

REPORT KSHELL DECOMPOSITION

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1 INTRODUCTION

K-Shell decomposition helps in finding out the shell numbers of various nodes in a particular graph. This is particularly helpful in finding out the core of any graph. With the help of this knowledge we are working on ways to reach the core of the graph from any random point with only local knowledge to rely upon.

2 Literature Review

2.1 The H-index of a network node and its relation to degree and coreness

This paper discusses the fact how degree and coreness are related with each other with the help of a property called H-index. H-index is the property of a node that is defined by the relationship given below :

Let $G(V, E)$ denote a graph G with V vertices and E edges making it up. Now choosing any particular node let the degree of the node i be denoted by k_i and the degrees of its neighbours are $k_{j_1}, k_{j_2}, k_{j_3}, \dots, k_{j_{k_i}}$. Now the zero-order H-index of node i is :

$$h_i = \mathcal{H}(k_{j_1}, k_{j_2}, k_{j_3}, \dots, k_{j_{k_i}}).$$

Other than the zero-order H-index the n-order H-index can be calculated as :

$$h_i^{(n)} = \mathcal{H}(k_{j_1}^{(n-1)}, k_{j_2}^{(n-1)}, k_{j_3}^{(n-1)}, \dots, k_{j_{k_i}}^{(n-1)}).$$

3 Work Done

Various methods were applied to reach from periphery to core based on only a limited number of node traversal. The following methods are discussed below :

3.1 Random walk

Here starting from any node in the graph the core of the graph was to be reached. Movement from one node to the next neighbouring node was done randomly.

3.2 Hill climbing

Here starting from any node in the graph the core of the graph was to be reached based on the value of degree of the neighbouring node. Two variations of the hill climbing method was seen.

3.2.1 Travelling highest degree node which is least travelled

Traversal to subsequent nodes is decided based on the highest degree neighbours of a node and among those the least travelled node. This allows traversal to be towards higher degree nodes mostly.

3.2.2 Travelling least travelled node with highest degree

One of the basic issue of the previous approach is hinderance of traversal due to reaching of local maxima. In order to avoid that, a new method was applied where, the next neighbouring node to be travelled is decided on certain factors. The first factor is that the node should be least travelled. Second factor is that among all the least travelled nodes it should have the highest degree. This method of progression allows us to cover more number of nodes. Also if a node is already traversed, then it is better to try a different node as it may open up the oppurtunity to reach the core.