## Mathematics and CS Seminar

# Coordinating Caching and Computation in Networks


**Derya Malak**

MIT


Host: Vladimir Kolmogorov


This talk focuses on the central problem of coordinating computation and caching in networks in order to handle the large volume of data with growing computational demand, using some of the most recent results in stochastic geometry and information theory. Distributed caching is a powerful technique to minimize the total average delay by replacing the backhaul capacity with storage capacity at small cells, and to enable spectral reuse and throughput gain in networks. In order to leverage proximity-based communications, we exploited the spatial diversity of the content and reciprocation of the users as a proxy for optimizing cache placement. For general demand profiles under various small-scale fading distributions, our results suggest that it is required to flatten the demand distribution to optimize the cache hit rate. Motivated by the randomized caching models, we proposed a novel decentralized negatively associated cache placement policy, which is known as Matrn hard-core point process inspired cache placement (HCP). HCP captures the pairwise geometric interactions in networks. Contrasting it with the baseline spatially independent caching models, HCP shows that repulsive cache placement often yields a higher cache hit probability. Performance gain is more eminent for small cache sizes and small communication radii, which is promising for proximity-based applications. This talk also focuses on achieving delay and reliability guarantees; and developing scalable and robust solutions for connectivity in wireless networks. We investigated the tradeoff between in-order delivery delay and rate in wireless networks with imperfect (delayed and erased) feedback when coding. This approach has brought together signal flow techniques to the area of coding. We developed adaptive (re)coding techniques for delay sensitive applications, and reliable and scalable routing protocols for wireless mesh networks. We showed that using multi-hop WiFi links and recoding for long backhaul connections can provide a cost-effective solution in terms of delay. Finally, this talk describes a new perspective to cloud computing, by employing the concepts of graph entropy and function surjectivity in order to devise coding techniques for functional compression, and coordinating computation and caching in networks.


**Tuesday, February 5, 2019 10:00am - 11:00am**

Mondi Seminar Room 2, Central Building

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
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https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.