Karlsruhe Institute of Technology

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Combinatorial Design of Coded Caching Schemes

Bachelor's Thesis/Master's Thesis

Project

Communication networks get overburdened with data traffic during peak hours and underutilized in off-peak hours. Caching is a technique to alleviate the high transmission load of a server in a communication network during peak hours, and it involves prefetching popular content and storing it nearer to or at the user's device during off-peak hours. Depending on the limitations on memory, a part of these files would be prefetched and once the user makes a demand, the rest of the requested file will be transmitted.

Maddah-Ali and Niesen showed that coding can achieve significant gain over uncoded caching in broadcast networks. The Maddah-Ali and Niesen scheme has order-optimal rate, but the subpacketization is exponential in the number of users for certain memory regimes. In contrast, coded caching schemes can be designed using combinatorial structures that have linear subpacketization with a penalty in rate. This work investigates the pareto-optimality between memory, rate, and subpacketization of coded caching schemes.

Tasks

1. Using results from combinatorics, develop coded caching schemes with linear subpacketization.
2. Derive outer bounds for rate in terms of memory and subpacketization. (Master's level)

Requirements

- ✔ Programming language (e.g. Matlab, Python, C++)
- ✔ Knowledge in combinatorics and coding theory

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