Volume 6, Issue 11, November 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Comparative Study of Support Vector Machine with Artificial Neural Network Using Integer Datasets

Supriya Pahwa
M.Tech Scholar (CSE), BRCM CET, Bahal, Bhiwani, Haryana, India

Deepak Sinwar
Assistant Professor (CSE), BRCM CET, Bahal, Bhiwani, Haryana, India

Abstract: ***This Support Vector Machines (SVM) as well as Artificial Neural Networks (ANNs) is very powerful tools for classification, which can be used for pattern recognition and regression analysis. They are being used in a large array of different areas such as medicine, education, agriculture, climate etc. Numerical databases are widely used in almost every field of research. In this thesis, comparative study of Support Vector Machine with Artificial Neural Network using numerical datasets has been done. Basic information about ANN, including description of pattern recognition networks using feed-forward Learning Algorithm, has also been introduced as well as information about various kernels of SVM. Finally the classification comparison of numerical datasets using accuracy, CPU time, training time and testing time has been done. Classification has been done in two versions: using ANN and SVM. Both versions have been tested and their results of comparison are compared and presented here.***

Keywords: support vector machine, artificial neural network.

I. INTRODUCTION

The aim of this paper is to compare SVM and artificial neural network, investigating whether neural networks are competitive with support vector machine according to accuracy and time. Classification is one of the oldest and the most important method of data mining. There are two types of classification, one is supervised and other one is unsupervised. Supervised classification has many techniques. Support vector machine and artificial neural network are most popular techniques of classification. So, problem is to find out better technique between SVM and ANN.

Now a days, there are vast amount of data being stored in databases across the globe. Data mining offers promising ways to uncover hidden patterns from such amount of data. These hidden patterns can probably be used to predict future behaviour. Classification in the data mining is one of the tasks to uncover these hidden patterns. The input for the classification is the training datasets, whose class labels are already known. Many approaches have been introduced to solve the classification problem. SVM is considered as one of the most robust and efficient methods among all well-known algorithms for classification. It is the powerful algorithm used for supervised learning, and is widely used in classification problems [9, 10]. The major limitation of SVM is its low speed in the training and the test phases. To overcome this limitation, several researches have been proposed. Several researches have been done to reduce the computational cost by reducing the number of support vectors directly. But these efforts had not been able to give high accuracy. However, some other approaches have been used to cope with this problem. Neural Network is one of the approaches to solve this problem.

Motivation: Consider a market scenario, having two types of markets. One market is for middle class men and other for higher class. Manager of market does not have time to manually check the details and put the customer in one of the two categories. The manager may adopt some classification technique to automatically predict the class of a new customer by the old databases of the customers.

The remainder of this paper is organized as follows. Section 2 will review some work related with Support vector machine and Artificial neural network. Section 3, shows result of comparison between Support vector machine and Artificial neural network; and Section 4 reports conclusion.

II. BACKGROUND

In data mining, classification is one of the most popular tasks with wide variety of applications. Many algorithms have been presented to produce an accurate and efficient classifier. All these algorithms are worked on single table as an input but in real world applications, data is stored on multiple tables. There have been many techniques for classification as Neural Networks and Support Vector Machines. However, they can only be applied to data in single table. The conversion of the multiple tables to single table is very difficult and expensive. So, Multi-relational classification which uses weighted voting technique can be applied to combine classifiers to get class label based on the contribution of tables [6, 9].

SVM classifier is a powerful classifier for the classification task of data mining. SVM is based on statistical learning theory and used to find the optimal separating hyperplane between two classes. Optimal hyperplane is the one giving maximum margin between training examples of different classes. SVM converts the original data point to

dimensional space and the data point is viewed as a dimensional vector. The main aim of the SVM is to predict which class a new data point will be in. There are many hyperplanes that may classify the data. The best hyperplane is the one which has largest separation margin between two classes. We choose this hyperplane because the distance from the nearest point on the each side is maximized. This hyperplane is known as maximum-margin hyperplane or optimal hyperplane. By this hyperplane, the linear classifier is defined known as maximum margin classifier. Fig 1 is showing the concept of SVM.

