SHASHANK VATEDKA

Room 732, Institute of Network Coding
Ho Sin Hang Engineering Building
Chinese University of Hong Kong
Shatin, N.T., Hong Kong
shashank@inc.cuhk.edu.hk
shashank271089@gmail.com
https://github.com/svatedka/shashank.github.io

EDUCATION

Indian Institute of Science (IISc), Bengaluru, India
Ph.D in Electrical Communication Engineering   Aug 2011–Mar 2017 (expected)
Thesis: *Lattice Codes for Secure Communication and Secret Key Generation*
(submitted June 2016)
Advisor: Prof. Navin Kashyap.
GPA: 7.0/8.0

PES University (formerly PES Institute of Technology), Bengaluru
Bachelor of Engineering in Electronics and Communication   2007–11
GPA: 9.3/10.0

GRADUATE COURSEWORK

Analysis-1 (Real Analysis), Random Processes, Information Theory, Error Control Coding, Digital Communication, Space-Time Signal Processing and Coding, Information Theory and Coding for Nonstandard Channel Models.

EXPERIENCE

Research assistant   Sept 2016–present
Institute of Network Coding, The Chinese University of Hong Kong

Summer Intern   Jun–Aug 2015
Institute of Network Coding, The Chinese University of Hong Kong
Advisor: Prof. Pascal Vontobel.

RESEARCH INTERESTS

Information Theory, Physical layer security, Coding Theory, Lattices, Learning.

DISTINCTIONS

- TCS (Tata Consultancy Services) Research Fellowship   Jan 2014-present
- Ranked 75th in GATE-2011 (National level Graduate Aptitude Test in Engineering for postgraduate admissions) out of approx. 137,000 participants.   2011
- Ranked 63rd in Karnataka CET (Common entrance test for undergraduate admissions) out of approx. 100,000 participants.   2007

PUBLICATIONS

Published/Accepted in Refereed International Journals
1. S. Vatedka, N. Kashyap, *"Some "Goodness" Properties of LDA Lattices," to appear*, Problems of Information Transmission, accepted Oct. 2016.
2. S. Vatedka, N. Kashyap, A. Thangaraj, *"Secure Compute-and-Forward in a Bidirectional Relay,"* IEEE Transactions on Information Theory, vol. 51, no. 5, pp. 2531–2556, May 2015.

Journal Papers in Review/Preparation

1. S. Vatedka, N. Kashyap, *"Improving the Performance of Nested Lattice Codes Using Concatenation," submitted,* IEEE Transactions on Information Theory, submitted Aug. 2016.

Conference Publications
1. S. Vatedka, P.O. Vontobel, *"Pattern Maximum Likelihood Estimation of Finite-State Discrete-Time Markov Chains,"* International Symposium on Information Theory (ISIT), Barcelona, Spain, Jul. 2016.
2. S. Vatedka, N. Kashyap, *"A Lattice Coding Scheme for Secret Key Generation from Gaussian Markov Tree Sources,"* International Symposium on Information Theory (ISIT), Barcelona, Spain, Jul. 2016.
3. S. Vatedka, N. Kashyap, *"A Capacity-Achieving Coding Scheme for the AWGN Channel with Polynomial Encoding and Decoding Complexity,"* 2016 National Conference on Communications (NCC), Guwahati, India, Mar. 2016.
4. S. Vatedka, N. Kashyap, *"Some Goodness Properties of LDA Lattices,"* Information Theory Workshop (ITW), Jerusalem, Israel, Apr. 2015.
5. S. Vatedka, N. Kashyap, *"Nested Lattice Codes for Secure Bidirectional Relaying with Asymmetric Channel Gains,"* (*Invited*), Information Theory Workshop (ITW), Jerusalem, Israel, Apr. 2015.
6. Shashank V, N. Kashyap, *"Lattice Coding for Strongly Secure Compute-and-forward in a Bidirectional Relay,"* International Symposium on Information Theory (ISIT), Istanbul, Turkey, Jul. 2013.
7. N. Kashyap, Shashank V, A. Thangaraj, *"Secure Computation in a Bidirectional Relay,"* International Symposium on Information Theory (ISIT), MIT, Massachusetts, Jul. 2012.
8. A. V. Krishna, Shashank V, *"Mutual Information with Filterbank Equalization for MIMO Frequency Selective Channels",* National Conference on Communications(NCC), IISc, Bengaluru, Jan. 2011.

PROJECTS

- **Pattern maximum likelihood estimation of discrete-time Markov chains**
  Institute of Network Coding
  We studied the pattern maximum likelihood (PML) estimation problem for discrete-time Markov chains (DTMCs). Extending a similar result for memoryless sources, we showed that plug-in estimators obtained from the PML estimate can efficiently estimate functionals of the transition kernel which are invariant to a relabeling of the alphabet. We also studied some computationally efficient approximations of the PML estimate and studied some of their properties.

- **Secret key generation in the Gaussian source model**
  Indian Institute of Science
  We studied secret key generation in a multiterminal source model, where the terminals possess correlated Gaussian sources, and are jointly distributed according to a Markov tree structure. We gave a lattice-based coding scheme with an overall computational complexity which is polynomial in the number of samples. We found that in the fine quantization limit, our scheme achieves the secret key capacity in certain special cases. However, we were also able to find examples where our scheme does not achieve key capacity in the fine quantization limit.

