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Sales Forecast of Manufacturing Companies using Machine Learning navigating the Pandemic like COVID-19

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***Abstract*- This project is all about prediction of turnover of a company using machine learning. From this machine learning model, it can easily predict the next outcome in terms of turnover or whichever is equivalent to it. Future result prediction is very helpful for better understanding of market trends and stocks by using simple machine learning techniques. For this particular project, an Indian automobile industry has been selected for car sales prediction in the era of covid-19. This project shows, in the tough time of covid-19, if every other thing remains constant, what will be the sales trend for various automobile companies. will the graph go downwards or upwards? By using various machine learning techniques, it can predict the trend of graphs and in this project, it has been tried to show like this.**

Keywords: prediction, machine learning, automobile prediction, Covid-19.

I. INTRODUCTION

It has been a known fact that when there is a crisis in the world, every sector of the market is harshly affected and so does the automobile industry. The crisis mentioned here is not a regular problem but once in a century kind of situation which has a potential to break or collapse a whole established company at once. Talking about the impacts of this outbreak, the automobile industry has been the sector that excites a lot. Since this outbreak has happened this is one of the sectors that have been hugely impacted. Due to the lockdown and curfew in the country, automobiles have been the least concerned commodity for the people right now [1]. People are not thinking anything beyond the essential items which can be totally understandable and natural. But looking at the past of the automobile industry it has been quite fascinating how the future of this industry would be given the outbreak. Since the lockdown has affected many companies, few companies have started working on the future plans to attract the customers. Companies do not want their customers to not entertain them. They are finding new ways and ideas to increase their sale again. Definitely it is going to be a time taking process but the automobile company will definitely bounce back.

These have been dire times ones are a witness to. Nobody in their right mind would have ever imagined this devastating outbreak of such a pandemic. If somebody would have told one in the past 20 years about such a situation, it would have just brushed him/her off, thinking that person was ignorant of the advancements in the medical field. The outbreak of covid-19 has led to almost the entire world staying at home. And this means that one day to day need of people isn't being used at all, Automobiles. Although all industries have been hit severely due to this pandemic situation, the automobile sector is looking much bleaker compared to other industries. Cars, Bikes, Buses, almost all sorts of public and private transport are just lying around while humans are stuck in the houses. Since people are stuck in their houses, showrooms are closed; factories are closed, and hence supply and demand both are at a standstill. On top of that cars and bikes are of the least concern to people since they have their jobs, their family's safety, and financial security to be concerned about. This fear of financial security has left people scared to invest in cars since they feel it is not much of a necessity.

Since everybody in the automobile industry has been affected in this scenario the stress of loss is not equally divided among all. Some companies have to bear heavy loss whereas some companies do not in comparison to them. To know how to save a company from such a pandemic situation a prediction model has been a great tool to have. This model has been serving that particular service. The model will let the company know how they can actually save themselves in such a crisis situation and evolve strongly among others. Such a prediction model has been very handy and useful for such companies to emerge powerfully again by ensuring their worth, keeping in check about the requirement of production and the amount of sales needed. This model has let the companies know what necessary steps should be taken to lessen the impact of any such pandemic to their company. Now talking about the method or the implementation part, machine learning algorithms has been used to develop such a model. To train the machine the dataset has been used and after training

the machine it becomes ready to predict the required outcome easily. Machine learning is a very popular medium to make such a model. Since there is a common belief that machines can be trained [2]. It takes both input and output to train a machine and an algorithm is always expected as output of machine learning. The machines are being used nowadays because the machines are replacing the human intelligence, human hands, human involvement with machines since it is proved to be more efficient, more predictable and sometime more dependable. Therefore machine learning is important and thus necessary to meet one's requirements. It's quality of being more accurate, precise; its ability to store data, its ability to search data faster makes it an important tool to be used. This has been the reason why companies will now prefer to work online than working offline depending upon the machines, computers, mobile phones etc.

II. LITERATURE REVIEW

While making the project, the data has been collected from a dependable source [3] and applied various prediction techniques on it so that the results could be according to the need. The sale of the company in particular month was the necessary factor. On this factor one could feed the machine to train it and predict the next month's sale beforehand. This could also prevent the companies to go for an overproduction leading to various negative impacts depending on that production. If the number has been known beforehand then the company could prevent extra machine expenses, labor expenses, unnecessary overstocking, over utilization of raw materials, extra sales pressure and many other things can be saved by predicting it. This was still not a big issue if there was smoothness in the environment, but when the company has been dealing with such a pandemic situation then there are very few options available for these companies. If they do not predict the future sale earlier then they could face heavy loss whose recovery would be very tough during these tough times.

