

Ritvik Srivastava

CONTACT INFORMATION

Dual Degree Student
Dept. of Electrical Engineering
Indian Institute of Technology, Kanpur

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RESEARCH INTERESTS

Probability theory and its applications in Bayesian Machine Learning, Computational Neuroscience & Computational Cognitive Science

EDUCATION

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

- 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

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

PUBLICATIONS

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 [\[link\]](#)

MASTER'S THESIS

Asymptotic optimality of modified Shiryaev's procedure for sequential change detection
Mentor: Dr. Rakesh Bansal, *Dept. of Electrical Engg.*, IIT Kanpur **Ongoing**

Following a similar result in literature, wherein Page's celebrated CUSUM (Cumulative Sum) test for sequential change detection was modified to propose a test for the case where the post change distribution is unknown, we propose modifying the Shiryaev's procedure. We have employed the same technique of estimating the post change distribution by a universal entropy estimator for the case of change detection in a bayesian setting. We are trying to come up with bounds on the asymptotic performance of this new test and thus quantify how worse off the modified test is, when compared to the original procedure.

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 sti., control). A 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. Various parameters related to bi-stable stimuli were studied in the context of the designed experiment 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 AND TERM PAPERS COGNITIVE SCIENCE**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. [\[Report\]](#)

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 [\[Report\]](#)

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 [\[Report\]](#)

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 [\[Report\]](#)

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 [\[Report\]](#)

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 [\[Report\]](#)

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

**TECHNICAL
SKILLS**

- **Programming Languages:** C, R, python
- **Design Softwares:** Ansoft HFSS, Micro-Cap (Circuit Simulation Software), BRIAN
- **Other Tools:** MATLAB, GNU Octave, \LaTeX

**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