Survey on Long-Term Forecasting the Survival in Liver Transplantation Using Multilayer Perceptron Networks

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Abstract— **Medical prognoses have been an emerging area in mostly health care system. Mostly prognostics model based on the Survival Analysis Procedures and this model used in verity of the domain. Medical decision support systems helps to clinicians and doctors for the building strategies to understand surgical outcomes. Tenfold Cross Validation (CV) is an applied on the medical input dataset which has been obtained from the United Network Organ Sharing Database. Principal Component Analysis (PCA) are using for the dimensionally reduction of huge amount of data. For the reorganization of relation attributes between them using a Tertius, Treap and Apriori algorithms are using. In this we are going to purposes accurate and effectives models Artificial Neural Networks (ANN) for predicts Long-Term survival of the Liver Patients which are going to Liver Transportation (LT). Tenfold CV is applied on the medical input dataset it has been obtained from the United Network Organ Sharing Database system.**

Keywords: Tenfold Cross Validation, Principal Component Analysis, Artificial Neural Networks Organ Sharing Databases, Liver Transportation and Survival Predication.

I INTRODUCTION

Liver Transplantation is an effective's treatment for the chronic and acute liver diseases. Number of patients undergoes this type of treatment due to liver failure. Survival rate of patients depends on the quality of graft and availability of the donor. Two main goals of the Liver transplantation system are prolong survival and life quality . Model for End Stage Liver Disease (MELD) is using for the allocation of optical argons and MELD system follows sickest first policy.   Mostly they are using a FIIO (First in First Out) policy to allocate the livers without considering the characteristics of the recipient and donor. To predict survival of patient after the Liver Transplantation depends on the appropriated Donor-Recipient Match. Recipient and donor have set of features and these features matching are very important. Manual method for getting matching donor receipt feature is a complicated method.

In this author find out three parameters such as creatinine, international normalized ratio (INR) and bilirubin from MELD score it may be vary according to body weight of liver recipient. Mostly medical experts depends on the MELD score of survival prediction. The survival rates are occurring due to the inappropriate selection of the parameters. Orthotropic liver transplantation treatment

approach using for begins to end stage liver disease [1]. For the accuracy survival prediction three classifiers are used for liver transplantation patients. These Classifiers Multilayer Perception, Adaptive Resonance Theory (ART) and RBF MAP are used in the survival prediction.

For the liver transplantation donor characteristics are important factors. In the DRI (Donor Rate Identification) seen seven characteristics these are used to COX regression model. Artificial Neural Networks (ANN) is a computing system which is implementing either the software or hardware for the mimic computation abilities of biologic systems use of number of interconnected Artificial Neurons. Neuron takes information from the artificial neurons or the sensor it perform operation on data and it pass results on to the other artificial neuron. ANN also operates on real time [2].

Neural networks are also used in much real time application like Sonar Signal Processor, Hand Written Character Recognition, Robotics, Nucleic Acid Sequence Prediction and Image Reconstruction [3]. Neural Networks also has impact on the Clinical Medicine. Figure 1 shows the architecture of neuron networks which contains three layers output layer, hidden layer and input layer
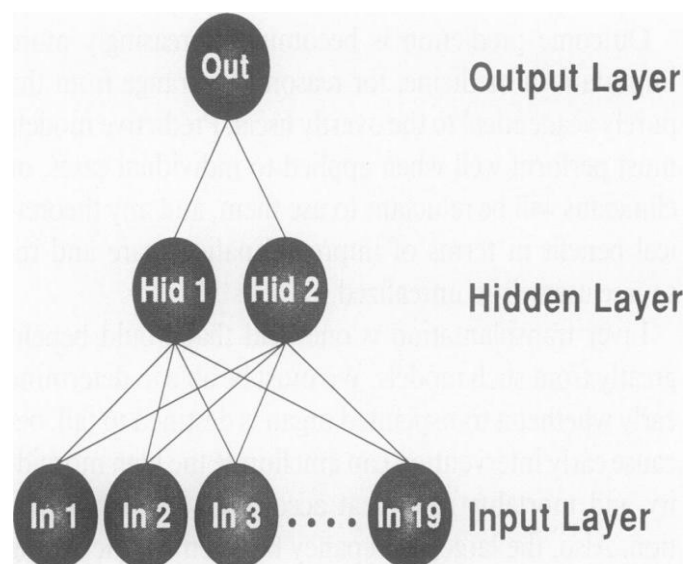

