

Ritvik Srivastava

CONTACT INFORMATION

Master's Degree holder
Dept. of Electrical Engineering
Indian Institute of Technology, Kanpur

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RESEARCH INTERESTS

Probability theory and theoretical machine learning.

EDUCATION

Dual Degree Student, Electrical Engineering, IIT Kanpur **2012 - 2017**

- B.Tech. CPI (Cumulative Performance Index) : 8.0 (On a scale of 10)
- M.Tech. CPI (Cumulative Performance Index) : 8.4 (On a scale of 10)

Delhi Public School, Bokaro, Central Board of Secondary Education (CBSE)

- AISSCE (All India Senior School Certificate Examination)(Class XII): 93.4%
- AISSE (All India Secondary School Exam) (Class X): 9.6 CGPA

PUBLICATIONS

R. Srivastava, Rakesh K. Bansal. "Sequential Change Detection Through Universal Compression - An Asymptotic Study", in *International Symposium on Information Theory (ISIT)*, 2018. [\[link\]](#)

Dheerak k. Chittam, Rakesh K. Bansal, **R. Srivastava** "Universal Compression of a Piecewise Stationary Source Through Sequential Change Detection", in *National Communications Conference (NCC)*, IIT Hyderabad, February 25-28, 2018.

R. Srivastava, S. Mukherjee and A. Biswas, "Design of Broadband Planar Substrate Integrated Waveguide (SIW) Transvar Coupler", in *IEEE International Symposium on Antennas and Propagation and North American Radio Science Meeting*, Vancouver, Canada, July, 2015 [\[link\]](#)

SCHOLASTIC ACHIEVEMENTS

- **Academic Excellence Award** for the Academic year 2012/13
- Awarded the National Talent Search Scholarship (**NTSE**) by the government of India , 2010
- Selected for the **KVPY** (Kishore Vaigyanik Protsahan Yojana) Fellowship in 2012 awarded by the **Indian Institute of Science**, Bangalore
- Qualified the **Regional Mathematical Olympiad** in 2010 organised by the National Board of Higher Mathematics and Department of Atomic Energy
- Ranked in **Top 0.1%** (amongst 500,000 students) in Joint Entrance Examination, 2012
- Ranked in **Top 0.1%** (amongst 600,000 students across the country) for the AIEEE, 2012
- Gold Medallist and recipient of the Blue tie for outstanding academic achievement for 6 consecutive years in middle school through high school

MASTER'S THESIS

Asymptotic operating characteristics of modified Page's CUSUM

Mentor: Dr. Rakesh Bansal, *Dept. of Electrical Engg.*, IIT Kanpur

May'16-May'17

A modified version of Page's CUSUM (Cumulative Sum test, one of the principle tests in sequential change detection) was studied. The modified test replaced the true Log-Likelihood Ratio (LLR) under the competing hypothesis via a pseudo-LLR. The pseudo-LLR consisted of a universal code (for ex: LZ77 or LZ78) being substituted for the true log-likelihood. 1-quick convergence property of such codes along with the r-quick convergence of the LLR was employed to come up with the result. More details can be found [\[link\]](#).

RESEARCH EXPERIENCE

Circular inferences in Schizophrenia

May-July 2015

Mentor: Dr. Sophie Deneve, *Laboratoire de Neurosciences Cognitives*, ENS, Paris

Worked on a model to predict the responses of normal, healthy participants when presented with a Necker cube stimulus in various experimental paradigms (Contradictory stimulus, Reinforced stimulus, control). A three layer Hidden Markov Model (HMM) was used to crudely simulate the top-down

and bottom up processing in the cortical areas, and the corresponding orientation of the Necker cube was sampled at each time step. The model was able to reproduce qualitatively a number of properties associated with this stimulus reported in literature like relative predominance, alternation rate etc. Next stage was planned to include patients to verify the hypothesis of aberrant circular inference (excitatory-inhibitory imbalance) in Schizophrenic subjects.

Design of an X-band (8-12Ghz) SIW Directional Coupler

May-July 2014

Mentor: Dr. Animesh Biswas, *Dept. of Electrical Engineering, IIT Kanpur.*

Applied the design procedures for a rectangular waveguide directional coupler (**Transvar coupler**) with some modifications for the fabrication of a SIW (Substrate Integrated Waveguide) directional coupler. Verified the applicability of the design procedure in the new paradigm (SIW paradigm), via simulations on Ansoft HFSS (High Frequency Structure Simulator) and experimental measurement of the various parameters of the fabricated structure. Finally, was able to establish trade-offs between various design parameters of the coupler like diameter of the via-holes and size of the coupling apertures. *Work done presented at IEEE International Symposium on Antennas and Propagation and North American Radio Science Meeting, Vancouver, Canada, July 2015*

COURSE PROJECTS COGNITIVE SCIENCE

AND TERM PAPERS

Integration of monocular cues in depth perception in grasshoppers

Sept.-Nov. 2014

Course project, SE367A: Cognitive Science, under Dr. Amitabha Mukherjee, IIT Kanpur

Designed & performed behavioural experiments with short horned grasshoppers, to ascertain the role of monocular depth cues in computing motion parallax. Demonstrated a significant departure from the normal peering behaviour, in grasshoppers whose one eye was artificially occluded.

