Compare Support vector machine to three-layer Neural Network on Titanic dataset

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Abstract –Titanic disaster occurred 100 years ago on April 15, 1912, killing about 1500 passengers and crew members. The fateful incident still compels the researchers and analysts to understand what can have led to the survival of some passengers and demise of the others. With the use of machine learning methods and a dataset provided by Kaggle consisting of 891 rows in the train set and 418 rows in the test set, we attempt to determine the correlation between factors such as age, sex, passenger class, fare etc. to the chance of survival of the passengers. In particular, compare two different machine learning technique SVM and neural network

Keywords – Machine learning, Support Vector Machine, Neural Network.

I. INTRODUCTION

Wide range of data are available and can be obtained easily from different sources. The field of machine learning has allowed analysts to uncover insights from obtained data. In this project we have used titanic dataset provided on https://www.kaggle.com/c/titanic[1]. Titanic disaster is one of the most famous shipwrecks in the world history. This dataset records various feature of passengers on Titanic, including wo survived and who didn't. Our goal is to apply machine-learning techniques on dataset to successfully predict which passengers survived the sinking of the Titanic. There was some element of luck involved in surviving the sinking, some groups of people were more likely to survive than others, such as women, children, and the upper-class. The effect of featured on survival has been investigated. Some feature has been added to dataset and some existing feature has been removed to obtain good accuracy. The method uses in this project include SVM and three-layer neural network. Various tools have used to implement these algorithms including Python, Pandas, Numpy, Matplotlib, Sklearn, TensorFlow etc.

II. RELATED WORK

Chatterjee[2] applied Multiple linear regression and Logistic regression to check survival rate of passenger and compare accuracy. The maximum accuracy obtained from multiple linear regression is 78.820%; the maximum accuracy obtained from Logistic regression is 80.756%.

Lam and Tang et al.[3] predicted the survival of passengers using different combination of feature using different machine learning algorithm include Naïve Bayes, SVM and decision tree. They didn't get significant differences in accuracy between tree methods. Sex feature seems to dominate the others in accurately predict survival.

Cicoria, Sherlock, et al.[4] carried out the prediction using Decision tree classification and cluster analysis. He suggested that sex is more important feature as compare to others in determining the survival of passengers.

Frey and savage et al.[5] have analyzed the Titanic disaster and concluded how survival chance was dependent on passenger features. Survival rate of women was more than three time than the survival rate of men. Children were higher survival chance. Survival chance were also dependent on financial means, passengers from first class were higher survival chance than second and third class passengers.

III. DATASET

The data I have used for this project is provided on the Kaggle website. Data consists 891 passengers sample for training set with their associated labels. The data is in the form of a CSV (Comma Separated Value) file. In training set for each passenger, his/her passenger class, name, sex, age, number of siblings/spouses aboard, number of Parents/children aboard, ticket number, fare, cabin and embarked are given. For the test set a sample of 418 passengers is provided. The attributes of the training set and their description have been mentioned in Table II. In Table II, III and IV training dataset sample has been given.

TABLE I: ATTRIBUTES IN TRAINING DATASET

ATTRIBUTES	DESCRIPTION
PassengerId	Id given to each traveler on the boat
Survived	Survival (0 = No, 1 = Yes)
Pclass	Ticket class. It has three possible values: 1,2,3 (first, second and third class)
Sex	Gender of the passengers (Male or Female)
Age	Age of the Passengers
Sibsp	Number of siblings and spouses traveling with the passenger
Parch	number of parents and children traveling with the passenger
Ticket	Ticket number
Fare	Passenger fare
Cabin	Cabin number
Embarked	Port of Embarkation (C = Cherbourg, Q = Queenstown, S = Southampton)

TABLE II: KAGGLE DATASET

PassengerId	Survived	Pclass
1	0	3
2	1	1
3	1	3
4	1	1
5	0	3

TABLE III: KAGGLE DATASET (Contd...)

Name	Sex	Age
Braund, Mr. Owen Harris	male	22.0
Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0
Heikkinen, Miss. Laina	female	26.0
Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0
Allen, Mr. William Henry	male	35.0

TABLE IV: KAGGLE DATASET (Contd...)

