

HIMANSHU ASNANI

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WORK EXPERIENCE

- **TATA INSTITUTE OF FUNDAMENTAL RESEARCH** Sept '19 - Present
Reader (eq. to tenure-track Assistant Professor), School of Technology and Computer Science Mumbai, India
- **UNIVERSITY OF WASHINGTON** July '18 - Present
Affiliate Assistant Professor, Electrical and Computer Engineering Department Seattle, WA
- **UNIVERSITY OF WASHINGTON** Feb '18 - June '19
Research Associate, Electrical and Computer Engineering Department Seattle, WA
- **IIT BOMBAY** Mar '17 - Mar '19
Visiting Assistant Professor, Electrical Engineering Department Mumbai, India
- **STANFORD UNIVERSITY** June '16 - August '16
Lecturer, Electrical Engineering Department Stanford, CA
- **SHIKHYA** Jan '18 - Present
Founding Advisor Cupertino, CA
- **SHIKHYA** Jan '16 - Dec '17
Co-Founder & CEO Cupertino, CA
- **ERICSSON R&D** April '14 - Feb '16
System Architect, DUIB IP Routers System & Technology San Jose, CA
- **ERICSSON R&D** June '13 - Sept '13
Engineering Intern, DUIB IP Routers System & Technology San Jose, CA

EDUCATION

- **STANFORD UNIVERSITY** Stanford, CA
Ph.D., Electrical Engineering Winter 2010 - Winter 2014
– GPA : 4.139 (Advisor : Prof. Tsachy Weissman)
- **STANFORD UNIVERSITY** Stanford, CA
M.S. in Electrical Engineering Fall 2009 - Spring 2011
– GPA : 4.046
- **INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY** Mumbai, India
B. Tech., Electrical Engineering Aug. 2005 - May 2009
– CGPA : 9.54/10 (Department Rank 4, Institute Rank 6)

RESEARCH INTERESTS

- Information and Coding Theory
- Statistical Estimation and Inference
- Machine Learning

ACADEMIC ACHIEVEMENTS

- Ranked 4th in IIT-JEE Main Examination and 1st in IIT-JEE Screening Examination 2005 all over India.
- **Bronze Medalist** at the 37th International Chemistry Olympiad (IChO) 2005, Taipei, Taiwan.
- **Gold Medalist** in Indian National Physics Olympiad (2005) and Indian National Chemistry Olympiad (2005).
- Ranked 1st in National Science Olympiad 2004 and 2005 all over India.

AWARDS AND SCHOLARSHIPS

- Named **Amazon Catalyst Fellow** for the year 2018 for "DeepCode : Inventing Communication Algorithms via Artificial Intelligence".

- Recipient of **Marconi Society Paul Baran Young Scholar Award** for the year 2014, which recognizes individuals who have, at an early age, demonstrated exceptional scientific and entrepreneurial capabilities with the potential to create significant advances in telecommunications and the Internet.
- **ISIT Student Paper Award Finalist** for the year 2011 in *IEEE International Symposium on Information Theory (ISIT)*, Saint Petersburg, Russia.
- Recipient of **Stanford Graduate Fellowship**.
- Awarded **Best Paper Award** for the paper "Scheduling with Limited Information in Wireless Systems" in **MobiHoc 2009**, New Orleans, Louisiana, USA.
- Awarded **Best B.Tech Project Award** for the year 2009 in IIT Bombay.
- Awarded **Bhavesh Gandhi Memorial Award** for Best B.Tech Research Seminar for the year 2008 in IIT Bombay.
- Invited to **First Theoretical Computing Winter School** organized by the *Institute of Theoretical Computer Science and Communications (ITCSC)* at the Chinese University of Hong Kong (CUHK) among 80 undergraduates from Universities in the Mainland China, Hong Kong, Taiwan and India.

BOOK CHAPTERS

- "Relations between Information and Estimation in the presence of Feedback", Himanshu Asnani, Kartik Venkat and Tsachy Weissman, **Invited contribution to Information and Control in Networks**, *Lecture Notes in Control and Information Sciences*, Volume 450, 2014, pp 157-175, Springer.