- **Design and analysis of lattice coding schemes with low decoding complexity**
  Indian Institute of Science
  Several nested lattice coding schemes with polynomial-time decoding complexity have been proposed for communication over Gaussian channels. A particular class of lattices is the Low Density Construction-A (LDA) lattices, obtained from nonbinary LDPC codes, which have polynomial-time belief propagation (BP) decoding algorithms. These have been theoretically shown to be optimal with lattice decoding, and empirically shown to perform well with BP decoding. We studied these lattices and proved that they have very good structural properties. We also studied a capacity-achieving concatenated lattice coding

scheme for the AWGN channel that has a polynomial-time encoding/decoding complexity and extended these results to other Gaussian source and channel coding problems.

- **Secure Communication in Bidirectional Relay networks**
  Indian Institute of Science
  Bidirectional relaying, where a relay helps two user nodes to exchange messages has been an active area of recent research. We studied the compute-and-forward scheme for bidirectional relaying from an information theoretic point of view. We designed coding schemes for reliable and information-theoretically secure communication, and obtained achievable rates for the same.

- **Performance Analysis of Filterbank Equalization for MIMO frequency selective channels**
  PES University (Undergraduate thesis work)
  We studied the error performance and mutual information of filterbank equalizers for MIMO frequency selective channels. Filterbank linear and decision feedback equalizers were analyzed. Expressions for mutual information were derived and compared with zero padded block processing systems. Analysis of diversity and coding gain were done through simulations.

PROGRAMMING SKILLS	- C, MATLAB.

PROFESSIONAL ACTIVITIES

Memberships
- Member, IEEE, IEEE Information Theory Society, IEEE Communications Society.

Reviewer
- IEEE Transactions on Information Theory, IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, IEEE Transactions on Information Forensics and Security.
- Regular reviewer for ISIT, NCC, SPCOM.

Volunteer
- Organiser, Student Seminar Series at the Dept. of ECE, IISc, Dec. 2012–Jun. 2016.
- International Conference on Signal Processing and Communications (SPCOM), IISc, Bengaluru, India, 2014.
- 2015 JTG/IEEE IT Society Summer School on Signal Processing, Communications and Networks, IISc, Bengaluru, India, July 2015.
- International Conference on Signal Processing and Communications (SPCOM), IISc, Bengaluru, India, 2016.

Participation in Conferences
- International Symposium on Information Theory (ISIT), Barcelona, Spain, Jul. 2016.
- National Conference on Communications, Guwahati, India, Mar. 2016.
- International Symposium on Information Theory (ISIT), Hong Kong, Jun. 2015.
- Information Theory Workshop (ITW), Jerusalem, Israel, Apr.–May 2015.
- International Symposium on Information Theory (ISIT), Istanbul, Turkey, Jul. 2013.
- International Conference on Signal Processing and Communications (SPCOM), Jul. 2012.
- National Conference on Communications (NCC), Bengaluru, India, Jan. 2011.

Participation in Workshops and Schools
- Bombay Information Theory Seminar, IIT Bombay, Mumbai, India, Jan. 2016.
- Lectures in Probability and Stochastic Processes, IISc, Bengaluru, India, Dec. 2015.
- Croucher Summer School in Information Theory (CSCIT), CUHK, Hong Kong, Jun. 2015.
- Joint Telematics Group/IEEE Information Theory Society Summer School in Signal Processing, Telecommunication, and Networking, IIT Madras, Chennai, India, Jun. 2014.

- Joint Telematics Group Summer School in Signal Processing, Telecommunication, and Networking, IIT Madras, Chennai, India, Jun. 2013.
- Workshop on Limit Theorems in Probability (organised by NMI), IISc, Bengaluru, India, Jan. 2013.
- Workshop on Network Science in Electrical Engineering and Computer Science (organised by NMI), IISc, Bengaluru, India, Jan. 2012.

Teaching assistance
- Information Theory (2012, 2013), Indian Institute of Science.
- Digital Signal Processing (2009), PES University.

TALKS

Conference talks
- "Pattern Maximum Likelihood Estimation of Finite-State Discrete-Time Markov Chains," ISIT, Barcelona, Spain, Jul. 2016.
- "A Lattice Coding Scheme for Secret Key Generation from Gaussian Markov Tree Sources," ISIT, Barcelona, Spain, Jul. 2016.
- "Some Goodness Properties of LDA Lattices," Information Theory Workshop (ITW), Jerusalem, Israel, Apr. 2015.
- "Nested Lattice Codes for Secure Bidirectional Relaying with Asymmetric Channel Gains," Information Theory Workshop (ITW), Jerusalem, Israel, Apr. 2015.
- "Lattice coding for strongly secure compute-and-forward in a bidirectional relay," ISIT, Istanbul, Turkey, Jul. 2013.
- "Mutual Information with Filterbank Equalization for MIMO Frequency Selective Channels," National Conference on Communications(NCC), IISc, Bengaluru, Jan. 2011.

Other talks
- "Secure compute-and-forward in a bidirectional relay," JTG/IEEE Information theory society summer school, Indian Institute of Technology, Chennai, Jun. 2013.
- "Secure compute-and-forward in a bidirectional relay," ECE Student seminar, Indian Institute of Science, Bengaluru, Nov. 2012.
- "Information-theoretic security," at PES University, Bengaluru, Feb. 2012.
- "Applications of linear algebra for electronics engineers," at PES University, Bengaluru, Oct. 2011.