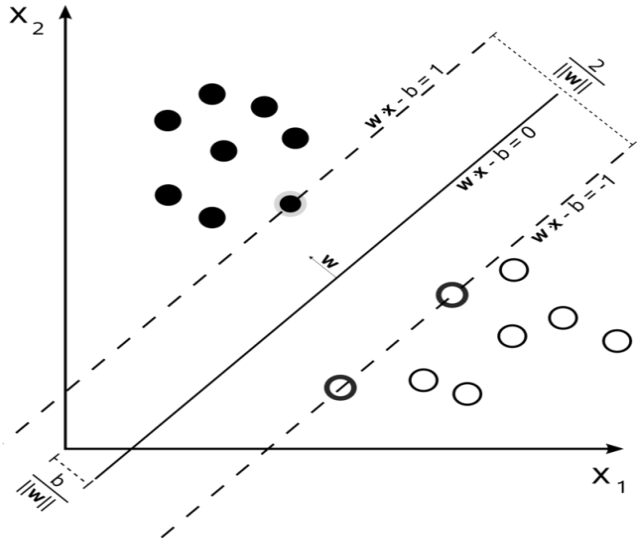

Fig.1-Support Vector Machine [14].

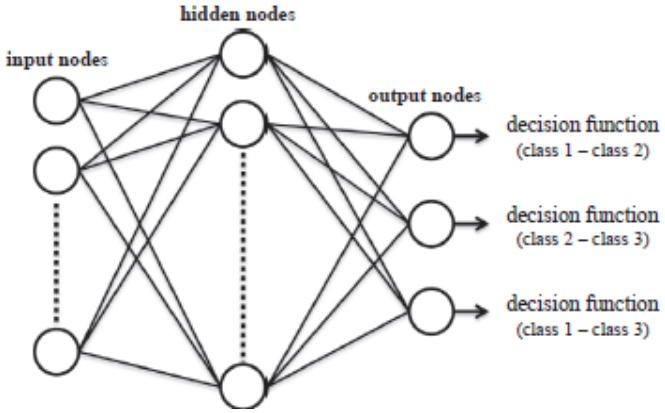

Fig. 2. Network diagram of ANN classification problem [11].

As we know, kernel method is used in SVM for pattern analysis and detects the types of relations. Kernel SVM requires evaluating the kernel for a test vector and each of the support vectors. Intersection kernel SVM and additive kernel SVM are introduced in [2, 5], which are independent of number of support vectors and gives more efficient classification than kernel SVM. SVM separates the class by parallel hyperplane but in some problems, the parallel hyperplane cannot be able to separate the classes. So, the concept of nonparallel hyperplane is introduced in [12]. Originally SVM was designed for binary classification but in the real world, the problems have multiple classes. This problem can be solved by constructing and combining several binary classifiers. Chen and Chen [1] used multiple simple classifiers to approximate the SVM for classification problem. The SVM is one of the best techniques and also gives high accuracy and efficiency compared to other techniques of classification. As the problem become complex, the computational cost of SVM increases. The major drawback of SVM is its computational cost. There are many approaches which can be used to reduce the cost. Decision tree can be applied to speed up the SVM in test phase. This approach has focused on reducing the number of test datapoints to be used in classification [4]. Another approach is based on adaptive genetic algorithm to optimally reduce the solutions for SVM by selecting vectors from the trained dataset. These datasets consist of the support vectors which best approximates the original discriminant function [3].

ANN can also be used to improve SVM's efficiency. ANN consists of three layers: the input layer, the hidden layer, ant the output layer the input layer take the inputs, then forward to hidden layer (one or more) and finally to output layer to produce decision function. Figure 2 shows the concept of neural network. ANN can be used such as multilayer perceptron, recurrent neural network, radial bases function neural network, etc. These neural networks are applied to SVM to speed up the process of classification. The complexity of NN in the learning is generally less compared to that of SVM. When neural network is applied on the test phase of SVM, it reduces the complexity of SVM by approximating the number of support vectors. When NN is applied to training phase, pre-partitioning of the set of support vectors can be done to reduce the time complexity.

III. COMPARING SVM AND ANN

This section compares SVM and ANN, and explains the Methodology.

A. Compared method

We focused on classification tasks. For SVMs, we tested the standard c- SVM, the rbf kernel or linear kernel.

B. Software used

We used the LIBSVM [a library for support vector]. For comparison with NN, we resorted to a matlab implementation. For NN, we used nprtool and MATLAB implementation.

C. Datasets

Several benchmark datasets from the University of California at Irvine (UCI) repository were used for the comparison, namely diabetes, heart, musk and statlog. The spect dataset from "A library of support vector machine" was also used.

D. Methodology

Step 1: We have taken the numeric datasets to compare the performances of Support Vector Machine and Artificial Neural Network.
Step 2: Create interface between LIBSVM 3.20 and MATLAB 7.10, as Support Vector Machine is not by default in MATLAB 7.10.
Step 3: Create M-file to classify the datasets using Neural Network.
Step 4: Results by Artificial Neural Network have been observed.
Step 5: Transform the datasets in LIBSVM format (csv format), to input to support vector machine.
Step 6: Create M-file to classify the datasets using Support Vector Machine.
Step 7: Results of support vector machine have been observed.
Step 8: Results are compared to check which one performs better

.