Figure 1. Neuron Network Architecture

II RELATED WORK

In paper [1] author proposed techniques for data analysis in this they used analytical process for mining of data. Access of dataset and finding out relationship between variables

in larger databases become a difficult task.. Powerful association algorithms which reduces space and time complexity. In this they purposed a Rule Mining Algorithm, it works on priority model to find out relationship between databases for this ,data structure treap has been used.

In paper [2] authors explains a technique for survival of patients after the Liver Transplantation using cox proportional hazards (COX PH) and Neural Networks Models. In this best time for liver Transplantation had been calculated and also survival of candidate using prognostic factors. A system result shows that the ANN system is better than the COX PH regression.

In paper [3] they purpose Rule Based system ,it is based on principle of equity and efficiency.Memetic Pareto Evolutionary Non-dominated Sorting Genetic Algorithm2 (MPENSGA2) and Multi Objective Evolutionary Algorithm are used for the training of Neural Networks. Accuracy of system is measured using a Model Performance. This techniques is helpful for the allocate organ in to medical.

In recent year medical records are increasing and manual processing of such becoming harder and use of Computer based Medical Prognosis is increasing day by day [4]. Machine Learning techniques are used by most of people because people can't understand such patterns easily due to huge amount of data. Proposed model artificial neural networks are using for organ allocation and survival prediction.

For predicting survival of patients are using organ transformation techniques. In this paper author had proposed the survival prediction model for defining 3 month mortality of patients after the liver transplantation [5]. Artificial neural networks model is used to calculate the survival rate of the liver transplantation. For this dataset named as united networks for organ sharing transplant registry is used. Machine learning techniques it helps to doctors takes prediction decision. This model is helpful for doctors to predicting the survival of LT patient.

Back propagation techniques have been used for the training multilayer neural networks in the supervised learning method. Back Propagation method also called Error Back Propagation and it is based on Error Correction Learning Rule it is mostly used in the machine learning algorithm in neural networks. In paper [6] Back propagation and Several Variation were used to improve performance of the algorithm. They compared the performance of the traditional Back Propagation Network Learning Algorithm with the Improved Back Propagation Network Algorithm.

In paper [7] authors propose techniques for predict survival rate of liver transplantation patients in two ways Clinical Manner and Computing. They proposed Artificial Neural Networks model for the defining 3 month mortality of liver transplant patient and for that they use united network of organ sharing dataset. MELD survival score 79.11 % and failure rate is 20.89%. They compare performance proposed RBF and existing RBF system. Finally they conclude that the MLP is suitable ANN model to predicting 3 month survival after the Liver Transplantation.

In paper [8] Model for End Stage Liver Disease (MELD) is used to determine prognosis of patients of liver cirrhosis. For this prediction Artificial Neural Networks (ANN) are used and using dataset of 251 consecutive people which are listed to Liver Transplantation at liver transplant unit in the Bologna, Italy. ANN is trained for the Prediction three month survivals on the 188 patients and it testing on the 63 unknown for the system. Final experiment conducts on 137 patients of Liver Transplantation in Kings College Hospital London United Kingdom. For the prediction of survival with the ANN and MELD system author had considered the same database. ANN techniques measure the rate of the mortality risk of the patients with cirrhosis more accurate than the MELD system.

In paper [9] key aspect of the donor which are impacting graft failure are highlighted. Here donor characteristics like height, age donation after the cardiac death and causes of death are considered.

