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ARTIFICIAL NEURAL NETWORK IN MEDICAL DATA CLASSIFICATION AND PREDICTION

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Abstract : *This work is aimed to find the success rate in "In Vitro Fertilization" using Artificial Neural Network. Artificial Neural Networks are very useful number of medical diagnosis applications. The overview of artificial neural network as applied to problems in the medical domains. The application of neural network method to medical problems and characterizes its advantages and problems in the context of medical background. In this thesis, we briefly review and discuss the philosophy, capabilities, and limitations of artificial neural networks in medical diagnosis. Classification is an important tool in medical diagnosis decision support. In this work fully contains the fertility rate on in-vitro fertilization in which applying the Artificial Neural Network techniques to find the fertility rate. Infertility is perceived as a problem across virtually all cultures and societies and affects an estimated 10%-15% of couples of reproductive ages. In recent years, the number of couples seeking treatment for infertility has dramatically increased due to factors such as postponement of childbearing in women, development of newer and more successful techniques for infertility treatment, and increasing awareness of available services. So we apply these IVF data's in Artificial Neural Network for predicting success rate. Each type of data provides information that must be evaluated and assigned to a particular pathology during the diagnostic process. The valuable collection of routinely collected data, applies in Artificial Neural Network. The Artificial Neural Network provides the output of training, testing, cross validation. The result provides the success rate of desired output and actual output. This Estimates getting of their chances of success. The objective was to explore the variability in, In Vitro Fertilization (IVF) success rates.*

Keywords - *Artificial Neural Network, In-Vitro fertilization, Medical Diagnosis, Human fertility rate.*

I. INTRODUCTION

Recently, applications of Artificial Neural Network and Rough Sets have been increased in business and medical related area. More and more development tools have emerged on the market [11]. Many Neural Net systems have been shown to work well in identifying intricate patterns, learning from experience, reaching some conclusion, and making predictions. The various Neural systems now in use are implemented with mathematical sound principles, they hold out promise for future applications. A Rough set is the philosophy of the method which is based on the assumption that, with every object, some information (data, knowledge) can be associated. The mathematical basis for the rough set theory is the objects of the information system characterized by the same information which are generated indiscernibility relations. In-vitro fertilization (IVF) has spread worldwide it begins in the UK, but its current practice, termed routine IVF, is being challenged by simpler routines. These include natural cycle IVF, which has been in the background for many years, minimal stimulation IVF, where doses of hormones are reduced, and the in-vitro maturation of human oocytes ready for fertilization in vitro maturation (IVM). These three approaches are now practiced in increasing numbers of IVF clinics, and may well replace routine IVF. IVF has been a common infertility treatment method since 1978. In IVF process, female germ cells (oocytes) are inseminated by sperm in IVF laboratories and embryos are cultured between 2-6days. Embryonic growth is observed and recorded by embryologists. Finally, selected embryo(s) are transferred into the woman's womb. IVF embryos may be transferred either at cleavage stage (day 2-3) or at blastocyst stage (day 5-6). Extended culture until the blastocyst stage allows self-selection of the most viable embryos since all the embryos cannot reach this stage in in-vitro conditions. Delaying the transfers until day 5 increase the implantation probability but also increase the risk of developmental failure. Consequently, prediction of blastocyst development is an important research question in IVF domain. Reproduction secures the survival of our species and also assures the continuation of culture through the transmission of skills and norms. As long as the level of fertility was broadly in line with level of mortality and hence assured relatively stable population size or moderate increases, there seemed to be little concern about the overall level of the human fertility. In this work, determines the fertility rate on in-vitro fertilization by applying Artificial Neural Network and Rough set techniques. It seems to be an invention of new tool that helps to find conclusion and prediction of the success rate of human fertilization. The ANN and RS are combined as a hybrid model which applied to predict the information from data. In this hybrid model, the supervised learning algorithm is used for well-defined output. The Multilayer Perceptron contains multiple hidden layers to calculate the desired result. This work aims to reduce the single machine learning techniques for medical data prediction. The knowledge acquired by ANN through training process is represented by the weights of the connections between the neurons, the threshold values and the activation function. Identifying the problem description at the Neural level is not possible because of the implicit knowledge representation of the neuron. This characteristic makes the Neural Network often called as 'black boxes'. To improve the quality of the learning, the Rough Sets Theory is used to select key parameters before training the predictor. The concept of RST is founded on the assumption that every object of the universe of discourse is associated with some information. The RST finds the description of sets of objects in terms of attribute values, checks dependency between

attributes, finds significance of attributes reduces attributes and derives decision rules. The rough sets based reduction of the attributes space not only improves the efficiency of the predictor itself, but also provides some additional information about the mechanisms governing decision-making.