As it has been a known fact that in such a pandemic situation, the essential products such as agricultural items, medicines, data facility, electricity, etc becomes more important than cars, bikes, travelling etc. So the sale of these things will definitely decrease which also has been evident with the sale record of the car companies during the lockdown in the country [4]. The sale during this time was as low as zero. Now when these companies come back in the market and start their sales journey again they would have to take necessary precautions such as maintaining social distancing and maintaining hygiene everywhere. This has also been sure that the foot fall in the showroom will decrease and many companies will go online with their sales strategy. The customers would have to be attracted towards the automobile sector which has to be tough work for these companies. As known that cars will be an important entity to be looked upon in the market. Thinking about people's sentiment, looking into various offers and after analyzing various analysts it can say that there can be a both ways swing in this industry. People would like to purchase a car in order to maintain social distance and avoid public transport. On the other hand people do not have jobs, money to take care of their basic needs then how will they meet the car's EMI. Talking about the EMI factor, there have been many announcements done recently about the relaxations in EMI to support the sales of these things. In order to predict the sales and production it have to select a few companies and analyze their market sales. The machine had been trained accordingly and thus the machine could then predict the next month's sales according to the previous data entries. For doing so various methods had been applied such as data collection, data selection, data cleaning, data preprocessing etc [5].

With predictions being made to expect for a recession even greater than the one of 2008, people are tightening their purses, spending lesser on all things generally and even lesser on automobiles. With millions of people losing their jobs it would be just impossible for companies to sell vehicles. On top of that with all sanitary precautions and less going out to public places, people who although want to buy a vehicle wouldn't prefer going to a showroom or a dealership to purchase a vehicle for the fear of contracting the virus. This situation would lead to a collapse of the showroom model and it would just convert them into showpieces for presenting the vehicles, where not a single unit has been sold. Automotive companies are trying to mitigate the problem of their losses by cutting down salaries and laying off thousands of employees, but this would only push the economy further down below where it already is. To recover from this blow, companies will have to be very patient. It would be better for companies to branch out into different sectors to support themselves. They should look at conglomerates like Tata to diversify their portfolio and to provide other services otherwise it would be very hard to recover. They must also start booking of cars online. Tesla already has such a model where it can book a test drive, buy a car, and apply for service of vehicles and many such services. Companies will need to look at this model and replicate or create such a model in order to maintain the customer's peace of mind and to sustain the highest standard of hygiene and sanitation. Companies must also provide vehicle servicing services at home for basic troubleshooting. With the recent partial lifting of the lockdown, the Government has allowed Automobile companies to open their factories and resume production. But, for the safety of their staff companies must also provide measures for social distancing and sanitation within their factories.

III. METHODOLOGY

The project started with a very simple idea, predicting any company's outcome in terms of production and sales. But the condition is, in real life, there are many factors affecting the production and sale of a company. So, it took an assumption "all the affecting factors are nil and all depending factors are constant". By this assumption, it can easily predict what is the next outcome in terms of production and sale of a company (if every other thing goes well). Some of the dependent factors are: natural resources, labor, capital, all kinds of goods and normative and positive statements.

Some affecting factors are: recession, natural disasters, political issue, market trend etc. it assumed that all the factors including depending and affecting too, are as same as they were in the last year.

This project has various steps and phase from collecting raw data to competition and comparing from real world scenarios.

The first task was to choose an appropriate company or sector to work on and get some data about it. It decided to work on Indian automotive sector. Indian automotive sector is a very vast sector and Indian market is the world's fourth largest in automotive sales and production. It has been growing tremendously and have a very bright future. So, it decided to work on it. It took five major players in this market named Maruti-Suzuki, Hyundai, Toyota, Honda and Tata motors. They belong to some well renowned and major brands in India. After deciding all these, the major work started with collecting some data for and from them.

Firstly, it found data from their websites but the data were inconsistent and had many values which were useless for us. It did some research and selected data of annual production of cars from 2019 to present. After that, it did some pre- processing techniques on raw data to make it clean for using machine learning algorithms. Data was majorly in numeric and excel tables. So it designed the datasets using all cleaned data values in csv format.