E. Experimental results

The Figures presents a comparison of the best results achieved by each method. It appears that much better results in classification were obtained using SVM than ANN. It also seems that SVMs are more resistant to insufficient data amount, because even for small set of integer datasets results were satisfactory. That cannot be said about ANN, which gives less accuracy as compared to SVM in integer datasets.

- **Accuracy**

Accuracy is the proximity of measurement results to the true value; precision, the repeatability, or reproducibility of the measurement. In the fields of science, engineering and statistics, the accuracy of a measurement system is the degree of closeness of measurements of a quantity to that quantity's true value. Accuracy of Support vector machine is always better than artificial neural network in classification of integer datasets. Comparison of Accuracy using SVM and ANN is presented in figure 3.

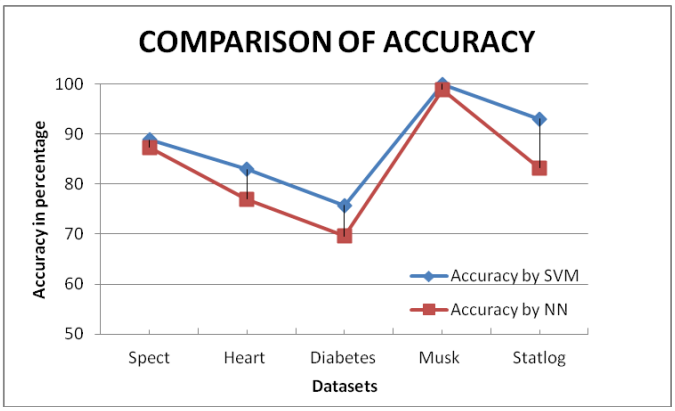

Fig. 3. Comparison ofAccuracy.

- **CPU Time**

CPU time (or process time) is the amount of time for which a central processing unit (CPU) was used for processing instructions of a computer program or operating system. The amount of time the CPU is actually executing instructions. During the execution of most programs, the CPU sits idle much of the time while the computer fetches data from the keyboard or disk, or sends data to an output device. This CPU time is the time used by the matlab to fetch data from datasets, process and gives results of classification. Comparison of results for CPU time by SVM and ANN are presented in figure 4.

- **Training Time**

Training time is the time in which the machine trains the network or prepares the model to perform classification task. In figure 5, comparison of Support vector machine and artificial neural network is presented.

- **Testing Time**

Testing time is defined as the time taken by machine to predict the class label of the datasets. In this dissertation, we have used two class labels using SVM and ANN. Figure 6 is showing the results of prediction time taken by Support vector Machine and Artificial neural network.

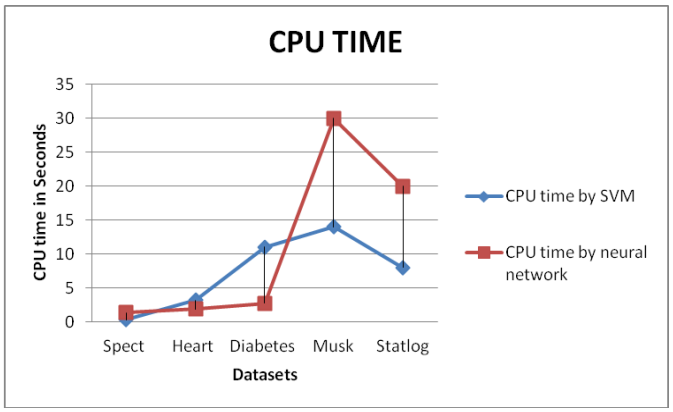

Fig 4: Comparison of CPU time.

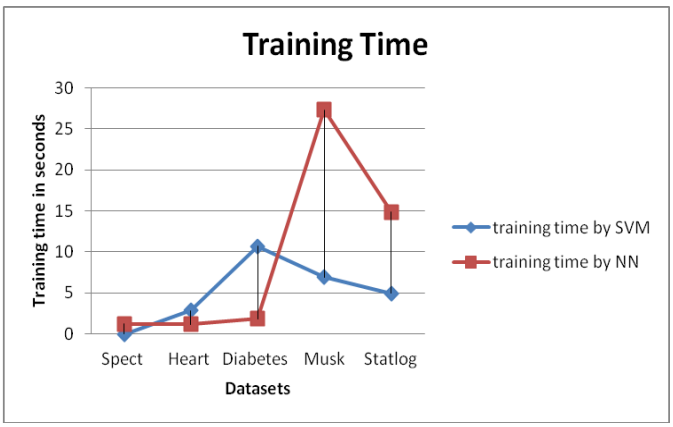

Fig 5: Comparison of training time.