II. LITERATURE REVIEW

M.J.Ruperez, J. D.Martin-Guerrero, C.Monserrat, M.Alcaniz reviews in the article Artificial Neural Networks for predicting dorsal pressure on the foot surface while walking[1] suggested getting the pressure rate the bottom of foot surface. It used the multilayer perceptron (MLP) since it can provide a single equation to model the exerted pressure for all the materials used shoe uppers. Five different models are produced, one model for each one of the four subjects under study and an overall model for the four subjects. The goal of research is to find model with good generalization capabilities (i.e., model that working appropriately not only for the case used to train the model but also for few cases) in order to have a useful predictor in routine practice. The achieved accuracy was very satisfactory since correlation coefficients between the predicted output and actual pressure in the validation data were higher than 0. 95 for those models developed for individual subjects. For the much more challenging the problem of an overall prediction subjects, the correlation coefficient was close to 0. 9 in the validation data set. New cases may involve either new material for the same subject or even new subjects and new materials. They accomplish the goal, two third of the patterns are trained to obtain the model (training data set) and remaining third kept for validation purpose. The entire working level of ANN is satisfied by applying these techniques.

M.Durairaj, Dr.K.Meena, Dr.S.Selvaraju reviews in the article Applying a data mining approach of rough sets on spermatological data analysis as predictors of in-vitro fertility of bull semen [2] pointed out to apply a relatively new data mining approach of rough set theory (RST) to analyze in vitro functional parameters to select most significant parameters that can be used to predict cleavage rate (CL) of given sperm. This is an effort to substitute the concept of rough set theory (RST) in the place of traditional statistical methods of data analysis. Since RST is a new mathematical approach in data mining based on classification as well as a promising technique. This is an approach to study realistic information. The traditional statistical models are not always optimal tools for knowledge discovery because of their model assumption of representativeness of the sample, and their sensitivity to irrelevant features. The prediction of sperm fertilizing ability has great economic importance for breeding animals when artificial insemination (AI) is used. When evaluating semen, the ultimate goal is to accurately predict its fertilizing potential. Even after much progress has been made, the ability to predict the fertility of semen with laboratory tests is still limited, mainly due to complexity of the spermatozoon and fertilization process. The basic purpose of semen evaluation procedures is to ensure that only good quality and highly fertile semen is used for artificial insemination (AI) purposes. It is very essential to properly analyze the data and carefully select a parameter or combination of in-vitro functional tests parameters that can be used to accurate prediction of semen fertility in animals.

S.J.Kaufmann, J.L.Eastaugh, S.Snowden, S.W.Smye and V.Sharma tells in the article "The application of Neural Networks in predicting the outcome of in-vitro fertilization"[6] point out the Infertility affects one in six couples at some time in their lives, with 48% of these couples requiring assisted is conception techniques in order to achieve a pregnancy Whilst the overall clinical pregnancy rate per embryo transfer is 23%, this varies widely between clinics. The Human Fertilization and Embryology Authority has attempted to analyses the results of all units, with weighting of different factors affecting assisted conception, and the published data have invariably led to comparisons between units. However, statistical models need to be developed to eliminate bias for valid comparisons. Neural Networks offer number of a novel approach to pattern recognition. In some instances Neural Networks can identify a wider range of associations than other statistical techniques due in part to their ability to recognize highly non-linear associations. It was hoped that a Neural Network approach may be able to predict success for individual couples about to undergo in-vitro fertilization (IVF) treatment. A Neural Network was constructed using the variables of age, number of eggs recovered, number of embryos transferred and whether there was embryo freezing. Overall the Network managed to achieve an accuracy of 59%.