After getting all this done, The data was perfect for machine learning algorithms. Machine learning is very useful technology which can predict an outcome. Basically this technique is an application of artificial intelligence which requires both input and output for getting an equation for an algorithm. So, it input month-wise sale and months for getting a desired output as a prediction of sale in next coming months.

Machine learning is of different types. Supervised learning, unsupervised learning and reinforcement learning. There are various machine learning algorithms which claim to do future prediction. Such as regression and classification. These are further classified into sub categories. Regression uses numeric values and classification uses categorical values. Regression has linear regression, logistic regression, multi regression. Classification can be done using KNN, random forest etc. [6]. There are many technologies that it can use but all these have different accuracy rates. Some require more than one technique to construct an efficient model, some require just one. So data has been analyzed thoroughly and found that classification cannot be used in the model. Regression is the only technique.

It, then, calculated all the coefficients and did feature scaling to train and test the data in linear regression. But the efficiency and accuracy of the model was poor. So it decided to do random forest regression in the model to train and test the dataset. Random forest regression is a meta estimator which fits different decision trees on a test set of data and takes the average of decision trees to improve itself [7]. More the number of decision trees, the smoother the graph will be and more efficient the model will be. It can also use bagging and boosting in that. After applying random forest regression, the model runs smoothly and is able to predict desired values. In this model it took around 100 decision trees (n-estimators) for more improved modeling and more efficient training of data. Test size of data is twenty percent of whole data. So, these were the necessary steps which were required to complete the model.

IV. OUTPUT

In the output graphs, X-axis shows the month number and Y-axis shows production and sales of a car manufacturer. Month number has been defined as the serial number of months when counted from January 2019 to present.

Example: [Jan-19= 1],[Feb-19 = 2],[Mar-19 = 3]…….[Jan-20 = 13] [Mar-20 = 15].

The prediction of April-2020 predicted by model is stated below the output graphs.

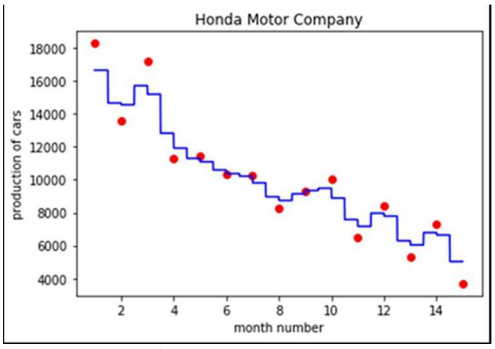

Fig1: Honda sales track

Honda: predict value: [10358.42]

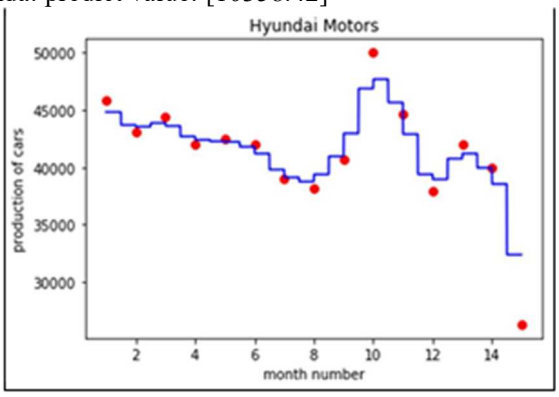

Fig2: Hyundai sales track

Hyundai: predict value: [41196.29]

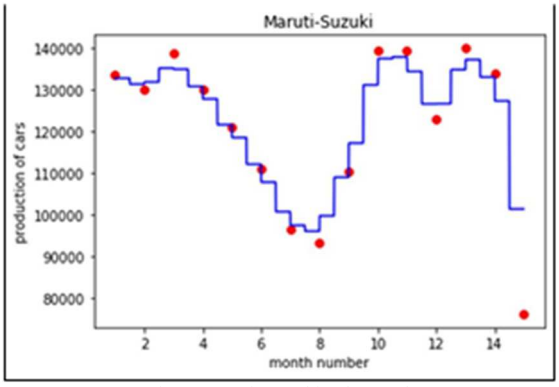

Fig3: Maruti-Suzuki sales track

Maruti-Suzuki: predict value: [107779.98]

