Shubham Chandak | CV

shubhamchandak94.github.io

Fourth year PhD student in Electrical Engineering at Stanford University, advised by Prof. Tsachy Weissman. Interested in DNA storage, bioinformatics, data compression, information theory and machine learning.

Education

- **Stanford University** — **Stanford, CA, USA**
  PhD, Electrical Engineering, ongoing — *2016–2021*
- **Stanford University** — **Stanford, CA, USA**
  MS, Electrical Engineering, GPA 4.2/4 — *2016–2018*
- **Indian Institute of Technology Bombay** — **Mumbai, India**
  B.Tech. in Electrical Engineering with Honours, CPI 9.99/10, Minor in Math — *2012–2016*

Academic Achievements

- **Qualcomm Innovation Fellowship** Finalist in 2019.
- **Beckman Technology Development Award** in 2018 for project on DNA Storage.
- Recipient of **The Numerical Technologies Co-Founders Fellowship** in 2017-18 awarded to the top performers in Stanford Electrical Engineering PhD qualifying exam.
- **Institute Silver Medal** at IIT Bombay for best academic standing in B.Tech. Electrical Engineering in 2016.
- **Prof. K. C. Mukherjee Award** at IIT Bombay for best project among B.Tech. Electrical Engineering students in 2016.
- Awarded the **Aditya Birla Scholarship** for 2012-16 by India's premier business house viz. Aditya Birla Group.
- **Gold medalist (International Rank 9)** at the **44th International Chemistry Olympiad**, Washington DC, USA in 2012.
- **All India Rank 15** in **IIT-JEE 2012** (IIT-Joint Entrance Exam) among more than 470,000 candidates.
- Recipient of **KVPY** Fellowship by Govt. of India with **All India Rank 6** in 2010.
- **NTSE** scholarship (National Talent Search Exam conducted by NCERT, Govt. of India) in 2009.

Publications

Journal

- S. Chandak, K. Tatwawadi, I. Ochoa, M. Hernaez and T. Weissman; SPRING: A next-generation compressor for FASTQ data, *Bioinformatics*, Volume 35, Issue 15, 1 August 2019, Pages 2674–2676.
- S. Chandak, K. Tatwawadi and T. Weissman; Compression of genomic sequencing reads via hash-based reordering: algorithm and analysis, *Bioinformatics*, Volume 34, Issue 4, 15 February 2018, Pages 558–567.
- N. Desai, C. Juvekar, S. Chandak and A. P. Chandrakasan, "An Actively Detuned Wireless Power Receiver With Public Key Cryptographic Authentication and Dynamic Power Allocation," in *IEEE Journal of Solid-State Circuits*, vol. 53, no. 1, pp. 236-246, Jan. 2018.

Conference

- S. Chandak, K. Tatwawadi, B. Lau, J. Mardia, M. Kubit, J. Neu, P. Griffin, M. Wootters, T. Weissman and H. Ji (2019). Improved read/write cost tradeoff in DNA-based data storage using LDPC codes. *2019 57th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, Monticello, IL, USA, 2019, pp. 147-156.
- A. Bhown, S. Mukherjee, S. Yang, S. Chandak, I. Fischer-Hwang, K. Tatwawadi and T. Weissman; "Humans are still the best lossy image compressors," *2019 Data Compression Conference (DCC)*, Snowbird, UT, USA, 2019, pp. 575-575.
- M. Goyal, K. Tatwawadi, S. Chandak and I. Ochoa; "DeepZip: Lossless Data Compression using Recurrent Neural Networks," *2019 Data Compression Conference (DCC)*, Snowbird, UT, USA, 2019, pp. 558-558.
- N. V. Desai, C. Juvekar, S. Chandak and A. P. Chandrakasan, "21.8 An actively detuned wireless power receiver with public key cryptographic authentication and dynamic power allocation," *2017 IEEE International Solid-State Circuits Conference (ISSCC)*, San Francisco, CA, 2017, pp. 366-367.

