

# **Project Report**

## **Title : Optimised Warehouse Management with Auto AI**

### **1. INTRODUCTION**

#### **1.1 Overview**

In this project we are going to deal with warehouse management. At present many food delivery companies are facing problems with management of perishable raw materials. Through our project we will predict the no. of orders for upcoming weeks and we will produce a list of predictions which helps the warehouse management easy and efficient. For this project we are using Machine Learning model. We developed the model by using Auto AI service in IBM cloud to develop an automatic machine learning algorithm based on the data sets.

#### **1.2 Purpose**

The purpose of this project is to establish the relation between the number of orders of food items for a food company and the required input features like number of the week, type of food, checkout price, base price, email promotions and the number of times the food item featured in the home page. To establish this relation, analysis of the past data is the most important. We made use of machine learning model to establish this relation, with that relation we are going to predict the expected orders for upcoming weeks by taking the inputs for upcoming weeks.

### **2. LITERATURE SURVEY**

#### **2.1 Existing problem**

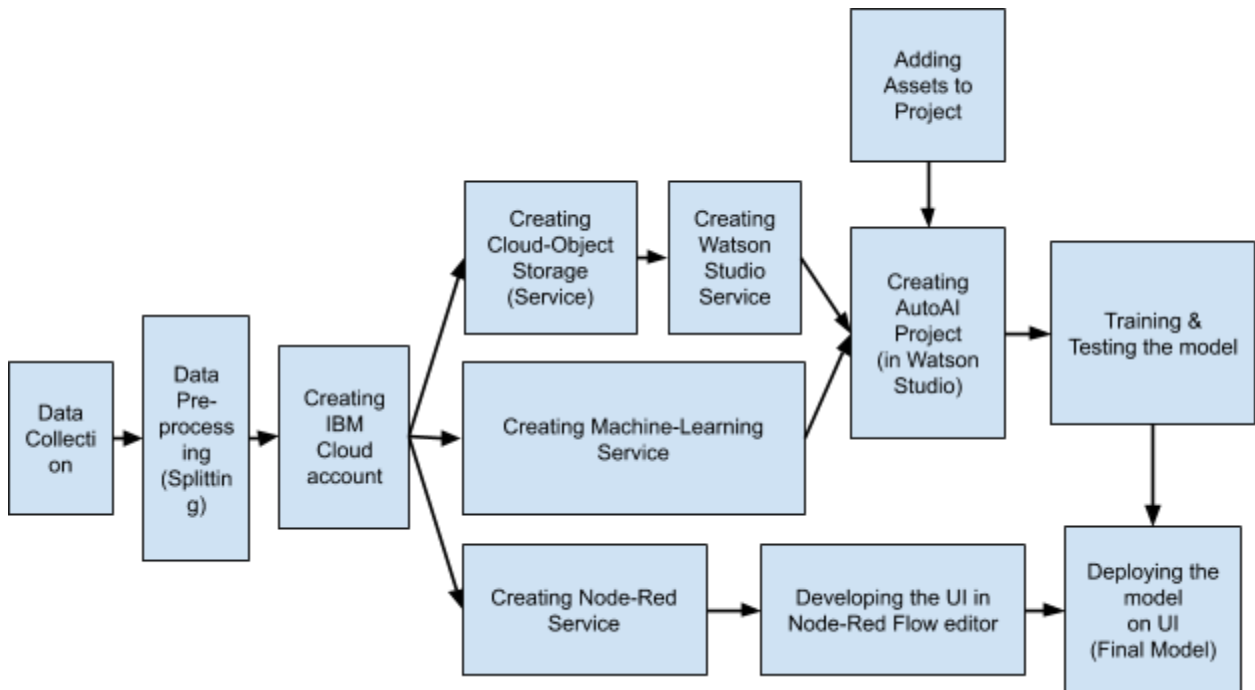
A food delivery company has to face a lot of problems with Perishable raw materials. Mainly not able to predict the sufficient future demands for the company. Due to this there will be more risk of wastage of materials or leads to out of stock. In both cases the company has to face economical loss. So, there is a need for accurate prediction of demands. Old statistical methods need to be developed by using the current technology for accurate predictions.

#### **2.2 Proposed solution**

Machine learning is the most trending and useful technology for business predictions. It has several advantages like more accuracy, automates forecast updates based on recent data, high data processing speed etc when compared to the existing methods. So, we prefer machine learning model as a suitable solution for the given problem.

### 3. THEORETICAL ANALYSIS

#### 3.1 Block diagram



#### 3.2 Hardware/Software designing

The first requirement for the machine learning model is data. We got the suitable dataset from kaggle website. Data set contains the features Week number, Center ID, Meal ID, Checkout price of the food items, Base price of the food items, number of Emails used to promote the food item, number of times the food item featured in home page of the website and the number of orders for each food item in every week. The data set contains a total of 145 weeks data of a food company. We divided that data set as training set contains 135 weeks data and the test set containing 10 weeks data.