PATENTS

- "BNG / Subscriber Management Integrated, FIB Based, Per Subscriber, Opt-in Opt-out, Multi Application Service Chaining Solution via Subscriber Service Chaining NextHop and Meta IP Lookup", Himanshu Asnani, Mustafa Arisoylu, Ramnathan Laxmikanthan and Prashant Anand, **US Patent Office**, Application Number 14/640,452.
- "Method and system for packet redundancy removal", Himanshu Asnani, Ritesh Kolte and Mustafa Arisoylu, **US Patent Office**, Application Number 14/579,987.
- "Method and system for load balancing in a software-defined networking (SDN) system upon server reconfiguration", Himanshu Asnani, Rohit Basaravaja, Myna Vajha, Prashant Anand, Arvind Mukundan and Mustafa Arisoylu, **US Patent Office**, Application Number 14/575,021.

PUBLICATIONS (under review)

- "Mimic and Classify : A meta-algorithm for Conditional Independence Testing", Rajat Sen, Karthikeyan Shanmugam, Himanshu Asnani, Arman Rahimzamani and Sreeram Kannan, *under review*, September 2018, [Link : <https://arxiv.org/abs/1806.09708>].

JOURNAL PUBLICATIONS (accepted)

- "LEARN Codes : Inventing Low-latency codes via Recurrent Neural Networks", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sreeram Kannan, Sewoong Oh, and Pramod Viswanath, *IEEE Journal of Selected Areas in Information Theory*, Vol. 1, Issue 1, pp 207-216, May 2020.
- "Deep Learning meets Coding Theory", Sreeram Kannan and Himanshu Asnani, *IEEE India Council Newsletter*, Vol. 14, No. 4, Oct - Dec 2019.
- "Network Compression: Worst-Case Analysis", Himanshu Asnani, Ilan Shomorony, A. Salman Avestimehr, and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 61, Issue 7, pp 3980 - 3995, July 2015.
- "Information Embedding on Actions", Behzad Ahmadi, Himanshu Asnani, Osvaldo Simeone and Haim Permuter, **IEEE Transactions on Information Theory**, Vol. 60, Issue 11, pp 6902 - 6916, November 2014.
- "Capacity of a POST Channel with and without Feedback", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 60, Issue 10, pp 2538 - 2542, October 2014.
- "To Feed or Not to Feed Back", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 60, Issue 9, pp 5150 - 5172, September 2014.
- "Successive Refinement with Decoder Cooperation and its Channel Coding Duals", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 59, Issue 9, pp 5511-5533, September 2013.

- "QualComp: a new lossy compressor for quality scores based on rate distortion theory", Idoia Ochoa, Himanshu Asnani, Dinesh Bharadia, Mainak Chowdhury, Tsachy Weissman, and Golan Yona, **BMC Bioinformatics**, 2013, 14:187, June 2013.
- "Multi-Terminal Source Coding with Action Dependent Side Information", Yeow-Khiang Chia, Himanshu Asnani and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 59, Issue 6, pp 3653-3667, June 2013.
- "On Real Time Coding with Limited Lookahead", Himanshu Asnani, and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 59, Issue 6, pp 3582-3607, June 2013.
- "Multiple access channel with partial-cribbing encoders", Haim Permuter, and Himanshu Asnani, **IEEE Transactions on Information Theory**, Vol. 59, Issue 4, pp 2252-2266, April 2013.
- "Probing Capacity", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, **IEEE Transactions on Information Theory**, Vol. 57, Issue 11, pp 7317-7332, November 2011..
- "A Potpourri of Fermi Problems", Praveen Pathak, Vijay Singh and Himanshu Asnani. *Published in Resonance*, pg. 58-66, June 2007.
- "Effective mass theory of a two-dimensional quantum dot in the presence of magnetic field", Himanshu Asnani, Raghu Mahajan, Praveen Pathak, and Vijay Singh, **PRAMANA**, Volume 73, Number 3, 573-580.
- "BenDaniel-Duke Boundary Conditions : A Two Dimensional Analysis", Himanshu Asnani, and Biswanath Patel. *Published in Prayas* (Students' Journal of Physics), Vol. 2, No. 6, pg. 191-194, Nov-Dec 2005.

CONFERENCE PUBLICATIONS (accepted)