Table I. Survey Table

Sr. No.	Paper Name	Authors Name	Technique Used	Advantage
1	Association Rule Mining Using Treap	S. S. Vinodchandra and H. S.	Association Rule Mining Algorithm	Time and space complexity is reduced
2	Five Years Survival of Patients after Liver Transplantation and its Effective Factors by Neural Network and Cox Proportional Hazard Regression Models	K. Sarinnapakorn and M. Kubat	Neural Networks and Cox Proportional Hazards regression model	Accuracy of ANN is much better for Prediction of LT patients and Cox PH methods performance is better in this paper.
3	Predicting Patient Survival after Liver Transplantation Using Evolutionary Multi Objective Artificial Neural Networks	C. Hervás-Martínez, and M. De La Mata	Mimetic Pareto Evolutionary non-Dominated Sorting Genetic Algorithm 2	Multi Objective Evolutionary Algorithm gives better performance than Mono Objective Algorithm

4	Predicting the Survival of Graft Following Liver Transplantation using a Nonlinear Model	S. S. V. Chandra and C. G. Raji	Artificial Neural Networks (ANN)	Improvements in the performance.
5	Graft Survival Prediction in Liver Transplantation using Artificial Neural Network Models	S. S. V. Chandra and C. G. Raji	Survival Prediction model for 3-month mortality of patients	System gives accuracy of 99.74% using Multilayer perception artificial neural network model

III PROPOSED SYSTEM

This paper proposes Artificial Neural Networks to predict long term survival rate of Liver Transplants patients In this System we consider united network organ sharing database as medical input dataset on this we applied tenfold Cross Validation (CV) method and ranking using a Principal Component Analysis (PCA). In this we also find out relationship between attributes and association rule mining techniques such as and treap, apriori and tertius are using for mining of rules.

Models in this system:

- UNOS Database:

United National Organ Sharing (UNOS) dataset has been used which is a Medical, Scientific, and Tex- Exempt and Educational Organization. UNOS works only Organ Procurement and Transplant Networks (OPTN). It is an official U. S. government network which is run by Health Resources and Services Administration UNOS dataset consists to the Pretransplant and Post-Transplant multi organ data.

- Artificial Neural Network (ANN) Classifier:

27 attributes of dataset are considered and which are given to the MLP model which is shown in fig 3. This model is trained using clinical attributes of patient related to Liver Transplantation for this used back prorogation algorithm. Input data consisting of attributes of recipient like EXC_HCC, ENCEPH_TCR, FINAL_ALBUMIN, BMI_TCR ,
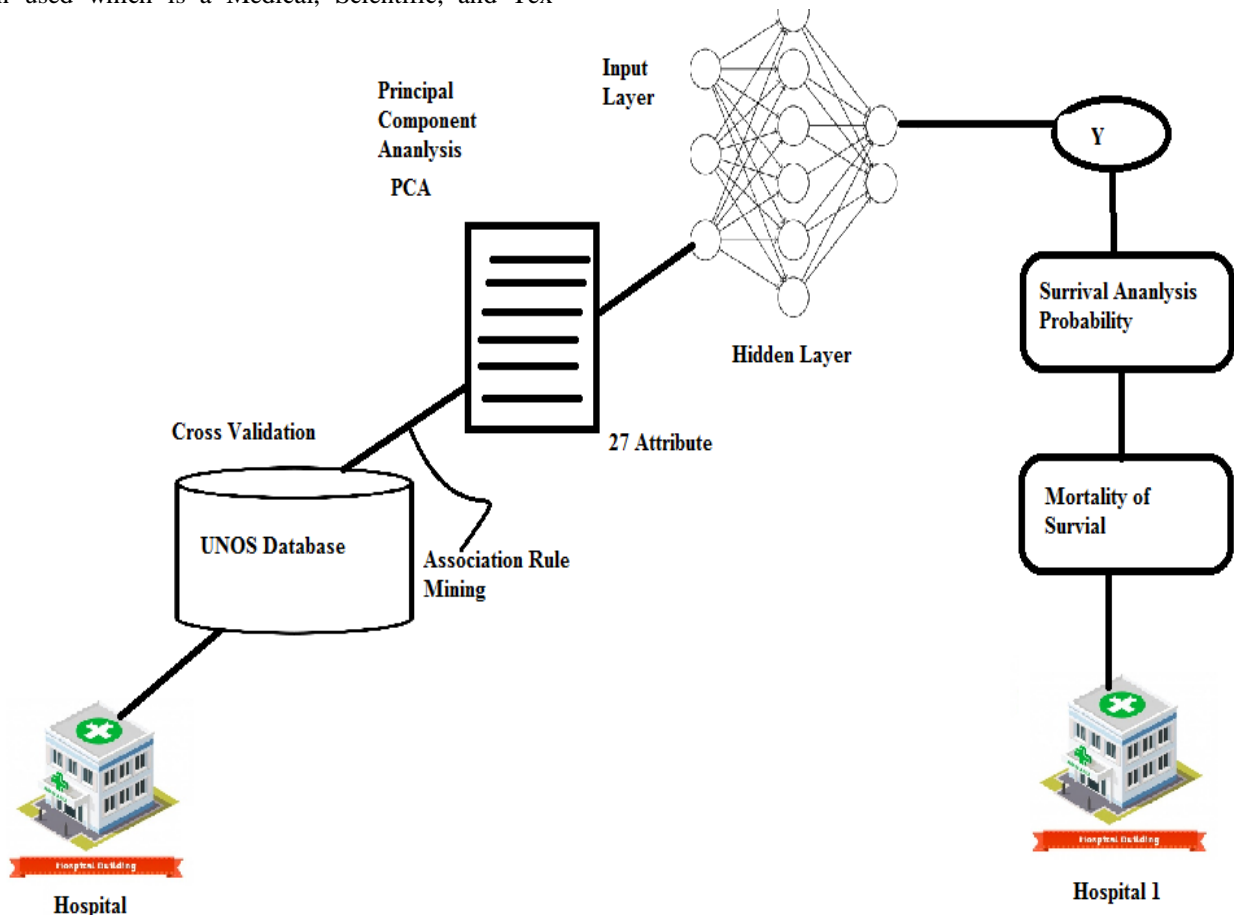