III. METHODOLOGY

1. Introduction

The Neural Network and rough sets methodologies have their place among intelligent classification and decision support systems. Knowledge of the system can be seen as organized data sets with the ability to perform classification [6]. Hence a formal framework capable of reasoning about classifications and delivering implicit facts from explicit knowledge would be helpful. The ANN and RST can be combined to obtain such a framework. This approach is based on the rough sets feature selection mechanism and Neural Networks efficient classification property.

2. Artificial Neural Network

Neural Networks is a field of Artificial Intelligence (AI) where we, by inspiration from the human brain, find data structures and algorithms for learning and classification of data. Many tasks that humans perform naturally fast, such as the recognition of a familiar face, proves to be a very complicated task for a computer when conventional programming methods are used. By applying Neural Network techniques, a program can learn by examples, and create an internal structure of rules to classify different inputs, such as recognizing images. As computers became more advanced in the 1950's, it was finally possible to simulate a hypothetical Neural Network. The first step

towards this was made by Nathanial Rochester from the IBM research laboratories. Unfortunately for him, the first attempt to do so failed. In 1959, Bernard Widrow and Marcian Hoff of Stanford developed models called "ADALINE" and "MADALINE. "In a typical display of Stanford's love for acronyms, the names come from their use of Multiple Adaptive Linear Elements. ADALINE was developed to recognize binary patterns so that if it was reading streaming bits from a phone line, it could predict the next bit. MADALINE was the first Neural Network applied to a real world problem, using an adaptive filter that eliminates echoes on phone lines. While the system is as ancient as air traffic control systems, like air traffic control systems, it is still in commercial use.

2.1 ANN in Infertility

Infertility is a social disease, which despite the intensive development of medical knowledge and advanced treatment techniques, still affects a significant percentage of couples. One of the contributing factors is postponing parenthood. The chance for getting pregnant decreases with woman's age, mainly due to the decrease in the number and quality of oocytes. The effectiveness of infertility treatments, including the most advanced called in Vitro Fertilization with Intracytoplasmic Sperm Injection and Embryo Transfer (IVF ICSI/ET), is also correlated to woman's age, with success rates averaging at 10–15% pregnancies per treatment cycle in women of 40 and more years of age. Then predictive methods allowing individual pro- gnosis are needed. They could allow selecting the best possible treatment approach and reducing the risk of complications [8].

Neural Networks offer a novel approach to pattern recognition and have been used in a wide range of applications, including medical image feature recognition and outcome prediction. Networks are interconnected layers of processing elements which mimic, at a much simplified level, the properties of biological neurons. Thus each neuron receives several numerical inputs, each of which is multiplied by a weighting factor. The sum of these weighted inputs becomes the argument in a transfer function which determines the numerical output from the neuron. A common relevant architecture comprises a layer of neurons to which input data are presented. The output from this layer becomes the input to the next and this pattern is repeated for the subsequent layers until the final layer, the output layer. By presenting to a Network data (inputs) for which the outcome (outputs) is known and adjusting the weights to measure the differences between the actual and derived Network output, any underlying associations between the data and the outcomes may be identified and the Network applied to previously unseen data to make predictions. In recent years Neural Networks have been applied to a wide variety of clinical applications; Baxt and Skora utilized Neural Networks to identify which patients presenting to a hospital accident and emergency department with chest pain had suffered an acute myocardial infarction. The model proved successful compared with physicians in terms of sensitivity (73.3% for physicians, 96.0% for Neural Network) and specificity (81. 1 and 96.0% respectively). Other successful applications include prediction of outcomes following liver transplantation and diagnostic categorization of low back disorders.

