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

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Stanford University Stanford, CA, USA

PhD, Electrical Engineering, ongoing 2016–2021

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Stanford University Stanford, CA, USA

MS, Electrical Engineering, GPA 4.2/4 2016–2018

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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.

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+ 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

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Philips Research North America Cambridge, MA, USA

Data Compression Research Intern June–September 2019

Worked on genomic data compression, supervised by Patrick Cheung.

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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.

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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.

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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