- "C-MI-GAN : Estimation of Conditional Mutual Information using MinMax formulation", Arnab Mondal, Arnab Bhattacharjee, Sudipto Mukherjee, Sreeram Kannan, Prathosh AP, and Himanshu Asnani, *to appear in Conference on Uncertainty in Artificial Intelligence*, 2020.
- "MaskAAE: Latent space optimization for Adversarial Auto-Encoders", Arnab Kumar Mondal, Sankalan Pal Chowdhury, Aravind Jayendran, Parag Singla, Himanshu Asnani, and Prathosh AP, *to appear in Conference on Uncertainty in Artificial Intelligence*, 2020.
- "Feedback Turbo Encoder", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sewoong Oh, Sreeram Kannan, and Pramod Viswanath, **21st IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)**, Virtual, May 26-28, 2020.
- "Joint Channel Coding and Modulation via Deep Learning", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sreeram Kannan, Sewoong Oh and Pramod Viswanath, **45th International Conference on Acoustics, Speech, and Signal Processing**, Virtual Barcelona, May 4-8, 2020.
- "Turbo Autoencoder: Deep learning based channel code for point-to-point communication channels", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sreeram Kannan, Sewoong Oh and Pramod Viswanath, **33rd Conference on Neural Information Processing Systems**, 2019.
- "CCMI : Classifier based Conditional Mutual Information Based Estimation", Sudipto Mukherjee, Himanshu Asnani and Sreeram Kannan, *to appear in Conference on Uncertainty in Artificial Intelligence 2019*, Tel Aviv, Israel, July 23-25, 2019.
- "MIND : Model Independent Neural Decoder", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sreeram Kannan *to appear in 20th IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC) 2019*, Cannes, France, July 2-5, 2019.
- "DEEPTURBO : Deep Turbo Decoder", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sreeram Kannan, Sewoong Oh, Pramod Viswanath *to appear in 20th IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC) 2019*, Cannes, France, July 2-5, 2019.
- "LEARN Codes: Inventing low-latency codes via recurrent neural networks", Yihan Jiang, Hyeji Kim, Himanshu Asnani, Sreeram Kannan, Sewoong Oh, and Pramod Viswanath *to appear in 53rd IEEE International Conference on Communications*, Shanghai, China, May 20-24, 2019.
- "On the Sum-capacity of Compound MAC Models with Distributed CSI and Unknown Fading Statistics", Debarbarnab Mitra, Himanshu Asnani, and Sibi Raj B. Pillai *to appear in 53rd Annual Conference on Information Systems & Sciences*, John Hopkins University, Baltimore, Maryland, USA, March 20-22, 2019.
- "ClusterGAN : Latent Space Clustering in Generative Adversarial Networks", Sudipto Mukherjee, Himanshu Asnani, Eugene Lin, and Sreeram Kannan, *to appear in Thirty-third AAAI Conference on Artificial Intelligence*, Honolulu, Hawaii, USA, January 27 - February 1, 2019 [Link : <https://arxiv.org/abs/1809.03627>].

- "Estimators for Multivariate Information Measures in Generative Probability Spaces", Arman Rahimzamani, Himanshu Asnani, Pramod Viswanath, and Sreeram Kannan, to appear in **Advances in Neural Information Processing Systems 31**, 2018 [Link : <https://arxiv.org/abs/1810.11551>].
- "Operational extremality of Gaussianity in network compression, communication, and coding", Himanshu Asnani, Ilan Shomorony, A. Salman Avestimehr, and Tsachy Weissman, in **IEEE Information Theory Workshop (ITW)**, Sevilla, Spain, September 9-13, 2013.
- "Network Compression: Worst-Case Analysis", Himanshu Asnani, Ilan Shomorony, A. Salman Avestimehr and Tsachy Weissman, in **IEEE International Symposium on Information Theory (ISIT)**, Istanbul, Turkey, July 7-12, 2013.
- "Information Embedding on Actions", Behzad Ahmadi, Himanshu Asnani, Osvaldo Simeone, and Haim Permuter, in **IEEE International Symposium on Information Theory (ISIT)**, Istanbul, Turkey, July 7-12, 2013.
- "Capacity of a POST Channel with and without Feedback", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, in **IEEE International Symposium on Information Theory (ISIT)**, Istanbul, Turkey, July 7-12, 2013.
- "Worst-Case Source for Distributed Compression with Quadratic Distortion", Ilan Shomorony, A. Salman Avestimehr, Himanshu Asnani, and Tsachy Weissman, in **IEEE Information Theory Workshop (ITW)**, EPFL, Lausanne, September 3-7, 2012.
- "Successive Refinement with Decoder Cooperation and its Channel Coding Duals", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, in **IEEE International Symposium on Information Theory (ISIT)**, Jul 1- Jul 6, 2012, Cambridge, MA, USA.
- "On Real Time Coding with Limited Lookahead", Himanshu Asnani and Tsachy Weissman, In **Proceedings of the 49th Annual Allerton Conference on Communications, Control and Computing**, Monticello, Illinois, September 28-30, 2011. (INVITED)
- "To Feed or Not to Feed Back", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, in **IEEE International Symposium on Information Theory (ISIT)**, Jul 31- Aug 5, 2011, Saint Petersburg, Russia (BEST STUDENT PAPER AWARD FINALIST).
- "Multi-terminal source coding with action dependent side information", Yeow-Khiang Chia, Himanshu Asnani, and Tsachy Weissman, in **IEEE International Symposium on Information Theory (ISIT)**, Jul 31- Aug 5, 2011, Saint Petersburg, Russia.
- "Multiple access channel with partial-cribbing encoders", Himanshu Asnani, and Haim Permuter, in **IEEE International Symposium on Information Theory (ISIT)**, Jul 31- Aug 5, 2011, Saint Petersburg, Russia.
- "Multiple access channel with partial and controlled cribbing encoders", Himanshu Asnani, and Haim Permuter, in **2010 IEEE 26th Convention of Electrical and Electronics Engineers in Israel (IEEEI)**, Nov 17-20, 2011, Eilat, Israel.
- "To Observe or Not to Observe the Channel State", Himanshu Asnani, Haim Permuter, and Tsachy Weissman, In **Proceedings of the 48th Annual Allerton Conference on Communications, Control and Computing**, Monticello, Illinois, September 29-October 1, 2010. (INVITED)
- "Learning to Optimally Exploit Multi-Channel Diversity in Wireless Systems", Prasanna Chaporkar, Alexandre Proutier and Himanshu Asnani, **IEEE INFOCOM 2010**, San Diego, CA.
- "Scheduling with Limited Information in Wireless Systems", Prasanna Chaporkar, Alexandre Proutier, Himanshu Asnani and Abhay Karandikar, in **Proceedings of the tenth ACM international symposium on Mobile ad hoc networking and computing (MobiHoc)**, New Orleans, LA May 2009 (BEST PAPER AWARD).
- "Social network analysis of the Short Message Service", Vikrat Tomar, Himanshu Asnani, Abhay Karandikar, Vinay Chander, Swati Agrawal, and Prateek Kapadia, in **2010 National Conference on Communications (NCC)**, India, Jan 29-31, 2010.

