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# Masterarbeit

## Hot Spot Communication Complexity

*Algebraic communication complexity* deals with the problem of computing the value of a given function (polynomial or rational function), when its input is distributed between different players. In particular, given a field $k$ and a rational function $f : k^{n_1} \times \ldots \times k^{n_r} \to k$, we want to know how many messages are necessary between the $r$ players, until one of them has enough information at his/her disposal to be able to compute the function value.

We consider players distributed in a network, where two of them can communicate directly exactly if there is an edge connecting them. In this setting, it turns out to be interesting to consider two measures of communication complexity. The first, as mentioned above, is the total number of messages sent in the network, whereas the second is the maximal number of messages flowing along an edge of the network. In this thesis, you will focus principally on this second issue trying to identify properties of the underlying graph and of the objective function that influences this complexity.

This theory turns out to be useful in *Distributed Algorithmic Mechanism Design problems*, where a population of selfish players are indirectly pushed towards a given social goal. In such problems, the players reside in different nodes of a network and they hold some private information. At some point they report some value (possibly lying) and the mechanism computes a social outcome. Collecting the data might induce an excessive communication burden and we want to investigate under which circumstances we are faced with a "hot spot" edge, where too many messages are sent along the same link causing a bottleneck effect and slowing down the process.

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