Data science and Complex networks szeminárium

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Cím: Robust Decentralized Mean Estimation with Limited Communication

Absztrakt:

Mean estimation, also known as average consensus, is an important computational primitive in decentralized systems. When the average of large vectors has to be computed, like in distributed data mining applications, reducing the communication cost becomes a key design goal. One way of reducing communication cost is to add dynamic stateful encoders and decoders to traditional mean estimation protocols. In this approach, each element of a vector message is encoded in a few bits (often only one bit) and decoded by the recipient node. However, due to this encoding and decoding mechanism, these protocols are much more sensitive to benign failure such as message drop and message delay. Properties such as mass conservation are harder to guarantee. Accordingly, known approaches are formulated under strong assumptions such as reliable communication, atomic non-overlapping transactions or even full synchrony. In this work, we propose a communication efficient algorithm that supports known codecs even if transactions overlap and the nodes are not synchronized. The algorithm is based on push-pull averaging, with novel features to support fault tolerance and compression. As an independent contribution, we also propose a novel codec, called the pivot codec. We demonstrate experimentally that our algorithm improves the performance of existing codecs and the novel pivot codec dominates the competing codecs in the scenarios we studied.

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