CURRENT ACADEMIC PROJECTS

- **DEEPCODE** Feb '18 - Present
 Collaboration : TIFR, UW-Seattle, UIUC, Samsung-AI, Intel
 - Leveraging modern statistical learning, such as deep learning and reinforcement learning to automatically invent communication schemes.
 - Building robust practical low-latency codes for multi-terminal network scenarios such as interference and relay channels.
- **CONDITIONAL INDEPENDENCE AND CAUSAL INFERENCE** Feb '18 - Present
 Collaboration : TIFR, UW-Seattle, IBM, UT-Austin
 - Inventing consistent and computationally efficient estimators for Conditional Mutual Information.

- Designing new paradigm for conditional independence testing.
- Leveraging the new designs for causal inference with applications in gene regulatory networks.

PAST ACADEMIC / INDUSTRY PROJECTS

- LOAD BALANCING / TRAFFIC STEERING / SDN-NFV** *April '14 - May '16*

• DUIB IP Routers System & Technology Ericsson R&D

 - **Network Traffic Redundancy Elimination:** Design optimal network redundancy elimination techniques via CDN (Content Delivery Networking) as well as network information theory techniques (e.g. compression, byte caching etc).
 - **Network Virtualization Network Function Virtualization (NFV) and Software Defined Networking (SDN):** Port applications on a virtualized platform and devise algorithms supporting business challenges. Define the architecture on Software Defined Networking (SDN) Applications, Data Plane for various networking solutions.
 - **Optimal Traffic Engineering Traffic Steering (TS) and Service Chaining (SC):** Define the architecture, strategy on traffic steering, service chaining and other related platform services (e.g. Legacy L2/L3) of SSR and SPR for internal and external applications / services.
- NETWORK COMPRESSION** *Jan '12 - May '15*

• Guide : Prof. Tsachy Weissman, Prof. A. Salman Avestimehr Stanford University, Cornell University

 - Proved Gaussian distribution to be worst case source and noise for distributed joint source channel coding over networks.
 - Provided a tractable and practically implementable algorithm to derive achievable schemes for non-Gaussian setting from Gaussian settings.
- HUMAN GENOME COMPRESSION** *Sept '11 - May '14*

• Guide : Prof. Tsachy Weissman, Prof. Golan Yona Stanford University

 - Developed theoretical framework for lossy compression of quality values, based on rate distortion theory, to effectively compress gene sequenced files
 - Proposed a tractable algorithm based on scalar quantization.
- COOPERATION IN COMMUNICATION** *Mar '11 - Apr '14*