We used all the software and hardware requirements for our project from the IBM Cloud services. To build the machine learning model we made use of AutoAI service in IBM Watson Studio service with the association of machine learning and Cloud-Object Storage (for storage purpose). The designing part is very easy as we are using the AutoAI. It will select the appropriate ML algorithm based on the data we gave and train the model with all the tuning required automatically (It will be a big task if we do those with our hands).

Total designing part will be divided into 3 major parts.

Those are

1. Building model
2. Developing the User Interface(UI)
3. Deploying the Machine learning model on UI.

### **Building model:**

We created an account on IBM Cloud(Light account) to use the services.We created the Cloud-Object storage service for all the storage needs in the cloud.We created the Machine Learning service,this service is needed to use Auto AI service and also for the deployment of the model.After we created Watson Studio service,this service is offering the Auto AI machine.We creates and Auto AI project in watson studio and after we added the training data set as an asset for the project.We selected the number of orders as predicted column and the service showed regression type algorithm as a suitable algorithm for our model.We trained our model and deployed locally on cloud and tested the model with the test data.

### **Developing the User Interface(UI):**

For developing the UI we used Node-Red service available in the IBM Cloud.Node-Red is a flow based editor to create the UI. We designed the UI to take all the required inputs from the user through a form and to display the predicted orders.In addition to that we created a dynamic pie-chart which will shows the accommodation of the particular food item in total orders in a particular week,which will make the warehouse manager to understand the importance of the each food item.This pie chart is dynamic means it will change after every successful prediction automatically.Along with that we added a dynamic table which will display the required information of the prediction in a row,this will stores the details of all predictions in a single session and also we provided an option to print the whole table after all required predictions for further use.

We also provided some basic FAQs about the model,some instructions and a small portion of the test data.

### **Deploying the Machine learning model on UI:**

Deployment is done after developing the UI.After the deployment the UI sends the inputs obtained from the user to the developed machine learning mode on cloud and returns the prediction from the model.We can use our model from the UI after the deployment.

## 4. EXPERIMENTAL INVESTIGATIONS

Auto AI service chooses Random Forest Regressor as a suitable learning algorithm for our data set and we trained our model with that algorithm. The Auto AI service generated 4 pipelines with different possible tunings and the performance of each pipeline over the holdout data. We saved the top performed pipeline algorithm for deployment.

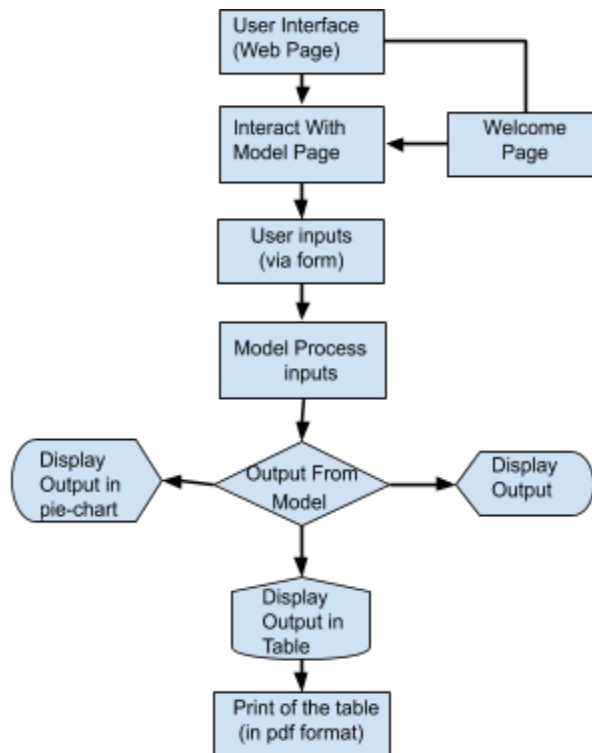
### Model evaluation measures:

	Cross Validation Score	Hold Out Score
<b>Explained Variance</b>	0.779	0.796
<b>MAE</b>	80.839	77.223
<b>MSE</b>	36207.283	32064.427
<b>MALE</b>	0.287	0.271
<b>MedAE</b>	38.800	37.500
<b>RMSE</b>	190.252	179.065
<b>RMSLE</b>	0.536	0.520
<b>R<sup>2</sup></b>	0.799	0.796

### Feature Importance:

1. Checkout price : 0.25
2. Meal ID : 0.27
3. Base Price : 0.11
4. Homepage Featured : 0.09
5. Number of the week : 0.07
6. Center ID : 0.06
7. Emails for promotion : 0.05

## 5.FLOW CHART



## 6.RESULT

Expected number of orders for one food item at a time will be delivered from the model with required inputs. To know the predicted orders for food items, we need to give the required inputs for every required food item. After the every successful prediction the Meal ID and the predicted orders will be visualised in the dynamic pie-chart and the Number of week, Center ID, Meal ID, predicted orders will be added to the dynamic table. At the end of the session we can take the summary of all predictions (i.e. The table) as a pdf for further use.