SibSp	Parch	Ticket	Fare	Cabin	Embarked
1	0	A/5 21171	7.2500	NaN	S
1	0	PC 17599	71.2833	C85	C
0	0	STON/O2. 3101282	7.9250	NaN	S
1	0	113803	53.1000	C123	S
0	0	373450	8.0500	NaN	S

IV. DATA ANALYSIS

We need to explore dataset to consider potential data input for the solution. This step is very important because the quality and quantity of data determine how good our model can be. Ticket feature may not be a correlation with survival. It contains 210 duplicates values. We may drop ticket feature. Cabin feature may be dropped as it is highly incomplete or contains many null values in training. PassengerId is not correlated with survival so we may be drop it from training dataset. Out of all passengers in training dataset 38% survived. From Fig.2 (a) and Fig.2 (b) we can see that there is significant difference is survival between Female (74.20%) and male (18.89%).

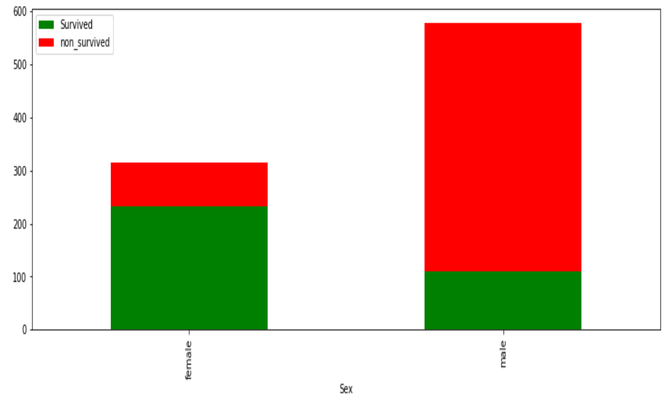

Fig.2 (a) Sex vs Survival

Sex	Number of people	Survived	Mean
female	314	233	0.742038
male	577	109	0.188908

Fig.2 (b) Sex vs. Survival

From Fig. 3 (a) and (b) we found out that female from first and second class have more than 90% survival chance and from third class only 50% survived while male has a much higher survival rate (36.88%) from first class then from second class (15.74%) and then from third class (13.54%).

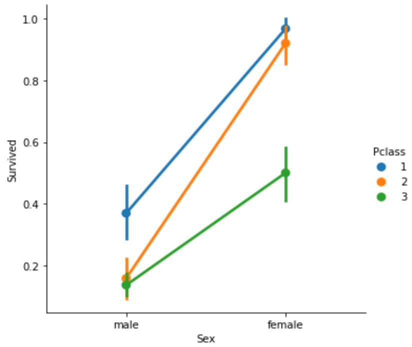

Fig.3 (a) Pclass and Sex vs. Survival

Sex	Pclass	Number of people	Survived	Mean
female	1	94	91	0.968085
	2	76	70	0.921053
	3	144	72	0.500000
male	1	122	45	0.368852
	2	108	17	0.157407
	3	347	47	0.135447

Fig.3 (b) Pclass and Sex vs. Survival

Average fare of Pclass 1 is high and also more people has survival chance from this class (136 people (63%)survived out of 216 people from Pclass 1) 87 people (47%) survived out of 184 people from Pclass 2 and 119 people (24%) survived out of 419 people from Pclass 3 as shown in Fig 4(a) and (b).

Pclass	Number of people	Survived	Mean
1	216	136	0.629630
2	184	87	0.472826
3	491	119	0.242363

Fig.4 (a) Pclass vs. Survival

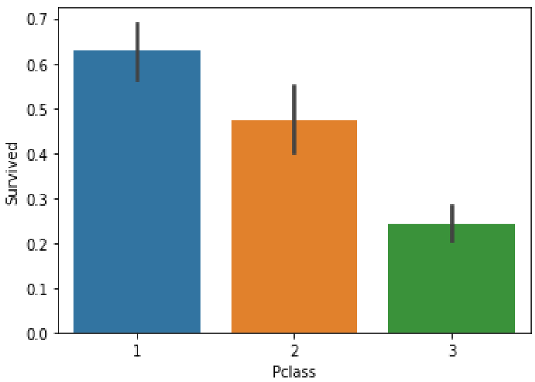

Fig.4 (b) Pclass vs. Survival

From Fig.5 (a, b, c) we can see that younger male of age range 5-10 year tend to survive as depicted by green histogram male of age range 20year-40year has more tend to die. Women survived more than men, as depicted by the larger female green histogram.