MACHINE LEARNING AND OPTIMIZATION

Gibbs sampling for Dirichlet Process Mixture Model

Jan.-Aprl. 2016

Course project, CS772A: Probabilistic Machine Learning, under Dr. Piyush Rai, IIT Kanpur

Tried out clustering using Dirichlet Process Mixture models (DPMs) on artificially generated datasets. Developed a basic understanding of various Bayesian non-parametric methods

Gaussian process (GPs) kernels for pattern discovery and extrapolation

Aug.-Nov. 2015

Course project, CS698A: Kernel Learning, under Dr. Harish Karnick, IIT Kanpur

Looked at ways of modelling kernels of GPs, specifically a method where the Fourier transform of the kernel was modelled using a mixture of Gaussians. Went through a representative thesis on it.

Non-linear Classification via Kernel Methods

Jan.-Aprl. 2016

Course project, EE698W: Convex Optimization, under Dr. Ketan Rajawat, IIT Kanpur

Surveyed the theory behind non-linear classification using Support vector Machines (SVMs). Ran various algorithms to solve the SVM optimization problem on standard datasets

INFORMATION AND CODING THEORY, SIGNAL PROCESSING

Distributed Estimation and Detection Over Gaussian MACs

Aug.-Nov. 2016

Term Paper, EE602A: Statistical Signal Processing, under Dr. Rajesh Hegde, IIT Kanpur

Implemented the proposed method and reproduced some of the results claimed in [\[1\]](#). Pointed out a few inaccuracies in the paper and assumptions required to circumvent the same

Survey on Braided Block Codes

Jan.-Aprl. 2016

Term Paper, EE628A: Error Control Coding, under Dr. Adrish Banerjee, IIT Kanpur

Reviewed existing literature on the construction of Braided Block Codes (BBCs) along with its code properties like minimum distance and asymptotic iterative decoding performance

Synthesis and Analysis of Stochastic Switching Circuits

Aug.-Nov. 2015

Term Paper, EE624A: Information Theory, under Dr. Adrish Banerjee, IIT Kanpur

Reviewed the basic definitions and properties related to the abstract notion of stochastic switching circuits. Studied the theoretical bounds on various properties of such circuits like error tolerance, expressibility and probability approximation

TEST SCORES

GRE: 328/340, Verbal:159/170, Quantitative:169/170, Analytical Writing: 4.5/6.0

WORKSHOPS

GIAN course on Modelling Cerebral Cortex and Plasticity

Aug. 7-16, 2016

Speakers: Dr. Mriganka Sur, Dr. Dipanjan Roy, Dr. Srinivas Chakravarthy

- Got introduced to various models of firing neurons, including leaky integrate and fire (LIF), Izhikevich model etc. and hands-on experience in simulation using BRIAN
- Attended talks on state of the art methods in imaging, experiment design and recordings

GIAN course on Advanced Topics in Coding Theory

Oct. 13-22, 2016

Speakers: Dr. Daniel J. Costello, Dr. Emre Telatar, Dr. Adrish Banerjee

- Attended talks focused on mainly two areas of active research in coding theory: first, various graph based codes for eg. LDPC codes, spatially coupled codes, and second polar codes

RELEVANT
COURSES

MATHEMATICS: Advanced Topics in Stochastic processes, Representation and Analysis of Random Signals (Probability Theory), Real Analysis, Applied Stochastic Processes, Probability and Statistics, Linear Algebra, Complex Analysis, Differential Equations

INFORMATION & CODING THEORY, MACHINE LEARNING: Probabilistic machine learning, Convex optimization in signal processing and communication, Topics in cryptography and coding, Information theory, Learning with Kernels, Machine learning techniques, *Statistical Signal Processing**

COGNITIVE SCIENCE: Introduction to cognitive science, Neurobiology, Introduction to psychology
*ongoing, Fall 2016

TECHNICAL
SKILLS

- **Programming Languages:** C++, C, R, python
- **Design Softwares:** Ansoft HFSS, Micro-Cap (Circuit Simulation Software), BRIAN
- **Other Tools:** MATLAB, GNU Octave, Tensorflow, Keras, L^AT_EX

POSITIONS OF
RESPONSIBILITY

- **Academic Mentor**, for the *Introductory Course on Mechanics* during 2013-2014: **Tutored and mentored** academically weak students from the same batch and junior batch
- **Teaching Assistant**, *EE621A: Representation and Analysis of Random Signals (Probability Theory)*: Was responsible for grading quizzes and exams, personally mentored a student
EE321A: Principles of Communication Systems: Graded quizzes and scribed lecture notes
- **Secretary, Quiz Club**, the hobby group formed of quizzers of IIT Kanpur: Actively involved in organizing quiz events and in participating in various quizzes