Technische Universität Berlin
Database Systems and Information Management Group

Assignment

Graph Mining with Stratosphere

In this assignment, you will use the Stratosphere system (`http://www.stratosphere.eu/`) for conducting network analysis. You will analyze the "Slashdot-Zoo" dataset, the signed social network of users of the technology news site Slashdot (`http://slashdot.org`), connected by directed 'friend' and 'foe' relations. The network contains 79,120 vertices connected by 515,581 edges. Every edge is marked with either '+1' or '-1' to denote a friend or foe relationship.

Preparation

- Clone the source code for the assignment from `https://github.com/stratosphere/graphmining-tutorial`. It is a standard Java project than can be built with Maven.
- Download the dataset from `http://konect.uni-koblenz.de/networks/slashdot-zoo` and unpack it on your machine.
- Adjust the method *de.tuberlin.dima.aim3.graphmining.Config#pathToSlashdotZoo()* to point to the location of the file *out.slashdot-zoo* that you unpacked from the downloaded dataset.

Network Statistics

The first part of the assignment deals with the computation of simple network statistics such as the distribution of the number of out-going edges per vertex.

The class *de.tuberlin.dima.aim3.graphmining.statistics.OutDegreeDistribution* describes a Stratosphere program which computes this distribution. Note that it ignores the sign of the edges.

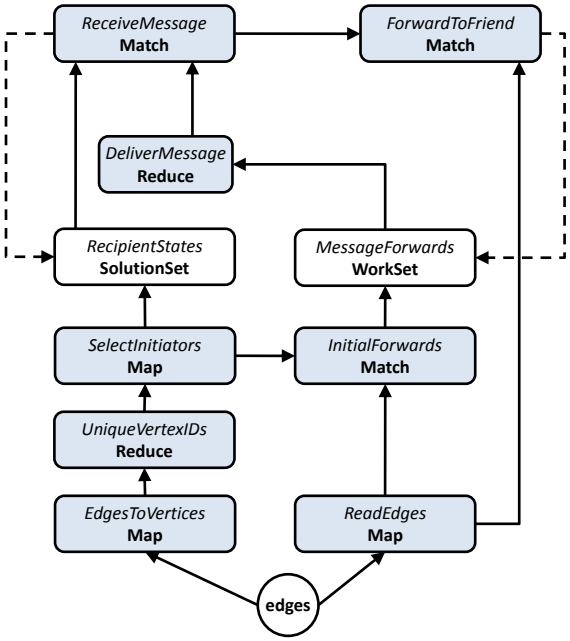
1. **Signed out-degree distribution**
   Write a new Stratosphere program *SignedOutDegreeDistribution* which computes two out-degree distributions, the first one incorporating only friend edges, the second one incorporating only foe edges.
2. **Determining the average ratio of friends and foes**
   Write a new Stratosphere program *AverageFriendFoeRatio* that computes the average ratio of friends and foes per vertex in the network. Note that you can create a *ReduceStub* without *keyField* as a way to compute the final aggregate number for this task.

Simulating Message Spread in Networks

In this exercise, you will use the iterative data flows provided by Stratosphere to simulate message spread in networks.

The underlying algorithm aims to simulate the forwarding of a chain-letter between users in the social network. Initially, a tiny fraction of the users is selected as initiators of the chain-letter. For each user that they have a connection to, they will forward the letter with a probability of 50%. All users that now receive the letter (and have not seen it yet) will repeat this process: They will forward the letter again to their connections with a probability of 50% per link.

The class *de.tuberlin.dima.aim3.graphmining.chainletter.ChainLetter* has a preliminary implementation of this algorithm. The following diagram describes the dataflow in this iterative Stratosphere program:



3. **Understand the dataflow**

   For every operator used in the plan, describe its role in the simulation algorithm in 1 or 2 short sentences. Why is this algorithm implementation guaranteed to convergence?

4. **Join performance**

   Look at the join performed by the *InitialForwards*-operator. What kind of join is it? How could you alter the plan to increase the performance for this join?

5. **Messages to friends only**

   Modify the code to ensure that messages are only forwarded between friends.