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Bipartite Graph Matching In Donor-Recipient Using Enhanced Drpm Algorithm for Liver Transplantation

By

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Abstract

The matching of Donor to Recipient for the liver transplanatation using the MELD Score which gives the ranges for the survival of the life. The bipartite graph along with MELD Score produces the preferences such as poor, low and good survival rate. This will give the maximum number of preferences for the D-R matching. To avoid the maximum preferences, the perfect matching is introduced to exact matching for the donor to recipient in liver gtransplanatation.

Keywords: Data preprocessing and data collection , Data selection and Data analysis, MELD Score, DRPM algorithm

Introduction

The matching for the donor to recipient in liver transplanatation is taken as important to provide the survival rate of the patients. First steps to preprocess the data from the dataset and prediction of the D-R matching which helps the liver patient's for survival.The numbers of parameters are considered as important. The D-R matching which predict the survival and life quality. Both the sides (donor-recipient), the number of nodes or features are available. Predict the important parameters for the D-R matching.Compare the analysis of D-R matching with Total bilirubin and Direct bilirubin. Analysis of D-R matching with Aspartate and Alamine Aminotransferase. Analysis of D-R matching with Total proteins and Albumin.

Analysis of D-R matching with Albumin and Globulin Ratio and Total proteins ,Blood Glucose Random, Blood Urea, Serum Creatinine, Hemoglobin, Blood Pressure. These are the important features and analyzed with feature extraction and feature selection. To find the set of pairs

between Donor to Recipient matching. The long term survival of the liver patients after liver transplanation based on the D-R matching using the Bipartite graph and the perfect matching method.

2. Related works

a. W.H. Cunningham and A.B. Marsh III (1978) In this, which is used to find the perfect matching of K different pairwise based on the binary partitioning. The best complexity bound $O(K^{n3})$, n is the number of nodes.,

b. J.R. Brown (1974) described the concept of an alternating path and analyzing matching problems. In a weighted graph, the method which is not find the shortest alternating path. This shows the problem of finding shortest path in directed and undirected graph.

c. U. Derigs (1981) described about solving of minimum weight perfect matching problems by an efficient procedure. The augmenting path is constructed for ptimal matching along with shortest augmenting paths with special techinque.

d. J. Edmonds and R.M. Karp (1972) introduced algorithms for the Hitchcock transportation problem, the general minimum-cost flow problem maximum flow problem and there is upper bounds, numbers of steps required by earlier algorithms.

e. G. Gallo and S. Pallotino (1983) described about the shortest path methods. The single shortest path tree problem and the all-pairs shortest path problem are considered and also classification of the shortest path algorithms.

f. H.W. Hamacher and M. Queyranne (1985) described about an alternative algorithm is based on a binary search tree procedure. Based on a matroid, the problems of finding the K best and applied perfect matchings.

B. E.L. Lawler (1972) described about that a given discrete optimization problem, computing the best and next best solutions. To find an optimal solution to a problem,the number of computational steps required.

a. K.G. Murty (1968) described about an algorithm using the Hungarian method to find the minimal cost assignment . Arrange in increasing order of cost and ranking the assisgnment by an efficient algorithm.

C. K.Fukuda, T.Matsui(1994) described to find the perfect matchings in a bipartite graph using the binary partitioning method (algorithm requires O(c(n+m)+n2.5)) and O(nm) memory storage ,where n is vertices, m is edges , n and c is number of perfect matchings in the given bipartite graph.

D. M. Weber (1981) introduced about the perfect matching problem and reoptimizing problem of matching. It also described briefly about the Edmonds' algorithm. Postoptimality procedures base on the order of cardinality N.

Research methodology

3.1 Data Collection and Data Preprocessing

The datasets collected from UCI ML Repository. The dataset is multi organ and contain liver patients records (both male and female liver patients records). Data is collected and load, read and check the null value. The null value is filled by mean value. These steps are important in the preprocessing.

Dimensionality Reduction

4.1 Feature Extraction and Feature Analysis

To find the most meaningful inputs such as Age, Gender, Albumin and Globulin Ratio, Aspartate_Aminotransferase, Total_Protiens, ,Albumin , Alamine Aminotransferase, Total

Bilirubin, Direct Bilirubin, Alkaline Phosphotase, Blood Glucose Random, Blood Urea, Serum Creatinine, Hemoglobin, Blood Pressure. By using the correlation method, there is a direct relationship for the following attributes such as Aspartate Aminotransferase, Albumin and Globulin_Ratio, Direct Bilirubin, Albumin, Total Bilirubin, Total Protiens, Blood Urea and Serum Creatinine. In this, the above mentioned attributes are similar and gives similar performance. The following attributes taken for matching process using bipartite graph method for D-R matching.

5. Donor to Recipient Bipartite Graph Matching

Donor-Recipient Perfect Matching (DRPM)

By providing the proposed DRPM algorithm, Donor to Recipient has exact perfect matching and also the most respective nodes is assigned from D-R higher preferences list of nodes. In this algorithm which provides the individual pair matching nodes between the D-R matching. Filtering from the higher preferences MELD Score and pair the perfect matching between D-R matching.