2.2 Hybrid Model

Hybrid model proposed in this paper is composed of rough set component and Neural Network component. By rough set, some rules are extracted from the information system. Using rough set tool, the discovery of knowledge is effected by two kinds of rules: deterministic and non-deterministic. Sometimes, the rules generated by rough set approach fail to predict newly entered object because of non-deterministic rules [11]. To handle this situation, some researchers reported that reduced data set (horizontally or vertically) is fed into Neural Network for complementing the limitation of rough set, which finally produces full prediction of new case data. The two possible hybrid models are tested. Rough set component combined with Neural Network trained only with horizontally reduced information system is Hybrid Model, and rough set combined with Neural Network trained with 2D reduced information system is Hybrid Model II. These two hybrid models will be compared with traditional discriminate analysis model and Neural Network model.

Each method described above can be used completely independently, or the techniques can be combined to exploit the strengths that each possess. There are numerous ways of hybridizing these methods, of which three popular systems are explained below.

Neuro-fuzzy Systems

One powerful combination of soft computing techniques is the field of neuro fuzzy systems. One of the main drawbacks of Neural Networks is that they are 'black boxes'. Data goes in, a calculation is performed and the answer is produced, but it is difficult to find out exactly what the calculation is doing or why. Fuzzy logic systems do not suffer from this problem, their rule sets can always be 'translated' into easily understandable rules, but they are not capable of learning in the same way that Neural Networks are. This usually means that the rules and membership functions used need to be written and tuned by hand. When expert knowledge can be used to write these systems then this task is relatively simple, but this is not always possible to find experts in the problem domain.

This branch of Soft Computing has expanded rapidly in recent years, and it has been used in a wide variety of applications. In one such example a neuro-fuzzy system was trained to predict the next 48 hours of electricity demand in Victoria, Australia. When tested on previously unseen data, this system predicted the demand with an error rate of only 0.0092.

Genetic Fuzzy Systems

Another way of tuning fuzzy systems is to use Evolutionary Computing techniques to evolve the rule set and membership

functions. This is particularly useful when a system cannot be trained using expected or previously measured output values, for example when a controller for a dynamic system is being developed. The controllers can, however, be judged on how well they perform, and this can be used as the fitness function in an evolutionary algorithm. Much like the neuro-fuzzy system, the various aspects of the fuzzy logical system are parameterized. These aspects include the membership functions and information on the fuzzy rule set. This information is then encoded into a string or strings that represent a candidate's genetic material. Genetic algorithms can then be applied to evolve the fuzzy system until an optimum solution is found.

2.2.1 Using Rough sets and Neural Networks

Rough sets and Neural Networks are two common techniques applied to rule extraction from data table. Integrating the advantages of two approaches, this paper presents a Hybrid Rule Extraction Method (HREM) using rough sets and Neural Networks. In the HREM, the rule extraction is mainly done based on rough sets, while Neural Networks are only served as a tool to reduce the decision table and filter its noises when the final knowledge (rule sets) is generated from the reduced decision table by rough sets. Therefore, the HREM avoids the difficult of extracting rules from a trained Neural Network and possesses the robustness which the rough sets based approaches are lacking. The effectiveness of HREM is verified by comparing the experiment results with the approaches of traditional rough sets and Neural Networks.

In these work two tools of soft computing is applied for preprocessing and predicting the outcome of In-Vitro fertilization. The rough sets used as a preprocessor and ANN as predictor. In figure.1 shows the hybrid model of rough set and ANN for preprocessing and predicting. It seems to be an integrated structure that may have both a tools that are in a single structure. In the part of RST, it done the preprocessing from the data set and construct the decision table and it used to attribute reduction. The reduced data set from decision table used to the Artificial Neural Network construction and get a classified system of results. The satisfied criteria will be a basic term to be analyzed.

The above model shows the hybrid method of ANN and RST for way of analyzing the data. The data will be preprocessed by using RST to get the influential attributes reduction. The reduced decision table is the input of ANN. The Network may train and test with actual output. The Neural Network is trained in a way in which the actual and desired outputs are nearly equal. If the outputs are same means the trained Network have extract the rules to set for the new way of classification system. So the Network may help for the future prediction in way of the training and produce the result for the current issues.

