## Title: Achieving Efficiency in Simulation of Distribution Tails with Self-Structuring Importance Samplers

Speaker: Dr. Anand Deo, Singapore University of Technology and Design

## Area: DS

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## Abstract:

Motivated by the increasing adoption of models which facilitate greater automation in risk management and decision-making, this paper presents a novel Importance Sampling (IS) scheme for measuring distribution tails of objectives modelled with enabling tools such as feature-based decision rules, mixed integer linear programs, deep neural networks, etc. Conventional efficient IS approaches suffer from feasibility and scalability concerns due to the need to intricately tailor the sampler to the underlying probability distribution and the objective. This challenge is overcome in the proposed black-box scheme by automating the selection of an effective IS distribution with a transformation that implicitly learns and replicates the concentration properties observed in less rare samples. This novel approach is guided by a large deviations principle that brings out the phenomenon of self-similarity of optimal IS distributions. The proposed sampler is the first to attain asymptotically optimal variance reduction across a spectrum of multivariate distributions despite being oblivious to the underlying structure. Applicability to decision making is exhibited by demonstrating that the algorithm easily adapts itself for use in optimization problems involving distribution tails. Numerical experiments validate the theoretical findings.

## Speaker Profile:



Anand Deo is a postdoctoral researcher at the Singapore University of Technology and Design. He holds a Ph.D. from the Tata Institute of Fundamental Research, Mumbai. His research interests lie in Operations Research, Financial Engineering, Optimisation and Applied Probability. His work has been awarded Third Prize at the INFORMS JFIG Paper Competition, 2021, and the Best Paper Award at the CRISIL Doctoral Symposium, 2017, and has been published at leading venues in Operations Research, Simulation and Optimisation. He is currently working on developing algorithms for safe decision making in the

presence of distribution tails for problems in Operations, Finance and Machine Learning.