Patents

- S. Chandak, K. Tatwawadi, I. Ochoa, M. Hernaez and T. Weissman. Systems and Methods for Compressing Genetic Sequencing Data and Uses Thereof. *Patent application filed.*

- C. Wen, L. Wang, J. Aparicio, S. Chandak, K. Tatwawadi and T. Weissman. Embedded Deep Compression for Time Series Data. *Patent application filed.*
- A. P. Chandrakasan, N. Desai, C. Juvekar and S. Chandak. Detuning for a resonant wireless power transfer system including cryptography. *Patent application filed.*

Talks

- Error correcting codes for DNA based data storage. *ISMB/ECCB 2019*, Basel, July 21-25, 2019.
- SPRING: A next-generation compressor for FASTQ data. *ISMB/ECCB 2019*, Basel, July 21-25, 2019. *Invited.*
- SPRING: A next-generation compressor for FASTQ data. *Stanford Compression Workshop 2019*, Stanford, February 15, 2019. *Invited.*
- SPRING: A practical compressor for short-read FASTQ data. *56th Annual Allerton Conference on Communication, Control, and Computing*, Urbana, IL, October 3-5, 2018. *Invited.*

Poster

- Error correcting codes for DNA based data storage. *ISMB/ECCB 2019*, Basel, July 21-25, 2019.
- SPRING: A practical compressor for short-read FASTQ data. *ISMB 2018*, Chicago, IL, July 6-10, 2018.
- Compression of genomic sequencing reads with and without preserving the order. *2017 Biomedical Computation at Stanford Symposium*, Stanford University, 10 April, 2017.

Experience

- **Philips Research North America** — **Cambridge, MA, USA**
  Data Compression Research Intern — *June–September 2019*
  Worked on genomic data compression, supervised by Patrick Cheung.
- **Massachusetts Institute of Technology** — **Cambridge, MA, USA**
  Summer Intern — *May–July 2015*
  Worked on hardware implementation of Elliptic Curve Cryptography for IoT applications, supervised by Prof. Anantha Chandrakasan.
- **Oxford Brookes University** — **Oxford, UK**
  Summer Intern — *May–July 2014*
  Worked on electrode design for Functional Electrical Stimulation using numerical analysis, supervised by Prof. Cristiana Sebu.

Course Projects

- **Implementation and analysis of stabilizer codes in pyQuil** — *Spring 2018-19*
  Stabilizer codes form a large family of quantum error correcting codes that includes well-known codes such as Shor code, Steane code, CSS codes and toric codes.
  - As part of "CS 269Q: Quantum Computer Programming", we built a framework for encoding and decoding of general stabilizer codes on pyQuil and tested specific single qubit codes with standard quantum noise models.
- **Codes for DNA storage** — *Spring 2017-18*
  - Studied the trade-off between coding density and reading efficiency for DNA storage as part of course project for "EE 388: Modern Coding Theory".
  - Proposed practical error-correction schemes based on RaptorQ codes, BCH codes and LDPC codes.
  - Proposed schemes for run-length constrained coding using Fibonacci codes.
  - Achieved close-to-optimal results for a range of error rates.
- **Understanding the Amazon Rainforest from Space using CNNs** — *Spring 2016-17*
  - Participated in Kaggle contest "Understanding the Amazon from Space" by Planet Labs, as part of course project for "CS231N: Convolutional Neural Networks for Visual Recognition".
  - Tested various architectures for multi-class, multi-label prediction of weather and land-use features based on satellite images of the Amazon rainforest.
  - Received Bronze medal from Kaggle for getting leaderboard rank of 67 among 938 teams.

Coursework

- **Electrical Engineering:** Modern Coding Theory, Universal Schemes in Information Theory, Information Theory, Convex Optimization, Digital Signal Processing, Digital Communications, Control Systems, Microprocessors
- **Computer Science:** Advanced Cryptography, Quantum Computing, Cryptocurrencies & Blockchain Technologies, Cryptography, Convolutional Neural Networks for Visual Recognition, Probabilistic Graphical Models, Automata & Complexity Theory, Machine Learning, Web Applications
- **Statistics & Probability:** Advanced Probability & Random Processes
- **Mathematics:** Measure Theory, General Topology, Graph Theory, Abstract Algebra, Fourier Analysis, Complex Analysis, Real Analysis, Partial Differential Equations
- **Humanities & Social Sciences:** Economics, Sociology, Environmental Studies

Other Experience

- Collaboration project with Siemens on compression of sensor data in 2017-19.
- Teaching Assistant for EE 178 - Probabilistic Systems Analysis in Autumn 2017-18 and EE 376A - Information Theory in Winter 2018-19.
- Co-organizer of Stanford Compression Workshop 2019.
- Contributing to genie, an open-source codec for the MPEG-G standard for genomic information representation.

Technical and Personal Skills

- **Programming:**
  - Proficient in: C++, Python, NumPy, Matlab, LaTeX
  - Experience with: Tensorflow, Keras, R, VHDL, Arduino, SageMath, CVX, Javascript, MEAN stack
- Introductory Piano Class at Stanford.
- **Languages:** Hindi, English