Figure 2 System Architecture

FINAL_BILIRUBIN, FINAL_ASCITES, FINAL_INR, FINAL_MELD_PELD_LAB_SCORE, GENDER, MALIG_TRR INIT_AGE, FINAL_MELD_OR_PELD, MALIG_TCR, FINAL_SERUM_SODIUM and Donor attributes are CREAT_DON, CLIN_INFECT_DON, AGE_DON, GENDER_DON, DON_TY, CREAT_DON, DIABETES_DON, TBILI_DON, SGOT_DON, and NON_HRT_DON and Transplantation attributes such as TX_LIV and NUM_PREV-TX. For training, Clinical data and activation function are used in hidden layer, it is sigmoid function. Proper the donor–recipient matching is needed for the best survival of patients undergoing LT.

- Survival Analysis Probability:

Survival rate of LT patient is nothing but the time between the dead and live stage of patient. For the survival analysis each patient is calculated using the follow up data. Survival probability of each patient is calculated from this equation:

$$S_p = \frac{(Patient\ Living\ at\ the\ Start) - (Patient\ Die)}{(Patint\ Living\ at\ the\ Start)}$$

- Mortality of Survival:

LT survival rate are calculated from the MELD score. Mortality rate are calculated using this equation:

$$\text{Mortality of Survival Patient}(\%) = \frac{(exp(-4.3 + 0.16 * MELD) * 100)}{(1 + exp(-4.3 + 0.16 * MELD))}$$

MELD is the value of LT patients which is different from one and another. This MELD values is available in the data set of LT.

IV CONCLUSION

Liver Translation (LT) is definitive treatment for the Acute and Chronic end stage disease of Liver. Currently, collection and sharing of liver organs are the most important aspects of LT. In the recent years survival rate of patient who undergoes in LT treatment had been find out using several machine learning techniques. In this we are going to propose Machine learning techniques known as Artificial Neural Networks (ANN) which predicts survival rate of patient. The doctor's decision to allocate liver to a patient may sometimes be biased, which can be avoided by using machine learning techniques. Mentioned MLP model could achieve a high rate of survival by choosing the appropriate attributes of donor, recipient and transplantation.. So as to help the doctors to predict the best survival of patients who undergo LT with long term mortality

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