

# 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 2016–2022
- 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

- Siemens Inventor of the Year 2020 award in Open Innovation category for sensor time-series compression project.
- 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 44<sup>th</sup> 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, J. Neu, K. Tatwawadi, J. Mardia, B. Lau, M. Kubit, R. Hulett, P. Griffin, M. Wootters, T. Weissman and H. Ji; "Overcoming high nanopore basecaller error rates for DNA storage via basecaller-decoder integration and convolutional codes," 2020 *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Barcelona, Spain, 2020, pp. 8822–8826.
- S. Chandak, K. Tatwawadi, C. Wen, L. Wang, J.A. Ojea and T. Weissman; "LFZip: Lossy compression of multivariate floating-point time series data via improved prediction," 2020 *Data Compression Conference (DCC)*, Snowbird, UT, USA, 2020, pp. 342–351.
- M. Goyal, K. Tatwawadi, S. Chandak and I. Ochoa; "DZip: improved general-purpose lossless compression based on novel neural network modeling," 2020 *Data Compression Conference (DCC)*, Snowbird, UT, USA, 2020, pp. 372–372.
- S. Chandak, K. Tatwawadi, B. Lau, J. Mardia, M. Kubit, J. Neu, P. Griffin, M. Wootters, T. Weissman and H. Ji; "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. Bhowan, 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. *U.S. Patent Application No. 16/545,751*.
- 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. *U.S. Patent No. 10,651,687* issued 12 May 2020.

## Preprints.....

- S. Chandak, K. Tatwawadi, S. Sridhar and T. Weissman; Impact of lossy compression of nanopore raw signal data on basecall and consensus accuracy, *BioRxiv* (2020).
- K. Tatwawadi and S. Chandak; Tutorial on algebraic deletion correction codes, *arXiv* (2019).

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

## 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.

- **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

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- **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:** Probabilistic Methods, Measure Theory, General Topology, Graph Theory, Abstract Algebra, Fourier Analysis, Complex Analysis, Real Analysis, Partial Differential Equations
- **Genomics:** Genomics, The Human Genome Source Code
- **Humanities & Social Sciences:** Economics, Sociology, Environmental Studies

## Other Experience

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- Collaboration project with Siemens on compression of sensor data since 2017.
- Teaching Assistant:
  - EE 178 - Probabilistic Systems Analysis, Autumn 2017-18
  - EE 376A - Information Theory, Winter 2018-19.
  - EE 276 - Information Theory, Winter 2019-20.
- Co-organizer of Stanford Compression Workshop 2019.
- Contributing to genie, an open-source codec for the MPEG-G standard for genomic information representation since 2018.
- Mentor for STEM to SHTM summer internship for high school students in 2020.

## Technical and Personal Skills

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