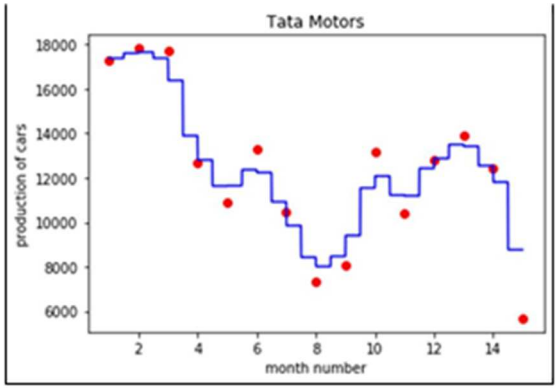

Fig4: Tata sales track

Tata: predict value: [12234.85]

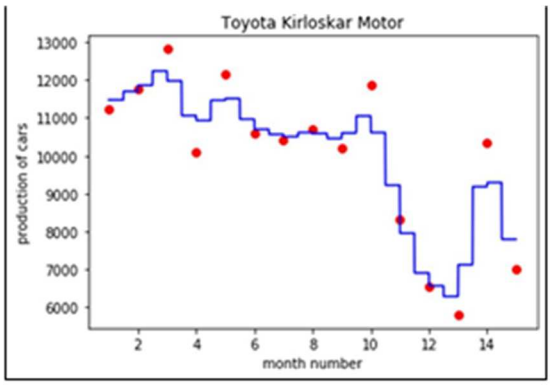

Fig5: Toyota Kirloskar sales track

Toyota: predict value: [10696.31]

The graphs here between

i. Honda Motor Company's productions of cars vs. the month number in which these sales took placed month wise
ii. Hyundai Motor Company's productions of cars vs. the month number in which these sales took placed month wise
iii. Maruti-Suzuki's car production vs. the month in which they were produced in which these sales took placed month wise
iv. Tata Motor's productions of cars vs. the month number in which these sales took placed month wise
v. Toyota Kirloskar productions of cars vs. the month number in which these sales took placed month wise are plotted here respectively. The red dots denotes the value after applying regression on the dataset provided and the blue line here denotes the path that this graph is following. It is clearly seen that when there was no danger in the world by the corona virus outbreak the sale of the company was at its peak. Gradually the sale became decreasing as it is nearing the pandemic situation. As seen the sale in the month of April is near to zero due to the pandemic the final value is zero. The production of the cars could be predicted by the use of machine learning [8]. This project has simply done that and predicted a value that this company is going to produce in the coming month keeping few factors constant. Now talking about the predicted value which is coming out to be (as given in the table below)

Table 1. Predicted Values and Units

S. no.	Manufacturer's Name	Predicted value	Predicted units
1.	Honda Motor Company	10358.42	10358
2.	Tata Motors	12234.85	12234
3.	Hyundai Motors	41196.29	41196
4.	Toyota Kirloskar motor	10696.31	10696
5.	Maruti-Suzuki	107779.98	107779

Respectively keeping all the factors constant and assuming normal conditions, the value is in between the range of the number of maximum produced cars and the minimum number. The machine turns out to be working fine and thus this is the predicted value which can be matched in the month coming.

V. CONCLUSION

The project has successfully met its aim and is ready to predict all the future behavior and trends of the market based on the then scenario. By this prediction model one can easily find out the possibility of the growth and sales of the company and can take actions accordingly. This model is ready to serve the purpose of fulfilling the prediction of sales and production after the impact of the corona virus outbreak. Further if anything this sort or any other pandemic hit again then this model is going to suggest how to save the companies worth by providing the required details through its predictions. The model has been currently at a base level and covers few factors currently so it depends upon many circumstances and conditions. Further it has a lot of area to be worked upon and lots of factors to be taken care of and considered to give more accurate results. The basic purpose of making this model is to save companies from pandemic such as COVID-19. They can be insured with this type of a model and takes the necessary steps according to the benefit of the company in the upcoming time. The model has been predicting the possibility of saving the worth of a company and preventing them economically by not misusing their wealth. It gives a financial preparation to the company by predicting the future outcomes. The automobile industry has been in a very delicate situation, they need to listen to their customers to move forward treading carefully. Listening to the demand has been the only viable option for them to create sales in such times. If they stay patient then surely the tides will turn and the situation will get better, it has been just a matter of sticking to the basics.

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