

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI – 110 002

EXECUTIVE SUMMARY OF UGC MINOR RESEARCH PROJECT

1. Name and Address of the Principal Investigator:

Dr. Anil George K, Assistant Professor, Dept. of Computer Science, St. Thomas' College (Autonomous), Thrissur - 680001.

2. Name and Address of the Institution:

St. Thomas' College (Autonomous), Thrissur - 1, Kerala

3. UGC Approval No. And Date:

No.F.MRP/12th Plan/14-15/KLCA019 dated 10/12/2014.

1596-MRP/14-15/KLCA019/UGC-SWRO dated 04/02/2015.

4. Date of Implementation: 4th February 2015

5. Tenure of The Project: 2 years.

6. Total Grant Allocated: Rs.5,00,000/-

7. Total Grant Received: Rs. 4,50,000/-

8. Final Expenditure: Rs. 5,22,488/-

9. TITLE OF THE PROJECT: “A Soft Computing Paradigm for the Design of a Medical Decision Support System to Predict the Risk of Cardiovascular Events”

10. OBJECTIVES OF THE PROJECT:

- The first objective of the work is to develop a medical decision support system that could predict the risk of myocardial infarction based on clinical data exploiting advantages of decision trees, fuzzy logic and neural networks.
- The second objective of the work is to validate the developed model using several standard validation methods for acceptance.

11. WHETHER OBJECTIVES WERE ACHIEVED:

- The proposed design of a medical decision support system that could predict the risk of myocardial infarction was developed.
- The NFMDSS, the framework to predict the risk of myocardial infarction based on clinical data was developed.
- Standard validation techniques were employed to validate the developed model and verified that the model produces excellent results.

12. ACHIEVEMENTS FROM THE PROJECT:

- The NFMDSS, a medical decision support system to predict the risk of myocardial infarction based on clinical data was developed based on soft computing techniques.
- Three International papers were published
- Three international conference presentations were made.

13. SUMMARY OF THE FINDINGS:

The minor research project work applied artificial intelligence techniques in order to develop a diagnosis model that could predict the risk of myocardial infarction based on the risk factors of coronary artery disease in individuals. The method used is the integration of soft computing techniques of fuzzy logic, decision trees and neural networks to develop a “Neuro-Fuzzy Medical Decision Support System” (NFMDSS), a hybrid tool.

NFMDSS is developed by integrating a fuzzy decision tree (FDT) and a neuro-fuzzy model. An optimization technique with neural network is incorporated in the proposed hybrid intelligent system, NFMDSS, derived from the concept of TSK model. On the basis of knowledgebase evolved through a series of experiments with actual data, the medical prediction model is generated. The model is developed in three phases. In the first phase, the decision tree generates a set of fuzzy rules by implementing the fuzzy concept at the classification level of the decision tree. The second and third phases of NFMDSS architecture are implemented as a neural network system in two different stages. Validity of datasets and their results are verified.

The simulation tool used for the experimental purpose is MATLAB 7.9. Three different case studies have been employed in order to verify the effectiveness of the proposed system. The first case study is carried out using the case-control data and is validated using three different model validation techniques such as cross validation with control data, k -fold cross validation with training data and validation with training data with dummy values. Being a case-control study, the case data is referred to as coronary artery disease (CAD) data and the control data is referred to as non-coronary artery disease (non-CAD) data. In the case-control dataset, a set of 12 risk factors of CAD are considered as the input attributes with 301 instances for each group ranging between the age of 21 and 75. The other two case studies, which are essentially for testing the model, are based on Hospital CAD data collected from hospitals of Kerala and Cleveland CAD data from UCI repository.

The integration of decision tree, fuzzy logic and neural network delivers the NFMDSS model with higher performance and effectiveness than that of ANFIS and FCNL, with optimum number of rules. In addition to the common features of a neuro-fuzzy system, the major advantages of the proposed NFMDSS are the following.

- The number of inputs can be increased without affecting the performance of the system
- The NFMDSS model works with a compact set of rules compared to other models like ANFIS by the proper selection of rules of FDT
- A two-stage learning procedure that produces an optimal model and facilitates the use of the real data without sacrificing the generalization capability of the model
- The system can preserve higher effectiveness even though the dataset is high-dimensional.

The proposed NFMDSS has been designed, developed and implemented for pre-diagnosis of AMI only. But this system can be extended further in future so as to suit itself for pre-diagnosis of risks of other types of heart diseases, as well as other diseases with minimum effort.

14. CONTRIBUTION TO THE SOCIETY:

Acute myocardial infarction is one of the most serious threats to life and a major public health problem in India. Cardiovascular deaths in India are estimated to be 2.5 million per year. WHO reported that this will be doubled by the year 2020 and will be the leading cause of morbidity and mortality both in men and women. Earlier disease detection would give physicians time to educate patients about preventive measures and offer therapies, thus reducing the chance of early death.

This project develops a cost-effective but efficient decision support system to predict the severity of risk in Coronary Artery Disease, when a person has one or more of the risk factors of CAD. The proposed system can enhance the ability to make accurate diagnosis of CAD of the potential patients. By considering an important principle in health science, 'Prevention is better than cure', the proposed model may help the healthcare professionals in Cardiology. Thus the project is capable of fighting a major health hazard with the help of techniques of Computer Science.

Dr. Anil George K
(PRINCIPLE INVESTIGATOR)

Dr. Jenson P. O.
(REGISTRAR/PRINCIPAL)