2.3 In-VitroFertilization

In-vitro fertilization (IVF) is a process by which an egg is fertilized by sperm outside the body: in vitro. IVF is a major treatment for infertility when other methods of assisted reproductive technology have failed. The process involves monitoring a woman's ovulatory process, removing ovum or ova (egg or eggs) from the woman's ovaries and letting sperm fertilise them in a fluid medium in a laboratory. When a woman's natural cycle is monitored to collect a naturally selected ovum (egg) for fertilization, it is known as natural cycle IVF [7]. The fertilised egg (zygote) is then transferred to the patient's uterus with the intention of establishing a successful pregnancy. The first successful birth of a "test tube baby", Louise Brown, occurred in 1978. Louise Brown was born as a result of natural cycle IVF. Robert G. Edwards, the physiologist who developed the treatment, was awarded the Nobel Prize in Physiology or Medicine in 2010.

The term in vitro, from the Latin meaning in glass, is used, because early biological experiments involving cultivation of tissues outside the living organism from which they came, were carried out in glass containers such as beakers, test tubes, or petri dishes. Today, the term in vitro is used to refer to any biological procedure that is performed outside the organism it would normally be occurring in, to distinguish it from an in vivo procedure, where the tissue remains inside the living organism within which it is normally found. A colloquial term for babies conceived as the result of IVF, "test tube babies", refers to the tube-shaped containers of glass or plastic resin, called test tubes, which are commonly used in chemistry labs and biology labs. However, in vitro fertilization is usually performed in the shallower containers called Petri dishes. One IVF method, Autologous Endometrial Coculture, is actually performed on organic material, but is still considered in vitro. When it comes to infertility, IVF may be an option if you or your partner has been diagnosed with:

- Endometriosis
- Low sperm counts
- Problems with the uterus or fallopian tubes
- Problems with ovulation
- Antibody problems that harm sperm or eggs
- The inability of sperm to penetrate or survive in the cervical mucus
- An unexplained fertility problem

IV. RESULT AND DISCUSSION

In this research, the ANN and RST are the major tools that may use to process the medical data of IVF. So the attributes of IVF data will be pre-processed by RST and data prediction and classification is by using ANN. The IVF data are collected from various specialty hospitals for the infertility treatment in Tamilnadu.

4.1 Pre-processing of data

The Rough Set Theory is an excellent tool for the attribute reduction and selecting attributes which has been combined for the significant influence on IVF success. The RST have to done analyze and fill the data by using filling algorithm. The attribute will be reduced and shown in the different table. Rosetta is a simulation Rough Set toolkit for analysis data. ROSETTA is a toolkit for analyzing tabular data within the framework of rough set theory. ROSETTA is designed to support the overall data mining and knowledge discovery process: From initial browsing and preprocessing of the data, via computation of minimal attribute sets and generation of if-then rules or descriptive patterns, to validation and analysis of the induced rules or patterns.

ROSETTA is intended as a general-purpose tool for discernibility-based modeling, and is not geared specifically towards any particular application domain. ROSETTA offers a highly intuitive GUI environment where data-navigational abilities are emphasized. The GUI is highly object-oriented in that all manipulate objects are represented as individual GUI items, each with their own set of context-sensitive menus. The computational kernel is also available as a command-line program, suitable for being invoked from, e.g., Perl or Python scripts. It contains many algorithms like I/O, Completion, Discretization, Reduction, etc. In this research used the completion and reduction algorithms for selecting influential attributes.

s.no	Reduct	RHS Accuracy	LHS Coverage	RHS Coverage	RHS stability	LHS length	RHS length	support
	{Age(F), Endometriosis, Cervical Factor, Unexplained Factor, Sperm Concentration, Sperm Motility, No Of Oocytes Retrieved, No Of Embryos Transferred, Male Factor Only }	1	0.140351	0.246154	1	9	1	100