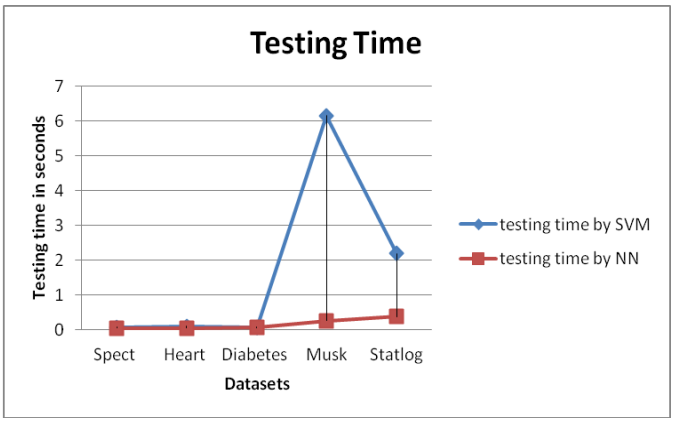

Fig 5: Comparison of training time..

SVM performed significantly better than Neural Network in the Accuracy and CPU time. Support Vector Machine classifies the data with the help of support vectors and Neural Network classifies the data with the help of hidden nodes. Number of support vector and Number of hidden nodes are equal.

IV. CONCLUSIONS

Experimental results indicate that support vector machine performed significantly better than Neural Network when talk about accuracy. It is observed that Support Vector Machine performed significantly better than Neural Network in the CPU time also. In the datasets below 5000 tuples, the CPU time takes by Support Vector Machine is approximately equal to time taken by Neural Network. If the number of features or attributes is less, then Neural Network takes less time than SVM but if Number of features is large, then SVM takes less time than Neural Network. In the datasets above 5000 tuples, the CPU time taken by Support Vector Machine is always less than time taken by Neural Network.

SVM perform best in classification when talk about accuracy. CPU time is divided into two times: training time, testing time. Experimental results indicate that support vector machine performed significantly better than Neural Network when talk about training time but in testing Neural Network performs better. In the Neural Network, number of hidden nodes is already decided but support vector machine generates number of support vectors by the model produced by training process itself. For the comparison of Neural Network and Support Vector Machine we used equal number of hidden nodes in Neural Network and number of Support Vectors in Support Vector Machine. At last we analyse that overall SVM is better than Neural Networks. But in testing time Support Vector Machine's performance is not good than Neural Network.

So we can conclude that SVM perform better then Neural Network in all scenarios except testing time.

REFERENCES

[1] U Fayyad, G.P Shapiro, P Smyth (1996). Knowledge Discovery and Data Mining: Towards a Unifying Framework. KDD-96 Proceedings. 82-88.

[2] V.N Vapnik (1999). An Overview of Statistical Learning Theory. IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 10, NO. 5, 988-999.

[3] C.W Hsu and C.J Lin (2002). A comparison of methods for multiclass support vector machines. IEEE transactions on neural networks, vol. 13, no. 2, 415-425.

[4] P ANDRAL(2002).The Equivalence of Support Vector Machine and Regularization Neural Networks.Neural Processing Letters 65, 97-104.

[5] V David, S anchez(2003).Advanced support vector machines and kernel methods.Neurocomputing 55 ,5 – 20.

[6] J.H Chen, C.S Chen (2004).Reducing SVM Classification Time Using Multiple Mirror Classifiers. IEEE Transaction on system, Man, and cybernetics, part B: Cybernetics 34,1173-1183.

[7] P.H Chen, C.J Lin and B.S olkopf(2005). A tutorial on n-support vector machines.APPLIED STOCHASTIC MODELS IN BUSINESS AND INDUSTRY volume 21,111–136.

[8] R.E Fan, P.H Chen, C.J Lin(2005).Working Set Selection Using Second Order Information for Training Support Vector Machines. Journal of Machine Learning Research 6,1889–1918.

[9] E Romero and D Toppo (2007). Comparing Support Vector Machines and Feedforward Neural Networks With Similar Hidden-Layer Weights. IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 18, NO. 3, 959-963.

[10] S Maji, A Berg & J Malik (2008).Classification using intersection kernel support vector machines is efficient. In proceeding of IEEE conference on computer vision and pattern recognisation (pp. 1-8).

[11] H.J Lin, J.P Yeh (2009).Optimal reduction of solutions for support vector machines. Applied mathematics and computation 214, 329-335.