## 7. ADVANTAGES AND DISADVANTAGES

### Advantages:

1. Easy to use
2. Decreases economical loss by reducing the wastage of perishable raw materials.
3. Increases profits by predicting the required quantity of demanded raw materials.
4. Less human effort for prediction of demand.
5. Helps in business expansion

Disadvantages:

1. Cannot do prediction for all food items at once
2. Cannot do appropriate predictions in uncertain situations.

## **8.APPLICATIONS**

This model can be used as a tool for estimating the demand for the food items(in the form of number of orders) for optimised management in the warehouse of a food delivery company,that helps in buying the required amount of raw materials for upcoming week(not more,not less).Results in the reduction of wastage and improves the availability of food items for customers(by preventing out of stock).

## **9.CONCLUSION**

It is clear that every food delivery company has a problem of wastage of perishable raw materials or lack of materials.To avoid that we developed a Machine Learning model to predict the no.of orders for next ten weeks based on the previous data availability.By that we can solve the problem facing by the food delivery companies.And the accuracy of our model is 79.6%.So we believe that our model can predict the no.of orders more accurately.

## **10.FUTURE SCOPE**

The present model is not adaptable to the uncertain conditions.We are expecting the adaptable model for the any situation with inputs,which can explain the model about the situation in future.Ability to take all the required inputs at a time and do process to make the user feels easy by avoiding the recurring work to all the food items.And the model can update itself by comparing the predicted orders and the actual number of orders for the last week.These are the expected modifications for our model to perform better in future.

## **11.BIBILOGRAPHY**

References:

- 1.<https://www.potential.com/articles/project-scope/>
- 2.<https://www.kaggle.com/shashkhr25/food-demand-forecasting-challenge/data>----Data

Source Kaggle Link

3.<https://www.youtube.com/watch?v=HBkY-Fs1d6E>---Youtube Video regarding creation of IBM cloud account

4.<https://cloud.ibm.com/docs/account?topic=account-signup>---documentation on creating account

5.<https://www.ibm.com/cloud/object-storage>--Documentation on what is cloud Object Storage

6..<https://www.youtube.com/watch?v=VEoj69V6Rfg>---Youtube video on creating Cloud Object Storage Service

7.<https://cloud.ibm.com/docs/cloud-object-storage/basics?topic=cloud-object-storage-provision>---Documentation on creating Cloud Object Storage

8.<https://www.youtube.com/watch?v=NmdjtezQMSM>---Youtube video on Machine learning service

9.<https://developer.ibm.com/recipes/tutorials/create-an-ibm-watson-studio-project/>--Documentation for creating IBM watson studio

10.<https://www.youtube.com/watch?v=eVHm9UlsbuI>--Youtube video on creation of Node-Red

11.[https://www.youtube.com/watch?v=iEadmCNb\\_hE](https://www.youtube.com/watch?v=iEadmCNb_hE)---Youtube Video on creation,developing of application on Node-Red

12.<https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai-build.html>---Article regarding creation of Watson Auto AI project

13.[https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai\\_example\\_binary\\_classifier.html#step1](https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai_example_binary_classifier.html#step1)---Sample model on IBM AutoAI

14.<https://dataplatform.cloud.ibm.com/docs/content/wsj/manage-data/add-data-project.html>---Article regarding adding assets

15.[https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai\\_example\\_binary\\_classifier.html#step1](https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai_example_binary_classifier.html#step1) --Documentation on Training the AutoAI Model

16.[https://www.youtube.com/watch?v=O5wqjk\\_GeJo](https://www.youtube.com/watch?v=O5wqjk_GeJo)----Youtube video on creating,training,testing and deployment of AutoAI

17. [https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai\\_example\\_binary\\_classifier.html#step3](https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai_example_binary_classifier.html#step3) - Documentation on Testing AutoAI
18. <https://developer.ibm.com/components/node-red/tutorials/how-to-create-a-node-red-starter-application/> - Documentation on create node-red application
19. [https://www.youtube.com/watch?v=O5wqjk\\_GeJo](https://www.youtube.com/watch?v=O5wqjk_GeJo) - Boot camp video on deployment