S.NO	Considered parameters	Significant influence of fertility	Used for Training ANN
1	Age(F)	YES	YES
2	Age(M)	NO	NO
3	Duration Of Infertility (Years)	NO	NO
4	Previous Pregnancy	NO	NO
5	If Yes, Previous Miscarriage	NO	NO
6	If Yes Miscarriage Caused	NO	NO
7	Medical Disorders	NO	NO
8	Previous Surgery	NO	NO
9	BMI(F)	NO	NO
10	Pre-Existing Symptoms Of Depression	NO	NO
11	Fear And Negative Treatment Attitude	NO	NO
12	Psychological And Emotional Factors	NO	NO
13	Difficulty In Tolerating Negative Emotions For Extended Time	NO	NO
14	Uncertainty	NO	NO
15	Strain Of Repeated Treatment	NO	NO
16	Endometriosis	YES	YES
17	Stages	NO	NO
18	Tubal Infertility	NO	NO
19	Ovulatory Factor	NO	NO
20	Hormonal Factor	NO	NO
21	Cervical Factor	YES	YES
22	Unexplained Factor	YES	YES
23	Semen Ejaculate Volume	NO	NO
24	Liquefaction Time	NO	NO
25	Gross And Microscopic Appearance	NO	NO
26	Sperm Concentration	YES	YES
27	Sperm Motility	YES	YES
28	Sperm Vitality	NO	NO
29	Sperm Morphology	NO	NO
30	No.of Oocytes Retrieved	YES	YES
31	No.of Embryos Transferred	YES	YES
32	Male Factor Only	YES	YES
33	Severe Male Factor	NO	NO
34	Female Factor Only	NO	NO
36	Unknown Factor	NO	NO

4.2 Completion

In the area of completion algorithm, it has so much of method but the Mean Completer (Mean/mode fill) method can fill the missing value by using some machine learning techniques.it produce a structure of completion data if any of the data may not fill in the database. For large datasets with missing values, complicated methods are not suitable because of their high computation cost. It tends to find simple methods that can reach performance as good as complicated ones. The results and experience obtained in the previous session suggested us that mean-and-mode method can be efficient and effective for large datasets with necessary improvements. The basic idea of our method is the cluster-based filling up of missing values. Instead of using mean-and-mode on the whole dataset will use mean-and-mode in its subsets obtained by clustering.

this algorithm can be applied to supervised data where missing value attributes can be either categorical or numeric. It produces a number of clusters equal to the number of values of the class attribute. At first, the whole instances are divided into clusters, where instances of each cluster have the same value of the class attribute. Then, in each cluster, the mean value is used to fill up missing values for each numeric attribute, and the mode value is used to fill up missing values for each categorical attribute.

In this research some of missing data are filled by those data not be included. So the relevant and suitable data will be placed the missing area compared with supervised learning process

4.3 Reduction

In the area of Reduction, the Johnson Reducer (Johnson's algorithm) used to find out the influential parameter for the highly impacted data for the future selection. It is the task of automatically extracting structured information from unstructured and/or semi-structured machine-readable documents. In most of the cases this activity concerns processing human language texts by means of Natural Language Processing (NLP). Recent activities in multimedia document processing like automatic annotation and content extraction out of images/audio/video could be seen as information extraction. Due to the difficulty of the problem, current approaches to IE focus on narrowly restricted domains.

Johnson's algorithm is the task where it intends to reduce the dataset dimension by analyzing and understanding the impact of its features on a model. Consider for example a predictive model C1A1 + C2A2 + C3A3 = S, where Ci are constants, Ai are features and S is the predictor output. It is interesting to understand how important are the used features (A1, A2 and A3) and what are their relevance to the model and their correlation with S. Such analysis allows us to select a subset of the original features, reducing the dimension and complexity of future steps on the Data Mining process. During a subset selection, try to identify and remove as much of the irrelevant and redundant information as possible. Data dimensionality reduction will be divided into three steps: relation computation, reduction and reduct validation. Relation computation is to generate relation matrices using a relation function with attributes. Then reduction algorithms are performed on the matrices and find some reduct of the original data. Finally employing a validation function, which may be a classifier or a discriminability criterion, it tests the reduct and find a best one. The below table shows the output result of reduct attributes and its supports.

s.no	Reduct	RHS Accuracy	LHS Coverage	RHS Coverage	RHS stability	LHS length	RHS length	support
1	{Age(F), Endometriosis, Cervical Factor, Unexplained Factor, Sperm Concentration, Sperm Motility, No Of Oocytes Retrieved, No Of Embryos Transferred, Male Factor Only }	1	0.140351	0.246154	1	9	1	100

4.4 Actual Output and Desired Output

Finally after getting these results only knows the if the actual and desired output for the IVF results are gradually same or not. If the results are not approximately match means again the training of network process will start for the correct result. The above graphs and tables shows the maximum of Actual and Desired outputs are same. Particularly the graph of actual and desired output level and ploter value showed in follow.

