BHARTI SCHOOL OF TELECOMMUNICATION AND TECHNOLOGY MANAGEMENT, IIT DELHI

Talk

Date : 25 May , 2020
Through Video-conferencing. Kindly connect via Google Meet
Timing: 15:00 – 16.00 Hrs

"On the Asymptotics of Some Large-Scale Networks"

By

Dr. Arpan Mukhopadhyay

Assistant Professor, Department of Computer Science, University of Warwick

Speaker's Profile

Arpan Mukhopadhyay received B.E. in electronics and telecommunication engineering from Jadavpur University, India, in 2009, M.E. in telecommunications from the Indian Institute of Science in 2011, and Ph.D. in electrical and computer engineering from the University of Waterloo, Canada, in 2016. He is currently an assistant professor with the Department of Computer Science, University of Warwick, U.K. His research interests include applied probability, stochastic processes, algorithm design, and optimization with applications to complex network analysis. He was a recipient of Best Paper Awards from the IFIP Performance 2015 Conference and the International Teletraffic Congress (ITC) 2015, and he received the Rising Scholar Award at the International Teletraffic Congress 2018 for his contributions to mean field analysis of large heterogeneous networks.

Abstract

In today's world, large-scale networks, (e.g. cloud data centres, social networks) are ubiquitous. Asymptotic analysis of such networks often provides interesting insights into their behaviours which are useful in practical system design. Using two examples, in this talk I shall discuss how stochastic analytical techniques can be used to characterise asymptotic behaviours of large-scale networks. The first example relates to designing efficient algorithms for caching systems, where the challenge is to replicate contents across a large number of caches and directing content requests to the right caches. The performance of such a system crucially depends on the replication algorithm used to replicate contents and the matching algorithm used to direct the content requests. We show that the problem of optimising the system performance jointly over the feasible the set of replication and matching strategies is computationally hard and propose simple schemes with provable guarantees for finite systems. Interestingly, however, we show that the proposed simple schemes tend to be the optimal schemes as the size of the system increases. This asymptotic optimality is established through the application of mean field techniques.

In the second example, we analyse models of opinion formation in a complete network of interacting agents. The agents are restricted to have binary opinions and we analyse if a consensus is achieved on a specific opinion and the time taken to reach a consensus state. Using martingale techniques and branching processes, we characterize the probability with which consensus is achieved on a given opinion and the mean consensus time starting from a given initial distribution of opinions. We observe that for the well known voter model the scaling law of the consensus time changes from linear to logarithmic in the number of agents when the agents are biased towards a specific opinion. Also, for the majority rule model we observe that the network undergoes a phase transition when the initial fraction of agents with a specific opinion increases beyond a certain threshold.

We look forward to your participation.