and Control
- Reviewed papers for IEEE American Control Conference
- Reviewed papers for Journal of Fluid Mechanics