Food Inventory Predictor

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ABSTRACT

As an organization in the food supply chain, estimating the food demands has always been a challenging problem to solve. Poor estimation of meal requirements may lead to excess or shortage of food. It, therefore, becomes essential to keep track of food consumption to meet the customers' demands. A system that predicts food demand can help organizations make informed decisions concerning the purchase of raw materials and avoiding wastage. In this study, we propose a food inventory prediction system that aids users in keeping track of their stock and make wise purchasing and preparation decisions. Our study involves (i) A literature review to formulate the design requirements, (ii) An iterative design process (iii) A comparison study with three Machine Learning algorithms. We plan to evaluate the tool by running the prediction model against the test data collected from the data set to predict the food demands for up to 10 weeks.

CCS CONCEPTS

• **Computing methodologies** → **Supervised learning by regression**; **Classification and regression trees**.

KEYWORDS

Data set, Neural networks, Data mining, Artificial Intelligence, Machine Learning, Supervised Learning

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1 MOTIVATION

With the increase in food consumption, restaurants face a challenge when catering to the needs of their customers. A restaurant will have to provide quality food and make sure they have sufficient stock of ingredients available to provide such quality food. Accessibility to a variety of options has made managing food quantities of every individual option difficult. This would lead either to an excess or a shortage in production of the varieties. Being able to predict the quantity needed 7-10 weeks in advance would not only manage production efficiently but will also have a ripple effect in reducing the prices of " in-demand " groceries. Food Organization would be able to change the prices of the stocked items based on availability, to increase their profit.

This application is helpful not only in restaurants but also in places like Universities. With the increase in the student population, the university dorms can better plan their meals and produce food only according to their needs. The university can reduce their spending by using our application and also ensure the students needs are satisfied.

2 INNOVATION

With the help of our tool, the users' (shop owners) can get an accurate description of the raw stock they will have to buy. In addition to this, our tool provides suggestions on the meals' prices depending on their demand. For example, when a cheeseburger is in demand in a particular restaurant, our tool would suggest the best price for the item to maximize the owner's profit.

The tool also includes a simulator component where the users' can visualize the demands incurred based on the prices they set. Using this simulation, the users can increase or decrease the costs, which help them improve their sales, thereby increasing revenue.

3 ACTION PLAN

We have obtained a data set comprising around 475,000 instances. For the study, we initially plan to conduct a literature review to obtain information on the approaches of related works in this area. The purpose of conducting a literature review is to formulate a set of design requirements for our tool.

Post the literature review, we would start working on the tool as per the formulated requirements. We plan to split the data set into a 70:30 ratio for training and testing as we believe this ratio would be ideal for our use case. The first step is preprocessing the data to remove noises, uncorrelated data in the training set.

We plan on choosing three Machine Learning algorithms for the task. The next phase involves feature selection where we select the right attributes and estimate the model parameters required for training. We loop the same process to tune the parameters and improve the accuracy. We will choose the best classifier out of the three based on accuracy, precision and other resultant parameters. We plan to conduct a study on the performance of the ML algorithms with respect to the tasks provided.

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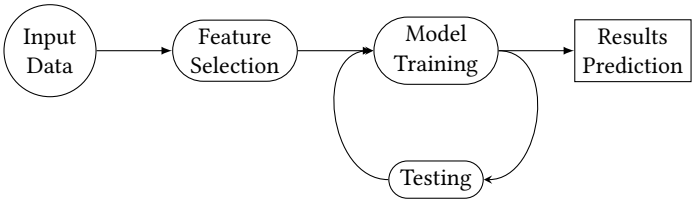

Fig 1: Flow diagram of the Food Inventory Prediction System

4 EVALUATION

By virtue of this application, we expect that food organizations plan ahead and better manage their stock. The models developed will be evaluated based on Mean Squared Error. We will predict the demand for the upcoming weeks in the test data from the data set. The best model will be decided based on the algorithm which provides the least Mean Squared Error and would be subsequently used in our tool.

5 PROJECT TIMELINE

We estimate the project to span approximately eight to nine weeks. Each of the milestones mentioned in the action plan section will take the following timelines.

- Literature Review - 2 weeks
- Model Selection, Data Pre-processing and Parameter Estimation - 1 week
- Model Training and Testing - 5 weeks
- Performance Evaluation and Tuning - 10 days

By midterm, we plan to conduct the literature survey, select the models on which we will train the data, pre-process the data set and estimate the initial parameters for the models. We must thoroughly analyze the various methodologies employed in similar areas to determine the improvement needed and select the appropriate models for this use case. Hence, the literature survey takes about two weeks. Following this, we will choose the models, pre-process the data and perform the calculations for the initial parameters for the models. These steps take about a week. With these parameters, we will train the models and evaluate the results. Following the midterm report, we plan to continue training the models and improve the accuracy for each of the models. Finally, we compare the various models and identify the best algorithm that fits the use case.

6 CONCLUSION

Presently, the management of raw materials to meet the food demands at restaurants, grocery shops and university food courts may not be optimal which can lead to either an excess or shortage of food produced. With the help of our application, the organizations can predict the demand for upcoming weeks and efficiently manage their food production and increase their revenue. The users can make use of this tool to aid their decision-making process with respect to food management.