• Guide : Prof. Tsachy Weissman, Prof. Haim Permuter Stanford University, Ben-Gurion University

 - Introduces new models of cooperation in wireless networks and distributed compression.
 - Characterized schemes that achieve optimal capacity.
- NETWORK REDUNDANCY ELIMINATION / LOAD BALANCING** *June '13 - Sept '13*

• DUIB IP Routers System & Technology Ericsson R&D

 - Designed architecture and algorithms for virtualization of load balancing for Smart Service Routers.
 - Designed the architecture and algorithms for new network redundancy elimination techniques - object and byte caching technologies for routers.
 - Developed techniques for efficient reliable data delivery via optimal transport as well as information theory for single sender multiple receiver based networks.
- CONTROL IN INFORMATION THEORY** *Jan '10 - July '12*

• Guide : Prof. Tsachy Weissman, Prof. Haim Permuter, Osvaldo Simeone Stanford, BGU, NJIT

 - Deals with remodeling of the existing resource constrained communication systems with the users taking decision that affect the quality or availability of channel state or side information.
 - Characterized optimal capacity regions as well as implementable schemes which achieve capacity.
 - Asymptotics in information theory are remodeled with emphasis to sequential communication.
- PERFORMANCE ANALYSIS OF SMS NETWORK** *B. Tech Project '08*

• Guide : Prof. Abhay Karandikar, Prof. Balaji Prabhakar IIT Bombay, Stanford University

 - Involves extensive **graph theoretical study** of the SMS network .
 - Aim to develop theoretical model for an SMS based **virtual social network**.
 - The work is in collaboration with **Tata Teleservices Limited (TTSL)**, Mumbai.
- OPTIMAL PROBING AND SCHEDULING IN WIRELESS SYSTEMS** *B. Tech Project '08*

• Guide : Prof. Prasanna Chaporkar, Prof. Abhay Karandikar IIT Bombay

 - Involves finding an optimal probing and scheduling policy for scenario when each user is associated with a particular weight.
 - Aim to incorporate power control in the optimal policy.
- RESOURCE ALLOCATION IN WIRELESS AD HOC PODCASTING** *Summer Internship '08*

• Guide : Prof. Jean-Yves Le Boudec EPFL, Lausanne

- Proposed schemes and **implementable algorithms** for maxmin fair and utility optimal allocation of channels in a wireless ad hoc podcast network.
- Proposed a **decentralized policy** which could be implementable on independent platforms.

STOCHASTIC DECISION CONTROL IN WIRELESS NETWORKS.

B. Tech Seminar
IIT Bombay

- Guide : Prof. Abhay Karandikar
 - Applied **stochastic control** applications to energy efficient network scheduling.
 - Proposed a novel **online stochastic approximation algorithm** for optimal resource allocation when channel states are partially known.

PEDOMETER

Electronic Design Lab
IIT Bombay

- Guide : Prof. Dinesh Sharma
 - Developed a **bimodular product** which can be used to measure walking/jogging speed, distance etc.
 - One of the modules could be worn in foot to sample motion data and perform calculations while other was a handheld display device which was **wirelessly connected** to foot module.

ANALYZING 2-DIMENSIONAL QUANTUM DOTS UNDER EFFECTIVE MASS THEORY

NIUS
HBCSE-TIFR

- Guide : Prof. Vijay Singh
 - Performed quantum mechanical analysis to obtain theoretical closed form expressions of the energy of an electron in a 2D quantum well.
 - Similar results were also obtained on the application of magnetic field as well.
 - This project was done as part of the National Initiative on Undergraduate Science(NIUS), at Homi Bhabha Centre for Science Education(HBCSE).

Relevant Courses

- Information Theory A&B, Network Information Theory, Modern Coding Theory, Universal Schemes in Information Theory.
- Machine Learning, Representation Learning.
- Theory of Probability A,B,&C, Modern Applied Statistics (Learning), Theory of Large Deviations. Inference, Estimation and Information Processing, Stochastic Modeling, Stochastic Calculus and Control.
- Game Theory, Randomized Algorithms.
- Signals and Systems, Stochastic Systems, Network Architecture and Performance Engineering, Principles of Cooperation in Wireless Networks.

Professional Activities

- Reviewer for ISIT, NIPS, ICML, JMLR, IEEE Transactions on Information Theory.
- Reviewer for Ericsson Patent Board 2014, 2015.

References

- **Prof. Tsachy Weissman**
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