

# Aqib Hasnain

## PERSONAL DETAILS

---

<i>Address</i>	UCSB Bioengineering Building, Room 1201B
<i>Phone</i>	(832) 875-4514
<i>Email</i>	<a href="mailto:aqib@ucsb.edu">aqib@ucsb.edu</a>
<i>Github</i>	<a href="https://github.com/AqibHasnain">https://github.com/AqibHasnain</a>
<i>Publications</i>	Google scholar profile
<i>Website</i>	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 (submitted to Molecular Systems Biology, 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<sup>A</sup>T<sub>E</sub>X, 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