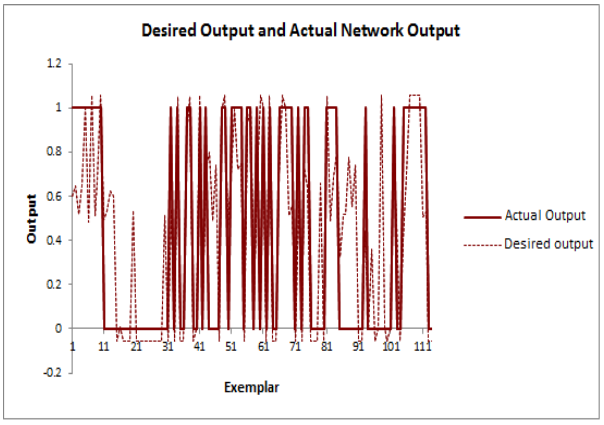

Fig 4.4 Graph for relation between Actual output and Desired output

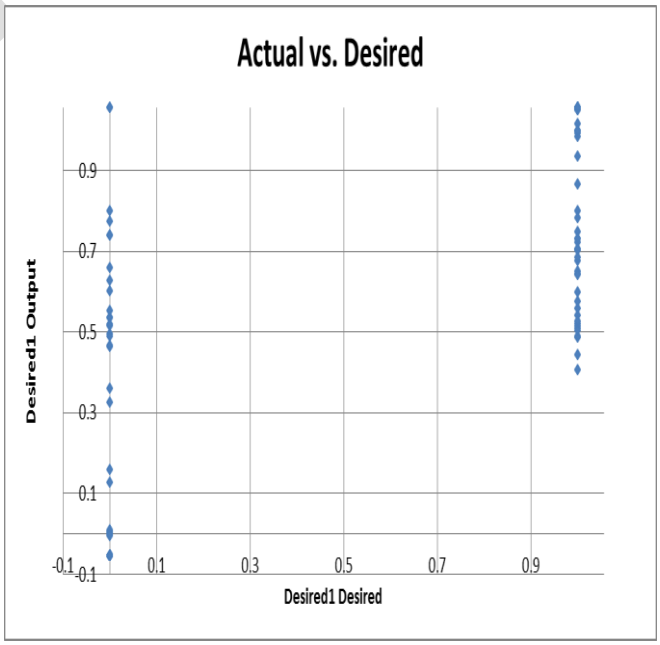

Fig 4.4 Plot graph level between Actual output and Desired output

So based on the graph and plot matrix, the Neural Network produces the numeric desired output. If the graph and test result are reliable and relative to actual means the

desired also gradually same to the actual output. The sample systematic desired output table as follows.

V. CONCLUSION AND FUTURE ENHANCEMENT

5.1 Conclusion

The area of Rough Set Theory and Artificial Neural Network are the competent tools for pre-processing and prediction. It helps to predict the result in advance and it affords a conclusion to the problem. It also helps to support the real life to find the IVF result. In this research, RST and ANN have done an important role for finding the success rate of the IVF data. It helps to get the approximate success rate of IVF treatment in many ways. Before starting IVF treatment, predicting the success rate will psychologically fix the positive mind setting which supports both technically and mentally. The prediction accuracy of 90% obtains by developing this application will be helpful for the field of medical science and research.

5.2 Future Enhancement

In this research, the data of more than 100 patients have been collected and tested. In future, to get the high accuracy result it will be tested with more number of instances also live test of IVF treatment will be used to compare with success rate and output of IVF treatment. An efficient hybrid method combining other algorithms will also be proposed for making as a high level well-organized prediction tool. If the success rate and output are same, the tool becomes more powerful in the IVF treatment. It makes a reassessment in the place of medical science against in-fertility. Another impact will be the reduction of cost and decrease in the rate of in-fertility

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