

COORG CONFERENCE ON PROBABILITY AND STOCHASTIC PROCESSES

Indian Academy of Sciences, Bangalore & Indian Statistical Institute, Delhi
Venue: Orange County, Coorg, Karnataka

February 27 - March 02, 2025

Abstract Book

Mini Courses (each course is of 3 x 1 hour duration):

[27/02/2025 — 01/03/2025: 04:15 PM - 05:15 PM]

Name: Azadeh Parvaneh, Leiden University, THE NETHERLANDS

Title: *Friendship paradox*

Abstract: Consider a group of individuals who form a social network. For each individual in the group, compute the difference between the average number of friends of friends and the number of friends (all friendships are mutual), and average these numbers over all the individuals in the group. It turns out that the latter average is always non-negative, and is strictly positive unless all groups of connected individuals have exactly the same number of friends. This bias, which at first glance seems counterintuitive, goes under the name of friendship paradox, even though it is a hard fact. In this mini course, we model the social network as a sparse random graph. We explain where the bias comes from, how it can be quantified, and illustrate it with two examples. We also look at the multi-level friendship paradox, where friends are selected according to an exploration process. We study the multi-level friendship paradox when the size of the graph and the depth of the exploration tend to infinity.

[27/02/2025 — 01/03/2025: 05:30 PM - 06:30 PM]

Name: Moumanti Poddar, IISER, Pune, INDIA

Title: *Probabilistic automata, two player combinatorial games and percolation*

Abstract: It is hard to overstate the usefulness of probabilistic cellular automata (PCAs) -- the applicability of PCAs spans many disciplines, including and not limited to probability, percolation, statistical mechanics, dynamical systems, theoretical computer sciences, natural sciences and computational cell biology. They are particularly useful for modelling naturally occurring processes that are governed by local, homogeneous update rules. In this short course, I attempt to establish close connections between PCAs on one hand, and well-studied topics of probability, combinatorics etc. on the other, such as percolation and percolation games on infinite lattice graphs, models of statistical mechanics, directed animals, models of social learning / models for understanding diffusion of technologies through a population of agents etc. on the other.

Invited Talks (each talk is of 30 minutes duration):

[01/03/2025: 03:30 PM - 04:00 PM]

Name: Antar Bandyopadhyay, ISI, Delhi & ISI, Kolkata, INDIA

Title: *Some de-preferential attachment random graph models via preferential attachment*

Abstract: In this talk, we will introduce a new set of *de-preferential* random graph models but using preferential attachments. We will discuss the difficulties involved in analysing such models and will indicate some asymptotic results.

[This is a joint work with Somak Laha.]

[28/02/2025: 03:00 PM - 03:30 PM]

Name: Arijit Chakarabarty, ISI, Kolkata, INDIA

Title: *Top eigenvalues and eigenvectors of inhomogeneous Erdős-Rényi random graphs*

Abstract: The talk is on eigenvalues outside the spectrum of inhomogeneous Erdős-Rényi random graphs and the corresponding eigenvectors. Depending on the rank of the inhomogeneity kernel generating the random graph, the largest few eigenvalues have a much higher magnitude than that of the bulk. Assuming the rank to be finite, the second order behaviour of those few eigenvalues, after suitable centring and scaling, is shown to be multivariate Gaussian. The asymptotic behaviour of the corresponding eigenvectors is also studied.

[This is based on joint works with Bishakh Bhattacharya, Sukrit Chakraborty and Rajat Subhra Hazra.]

[02/03/2025: 11:30 AM - 12:00 PM]

Name: Arup Bose, ISI, Kolkata, INDIA

Title: *TBA*

Abstract: TBA

[28/02/2025: 11:30 PM - 12:00 PM]

Name: Hideki Tanemura, Keio University, Yokohama, JAPAN

Title: *A unidirectional elephant random walk with a power law memory*

Abstract: For the standard elephant random walk, Laulin (2022) studied the case when the increment of the random walk is not uniformly distributed over the history instead has a power law distribution. We study such a problem for the unidirectional elephant random walk introduced by Harbola, Kumar, and Lindenberg (2014). We obtain three distinct phases depending on the memory parameter p and the power law exponent β . In one such phase, the elephant travels only a finite distance, almost surely, and the other two phases are distinguished by the speed at which the elephant travels. We also study the asymptotic behavior of the elephant random walk for each phase.

[This talk is based on the joint work with Rahul Roy (Indian Statistical Institute) and Masato Takei (Yokohama National University).]