[12] M Gao, S Zhou (2009). Research of Web Classification Mining Based on Classify Support Vector Machine. IEEE, ISECS International Colloquium on Computing, Communication, Control, and Management, 21-24.

[13] C.W Hsu, C.C Chang, and C.J Lin(2010).A Practical Guide to Support Vector Classification.National Taiwan University, Taipei 106, 1-16.

[14] E.Al-Daoud(2010).Integration of Support Vector Machine and Bayesian Neural Network for Data Mining and Classification.World Academy of Science, Engineering and Technology Vol:4 ,145-150.

[15] K Gayathri, N Kumarappan (2010). Accurate fault location on EHV lines using both RBF based support vector machine and SCALCG based neural network. Expert Systems with Applications 37, 8822–8830.

[16] M.A Kumar, M Gopal.(2010).A hybrid SVM based decision tree. Pattern recognition 43, 3977-3987.

[17] A Athanasopoulos, A Dimou, V Mezaris, I Kompatsiaris(2011).GPU ACCELERATION FOR SUPPORT VECTOR MACHINES.Proc. 12th International Workshop on Image Analysis for Multimedia Interactive Services, FP7-248984 GLOCAL.

[18] D Hongle (2011). An improved algorithm of the support vector machine. 1EEE, International Conference on Computer Science and Network Technology, 1315-1317.

[19] J Bozsik, M Kozma (2011). Neural Network based Support Vector Machine in Financial Default Forecast. IEEE 9th International Symposium on Intelligent Systems and Informatics, 163-167.

[20] R Zhang, W Wang(2011).Facilitating the applications of support vector machine by using a new kernel.Expert Systems with Applications 38 ,14225–14230.

[21] E.A Zanaty(2012).Support Vector Machines (SVMs) versus Multilayer Perception (MLP) in data classification.Egyptian Informatics Journal 13, 177–183.

[22] H.M Asraf, M.T Nooritawati, M.S.B Shah Rizam (2012).A Comparative Study in Kernel-Based Support Vector Machine of Oil Palm Leaves Nutrient Disease.Procedia Engineering 41,1353 – 1359.

[23] J JI, Q.F ZHA0 (2012). NNC+SVM: AN EMPIRICAL STUDY FOR FAST CLASSIFICATION. Proceedings of the 2012 International Conference on Machine Learning and Cybernetics, Xian, 427-433.

[24] Y Yang, Q He, X Hu (2012).A compact neural network for training support vector machines.Neurocomputing 86,193–198.

[25] C Zhanga, X Shaob, D Lia(2013).Knowledge-based Support Vector Classification Based on C-SVC.Procedia Computer Science 17, 1083 – 1090.

[26] D.S Jodasa, N.Marranghelloa, A.S Pereiraa, R.C Guido(2013).Comparing support vector machines and artificial neural networks in the recognition of steering angle for driving of mobile robots through paths in plantations.Procedia Computer Science 18 ,240 – 249.

[27] G Zhang, H Ge(2013).Support vector machine with a Pearson VII function kernel for discriminating halophilic and non-halophilic proteins.Computational Biology and Chemistry 46 ,16– 22.

[28] Md. S Islama, Md. M Kabira, N Kabirb(2013).Artificial neural networks based prediction of insolation on horizontal surfaces for Bangladesh.Procedia Technology 10 ,482 – 491.

[29] R.K Jade , L.K Verma, K Verma(2013).Classification using Neural Network & Support Vector Machine for Sonar dataset.International Journal of Computer Trends and Technology- volume4, 116-119.

[30] S Maji, A.C Berg & J Malik (2013). Efficient classification for additive kernel SVMs. IEEE transactions on pattern analysis and machine intelligence. Vol. 35, NO. 1, 66-77

[31] X Xu, Z Hou, C Lian and H He (2013). Online Learning Control Using Adaptive Critic Designs With Sparse Kernel Machines. IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS, VOL. 24, NO. 5, 762-775.

[32] Y.A Alsultanny(2013).Labor Market Forecasting by Using Data Mining.Procedia Computer Science 18 ,1700 – 1709.

[33] Z Qia, Y Tiana, Shia, X Yub(2013).Cost-Sensitive Support Vector Machine for Semi-Supervised Learning.Procedia Computer Science 18,1684 – 1689.

[34] A Dastanpour, S Ibrahim, R Mashinchi, A Selamat (2014). Comparison of Genetic Algorithm Optimization on Artificial Neural Network and Support Vector Machine in Intrusion Detection System. IEEE Conference on Open Systems,October 26-28,72-77.