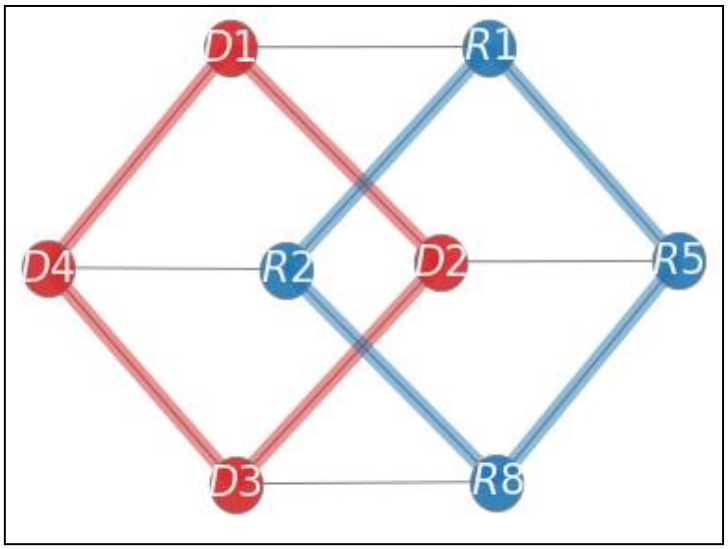

Figure 1. *D-R Perfect matching*

The figure 1.which shows the Donor to Recipient perfect matching. This proposed DRPM algorithm is taken the basic idea of perfect matching algorithms such as Randomized Approximator for counting perfect matchings, Greedy Randomized Approximator for counting perfect matchings, AKM (K-best perfect matching). From the maximum number of matching able to connect the perfect matching and each every matching nodes are connected with edges using the library Networkx. DRPM matching are used for the perfect matching to Donor - Recipient.

Proposed Algorithm: Drpm Algorithm

Pseudo Code:

1. Get the attributes from the high preferences MELD score.
2. Filter the scores from the high preferences MELD score for donor to recipient perfect matching.
3. Get the high preference MELD score (<15) for perfect matching
4. Finally fit the perfect matching for donor to recipient matching.

6. Results & discussions

Measure	RACPM	GREEDY	AKM	DRPM
Sensitivity	0.9524	0.9565	0.9804	0.9831
Specificity	0.2222	0.3333	0.1667	0.6
Precision	0.9346	0.9483	0.9677	0.9831
Accuracy	0.8947	0.9113	0.9497	0.9675
F1 Score	0.9434	0.9524	0.974	0.9831

