

Analyzing Biological Networks

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PROBLEM

Cytoscape is a software application that is used to interact and analyze large networks comprised of many edges and nodes. This can be done through built-in functionality or through plugins developed by third parties to add any missing functionality that will be beneficial to the researcher using Cytoscape. The main purpose of the CyFinder plugin is to provide users with many useful community detection algorithms that will make analyzing large biological networks much easier for the user. The current focus of the project is to add more community detection algorithms and to fix any issues with the user interface or general bugs, which will improve the performance and functionality of the CyFinder plugin.

CURRENT SYSTEM

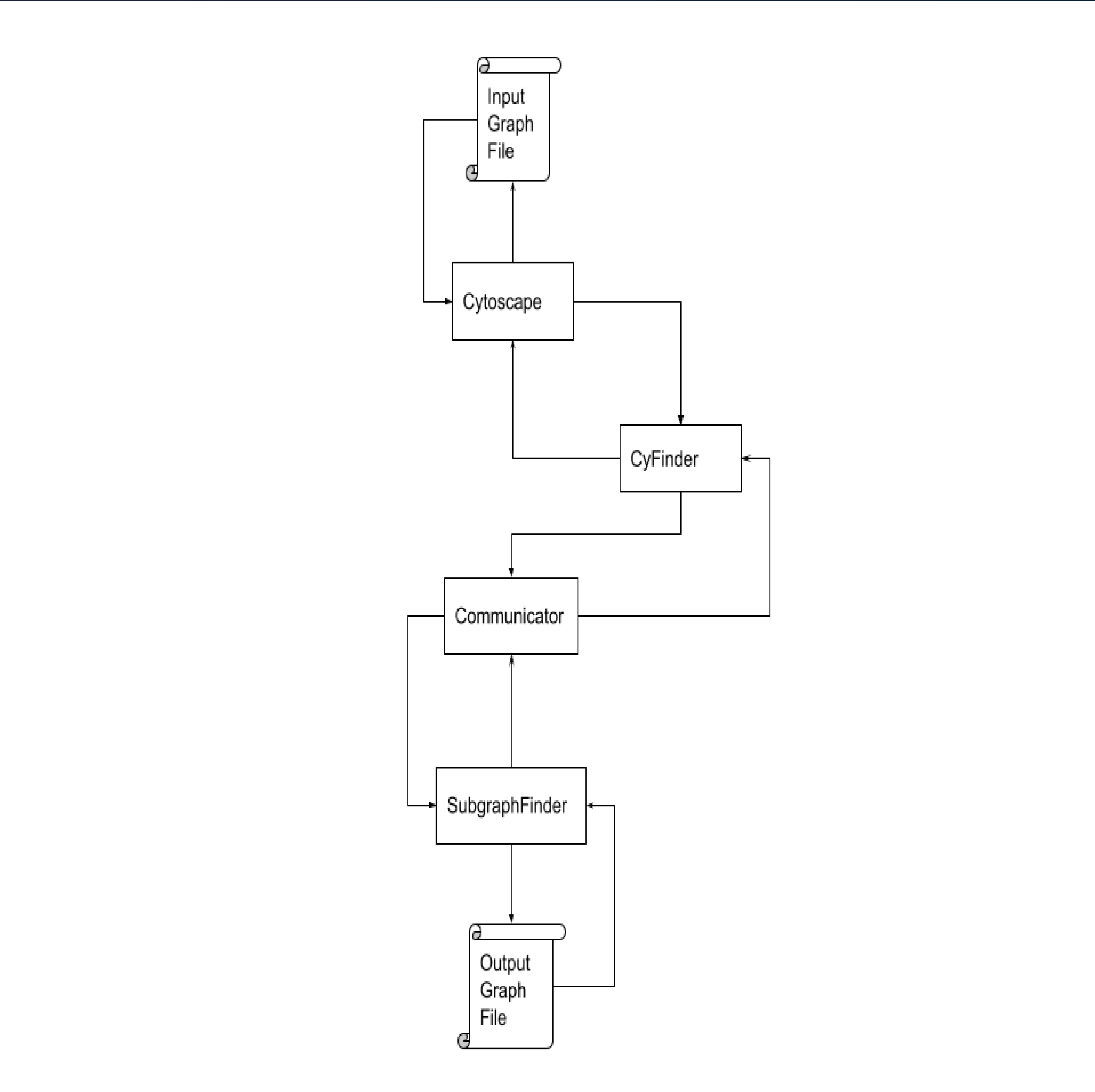
Within the current system, users can use the CyFinder plugin in Cytoscape to detect communities in a network using various algorithms, allow users to make a graph undirected via the additive and transformative methods, and allows users to find the maximal number of subgraphs. In this semester, the team focused on implanting the Infomap algorithm using the map equation. As a result, we expanded the current system by adding various classes associated with Huffman coding along with a map equation helper class that contains multiple methods that are responsible for calculating the summations involved in the map equation. A class for the Infomap algorithm was created that contained things such as a random walker method, a Huffman encoder method, and a map equation method that uses the methods from the map equation helper class. All the work was done in the back-end in the SubgraphFinder repository.

REQUIREMENTS

- Java
- Apache Maven
- Apache Ant
- Cytoscape
- Cytoscape API
- Eclipse



SYSTEM DESIGN



VERIFICATION

```

public class HuffmanNode {
    2 usages
    private String name; //This will give us the name of the node or the stri
    3 usages
    private int freq; //This will store the frequency of the nodes.
    2 usages
    private HuffmanNode left; //The node's left child.
    2 usages
    private HuffmanNode right; //The node's right child.
}

```

```

public class HuffComparator implements Comparator<HuffmanNode> {
    1 Jesus
    public int compare(HuffmanNode a, HuffmanNode b) { return a.getFreq() - b.getFreq(); }
}

```

```

public HuffmanNode generateTree(PrioritySet<HuffmanNode> minheap) {
    //Creates a root node.
    HuffmanNode root = null;

    while(minheap.size() > 1) {
        /*
        * Extracts the first minimum frequency. Assigns the value to a variable so that i
        * added to the second minimum frequency extracted.
        */
        HuffmanNode firstFreq = minheap.peak();
        minheap.poll();

        /*
        * Extracts the second minimum frequency. Assigns the value to a variable so that
        * added to the first minimum frequency extracted.
        */
        HuffmanNode secondFreq = minheap.peak();
        minheap.poll();
    }
}

```

```

PTGS2:111011
TOP2A:111100
AKT1:111101
CDH13:111110
NFKB1:111111

Process finished with exit code 0

```

SUMMARY

Implemented various classes that work together to generate Huffman codes for each of the nodes in a network based on the frequency determined by how many times a random walker visits a node in the network.

Implemented a map equation helper class that is responsible for doing most of the summations seen in the general map equation. Also created a map equation method that uses methods in the map equation helper class to calculate a result of the general map equation.

IMPLEMENTATION

- Java – programming language used to develop CyFinder plugin
- Apache Ant – builds the module that contains the logic for CyFinder
- Apache Maven – combines the logic contained in the module generated using Apache Ant to generate the JAR file
- Cytoscape API – contains the necessary tools that are required for integrating software in Cytoscape.
- Cytoscape – the core software used.

REFERENCES

- Rosvall, M., Axelsson, D., & Bergstrom, C.T. (2009). The map equation. *The European Physical Journal Special Topics*, 178, 13-23.

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