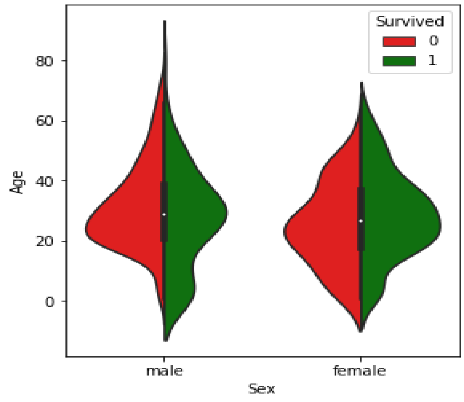

Fig.5 (a) Age and Sex vs. Survival

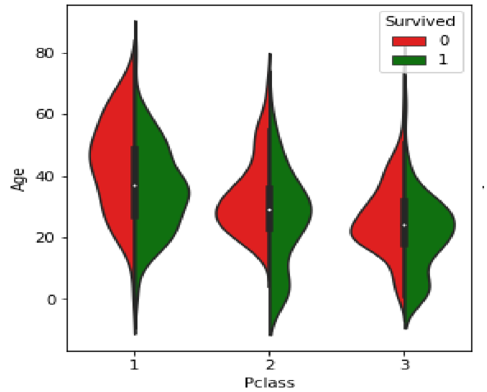

Fig.5 (b) Age and Pclass vs. Survival

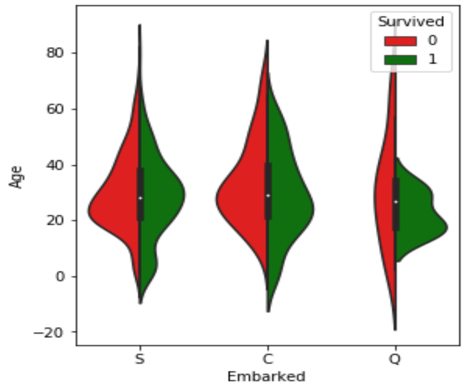

Fig.5 (c) Age and Embarked vs. Survival

V. FEATURE ENGINEERING

First I have combined train and test data for feature engineering to prevent any information mismatch in train and test data set. From the name extract title that can give additional information about the social status. There are total 18 title in data, map these title with Mr., Miss., Mrs., Officer, Master and Royalty, we need to convert these feature in binary format. Sex features were mapped to 0 as male and 1as female. Next feature is age;

null value of age has been filled with mean value of given age data. Now I combined the Sibsp and Parch to get family size as we can see from Fig.6 family size with 2, 3 and 4 members were high survival chance. Family has been converted into three group as singleton, small family and large family. Fare features ware converted into three group as low, medium and high fare range. In Embarked feature two null values were replaced by most frequent value S. After completion of feature engineering data were separated into two part first 891 data as train data and rest 418 data as test data. Then engineered feature were selected for modeling.

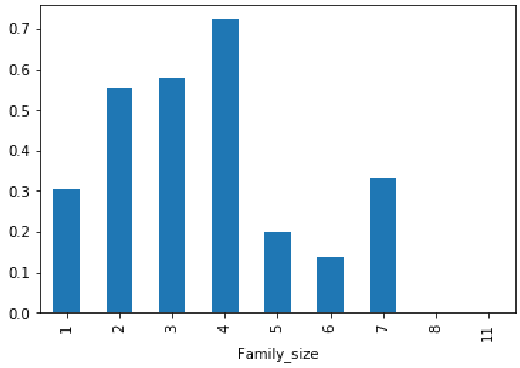

Fig.6 Family Size vs. Survival

VI. MODELING

Models uses in this project were SVM and neural network model with training data. The following feature were selected for data modeling a.) Pclass, b.) Sex, c.) Age, d.) Embarked, e.) Title, f.) Family, g.) Fare_data. Train data was split into train and test set for modeling purpose.

The SVM model was implemented for classification on train dataset. Rbf function was used as kernel in SVM model. We were able to achieve an accuracy rate of 88.88% on test data set.

The neural network build was a three-layer neural network. Two layer with relu function and third layer with sigmoid function. We were able to achieve an accuracy rate of 90.00% on test data set

TABLE IV: COMPARISON OF ALGORITHM

ALGORITHM	ACCURACY
SVM	88.88%
Neural Network	87.77%

I. CONCLUSION

In this project machine learning algorithm SVM and neural network has been successfully Implemented. We also determined the feature that were most the most significant for the prediction. We were observed that shows SVM higher accuracy rate than neural network model.

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