[28/02/2025: 12:00 PM - 12:30 PM]

Name: Krishanu Maulik, ISI, Kolkata, INDIA

Title: *Elephant random walk with regularly varying memory*

Abstract: Schutz and Trimper (2004) introduced Elephant Random Walk (ERW) as a variant of simple symmetric random walk with memory. In ERW, a step is chosen at random from the entire past history of the walk and either, with probability p , the selected step is repeated or a step with opposite sign is taken with the complementary probability. Here p is called the memory parameter. The walk has drawn wide attention over the last two decades since its introduction, as it shows phase transition based on p and anomalous behaviour. Laulin (2022) proposed a variant where the past step is selected with probability proportional to a weight sequence which is regularly varying of index $\gamma > -1$. The law of large numbers and fluctuations around the large number limit has been obtained for certain values of γ and p . We provide a complete analysis and functional limit theorems of the process for all values of γ and p . We provide the phase transitions and exhibit novel scalings for certain critical cases.

[This is a joint work with Aritra Majumder.]

[28/02/2025: 03:30 PM - 04:00 PM]

Name: Kumarjit Saha, Ashoka University, Haryana, INDIA

Title: *A drainage network with multi-dimensional amnesic elephant walkers*

Abstract: In this talk we will describe a directed random forest obtained from the movement of multi-dimensional interacting amnesic elephant walkers. At each location, due to amnesia, the elephant walker at that location can remember only a random number of steps taken by other elephants in the recent past leading into that location. We show that if the tail of the memory random variable decays sufficiently fast, then we observe a tree-forest dichotomy type of behaviour depending on dimensions.

[This is a joint work with Kartick Adhikari and Shambu Nath Maurya.]

[27/02/2025: 03:30 PM - 04:00 PM]

Name: Neeraja Sahashrebudhhe, IISER, Mohali, INDIA

Title: *Interacting urns with node-dependent sampling and reinforcement*

Abstract: A finite interacting urn model is a stochastic process involving N urns, where reinforcement in each urn depends on either the entire set of urns or a specific subset of them. In this talk, we will examine the asymptotic behaviour of two-colour urns under graph-based interactions with node-dependent sampling and reinforcement. Specifically, we will classify reinforcement schemes and network structures that lead to a deterministic limiting fraction of balls of each colour. While reinforcement can be of either Pólya-type or non-Pólya-type, the network is characterised by the in-degrees of nodes, the sampling type (preferential or de-preferential), and the nature of connections between different types of nodes.

[This talk is based on joint work with Gursharn Kaur and Yogesh.]

[27/02/2025: 03:00 PM - 03:30 PM]

Name: Parthanil Roy, IIT Bombay, Mumbai, INDIA

Title: *How Does Memory Affect Random Walks?*

Abstract: In this talk, we shall discuss how memory affects the behaviour of random processes and especially, random walks. A new model of random walks with memory will be introduced and their asymptotic properties will be investigated.

[Based on a joint work with Krishanu Maulik and Tamojit Sadhukhan.]

[28/02/2025: 10:15 AM - 10:45 AM]

Name: Rahul Roy, ISI, Delhi & IIIT, Delhi, INDIA

Title: *A game regarding consecutive outcomes of coin tosses*

Abstract: We describe a game regarding consecutive outcomes of coin tosses. To avoid giving the punchline, this abstract will not elaborate on the game.

[27/02/2025: 10:45 AM - 11:15 AM]

Name: Vivek Borkar, IIT Bombay, Mumbai, INDIA

Title: *The curse of non-markovianity in stochastic approximation*

Abstract: This talk will analyse the problem of non-markovian noise in stochastic approximation and argue that it amounts to stochastic approximation with an equivalent Markov noise. Implications to reinforcement learning algorithms will be discussed.

[01/03/2025: 03:00 PM - 03:30 PM]

Name: D. Yogeshwaran, ISI, Bangalore, INDIA

Title: *Sharp noise instability in continuum percolation via spectra of Poisson functionals*

Abstract: In this talk, I will discuss the noise sensitivity of crossings in dynamical critical planar continuum percolation models, such as the Boolean and Voronoi models, under Ornstein-Uhlenbeck (OU) dynamics. Here noise sensitivity refers to the phenomenon where small noise makes crossing events independent, while stability implies robustness. We establish a sharp transition: if noise decays quickly with respect to the window size, the model remains stable; otherwise, it becomes unstable. Our key tool is a spectral point process based on chaos expansion for Poisson functionals, paralleling spectral samples in the discrete setting. Based on this we propose a general criteria for continuum percolation models to exhibit noise instability, with quasi-multiplicativity of arm events being one of the key inputs.

[This is a joint work with Chinmoy Bhattacharjee and Giovanni Peccati.]