Table 1. *Range of all the performance Metrics*

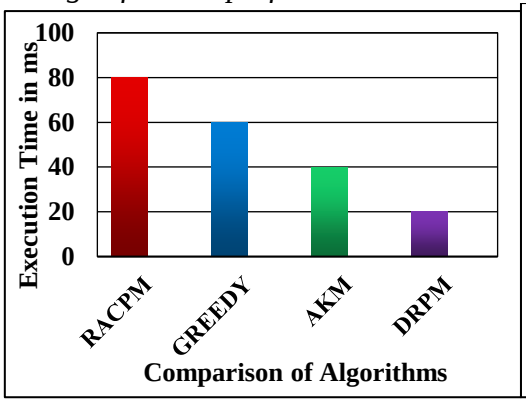

Figure 2.*Execution time*

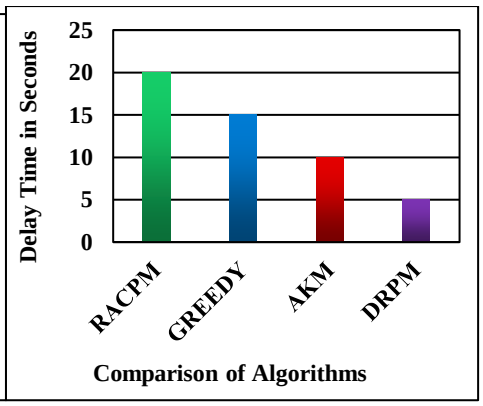

Figure 3. *Delay time*

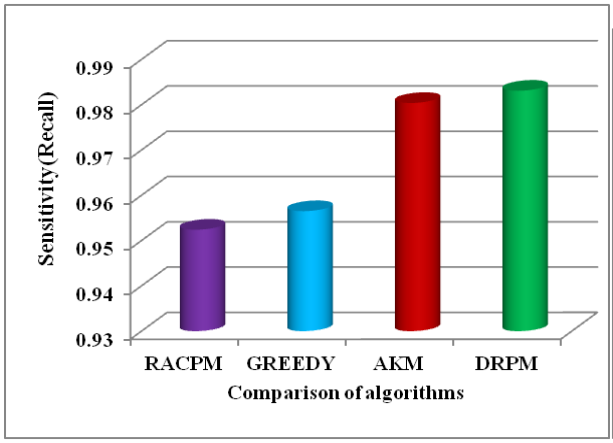

Figure 4. *Sensitivity %*

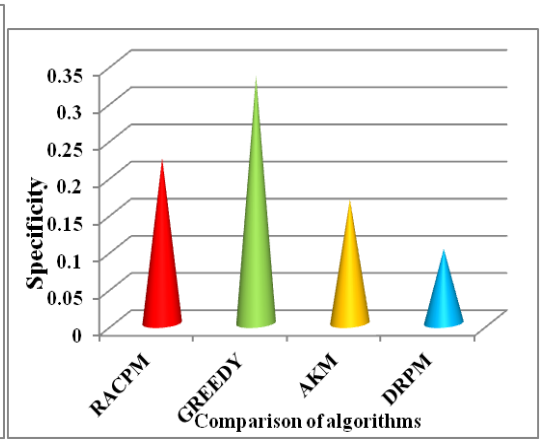

Figure 5. *Specificity %*

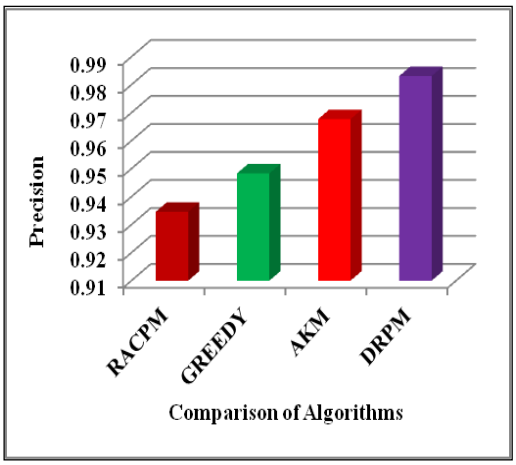

Figure 6. *Precision %*

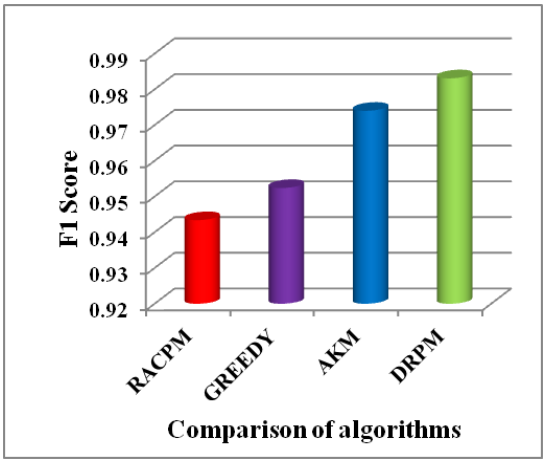

Figure 7. *F1-Score %*

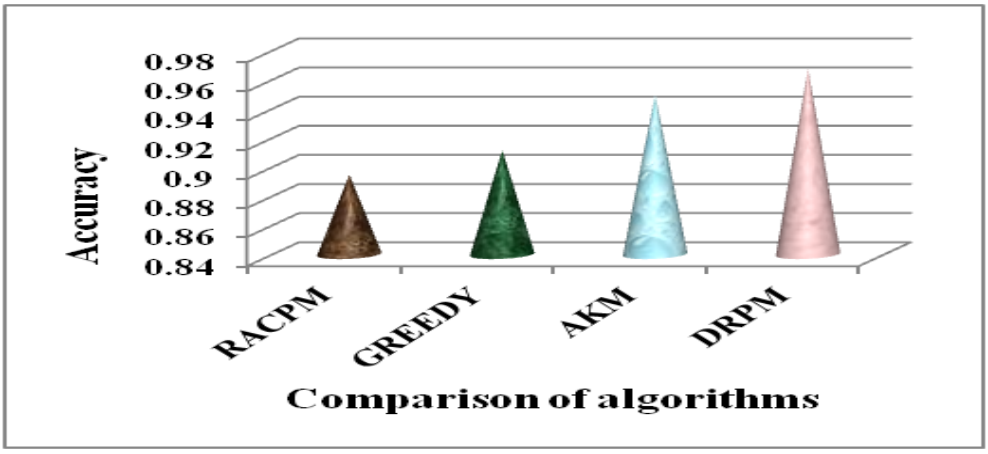

Figure 8. *Accuracy %*

The performance metrices of the figures shows the Execution time, Delay time, Recall, Specificity, Precision, Accuracy and F1-Score of all the existing algorithms compared with proposed algorithm which saves better time complexity and also the better improvement in the performance evaluation.

6. Conclusion

The bipartite graph method which provides the maximum number of matching preferences with MELD Score range. The MELD Score range list out the poor, low and good surival rate. The proposed algorithm taken the basic knowledge of other perfect matching algorithms. DRPM algorithm can predict the perfect pair of matching to improves the long term survival of the liver patients after liver transplanatation.

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