ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Distributed Computing

Experimental or Theoretical Lab/Semester-/Master Thesis

Approximating the Diameter of a Graph

One of the most basic properties of a graph is its diameter[1]: it is heavily used in algorithmic design and in network analysis. From lectures on algorithms one might remember that the diameter can be computed by executing a breadth-first-search (BFS) at each node taking time $O(n \cdot m)$, the diameter will be the depth of the deepest of those BFS-trees. Nowadays many of the graphs processed contain millions of nodes and edges. E.g. the facebook graph–each user is a node, nodes are connected if the corresponding users are friends–has about 600.000.000 nodes and 75.000.000.000 edges. Its diameter represents the length of the shortest chain of friends connecting any two people on earth. Since computing the diameter of graphs like this on a PC takes too much time, we are interested in faster approximations.

Figure 1: The facebook graph / chain of friends.

Option 1 (Experimental): During the thesis some (not distributed) algorithms that we suggest will be implemented. Further algorithms might be developed. Those algorithms will then be tested on (not that large) graphs. The goal of these tests will be to help us to 1.) identify the algorithms that might yield approximations (on restricted graph classes). 2.) figure out which restrictions this might be. 3.) find examples of graphs showing that an algorithm does not deliver a good approximation. Optional: combination with option 2.

Option 2 (Theory): the above algorithms will be analyzed / improved in a theoretic way.

Interested? Come to our office for coffee and a small chat or contact us by email / phone.

Contact

Stephan Holzer, ETZ G64.1, `stholzer@tik.ee.ethz.ch`, `044 632 7065`
Prof. Dr. Roger Wattenhofer, ETZ G63, `wattenhofer@tik.ee.ethz.ch`, `044 632 6312`

[1]The diameter is the length $\max_{u,v} d(u,v)$ of the "longest shortest path" between any two graph vertices u, v of a graph, where $d(u,v)$ is the length of the shortest u,v-path and thus the distance between u and v.