CROP YIELD PREDICTION BASED ON INDIAN AGRICULTURE USING MACHINE LEARNING

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ABSTRACT

The middle objective of collect yield appraisal is to achieve higher cultivating harvest creation and many spread out models are exploited to extend the yield of gather creation. Nowadays, ML is being involved in general in view of its adequacy in various regions like deciding, deficiency ID, plan affirmation, etc. The ML estimations moreover help to additionally foster the collect yield creation rate when there is a disaster in bad conditions. The ML estimations are applied for the gather decision system to decrease the hardships crop yield creation paying little heed to redirecting environment.

Keywords: Crop yield prediction, Lasso, Kernel Ridge, ENet, Stacked Regression.

1. INTRODUCTION

The middle objective of reap yield evaluation is to achieve higher cultivating harvest creation and many spread out models are exploited to extend the yield of gather creation. Nowadays, ML is being involved generally in light of its adequacy in various regions like deciding, inadequacy recognizable proof, plan affirmation, etc. The ML estimations in like manner help to additionally foster the reap yield creation rate when there is an adversity in regrettable conditions. The ML estimations are applied for the reap decision technique to reduce the disasters crop yield creation paying little heed to redirecting environment.

In India, there are more than 100 yields laid out around the whole country. These yields are arranged for better cognizance and portrayal. The data for this investigation has been acquired from the Indian Government Repository. The data contains properties - State, District, Crop, Season, Year, Area and Production with around 2.5 Lakhs insights. Depicts the states and districts of India which picture what characterization of harvests is famous in which season. We used Advanced Regression Techniques - Lasso, ENet and Kernel Ridge and further we used stacking of these models to restrict the Yield and to get better conjectures. A subset of AI is solidly associated with computational experiences, which focuses on making assumptions using PCs; but not all AI is real learning. Data mining is an associated field of study, focusing in on exploratory data assessment through independent learning. A couple of executions of AI use data and cerebrum organizations with the end goal that imitates the working of a natural psyche. In its application across business issues, AI is moreover insinuated as farsighted assessment.

II. HELPFUL HINTS

TITLE: A PARAMETER BASED ANFIS MODEL FOR CROP YIELD PREDICTION
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Prediction of any natural event requires information regarding its time of occurrence and nature, based on logical analysis. It resembles how human reasons which are quite different from how regular methods based on sentential logic, predicate logic operate. Predictive models take historic information and are able to predict the future values with less expense and more quickly. They can provide support for human decisions, making them more efficient or in some cases; they can be used to automate entire decision-making processes. The motivation behind the proposed work is to build and customize such a predictive model which can be used for predicting the crop yields by providing different attributes on which crop yield is dependent. Limitations: Manual analysis generates inconsistencies due to some factors like fatigue, contradiction of personal perceptions, etc. Soft Computing like fuzzy logic, neural computing, etc. can be applied to a wide variety of real world applications as they can handle uncertainties better than traditional methods.

TITLE: A STUDY ON CROP YIELD FORECASTING USING CLASSIFICATION TECHNIQUES
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India is generally an agricultural country. Agriculture is the single most important contributor to the Indian economy. Nowadays, Farmers are struggling to produce the yield because of unpredictable climatic changes and drastically reduce in water resource so; we are creating an agriculture data. This data could be gathered, stored and analyzed for useful information. It is used to promote new advanced methods and approaches such as data mining that can give the information of the previous results to the crop yield estimation. In this paper, we have demonstrated to estimate the crop yield, choose the most excellent crop, thereby improves the value and gain of the farming area using data mining techniques.

Limitations: Agriculture crop production depends on the season, biological, and economic cause. The prognosticating of agricultural yield is a challenging and desirable task for every nation..

TITLE: A STUDY ON VARIOUS DATA MINING TECHNIQUES FOR CROP YIELD PREDICTION
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India is an agriculture based country where most of the people derive their living from this sector. Due to such financial loss many farmers are committing suicide. If natural calamities are not present then there may be sudden pest attack destroying the crop. In any case farmer and the crop are always at the edge of risk. Government policies are there but that is not sufficient. The major crop producing states of India. Prediction of crop yield in advance can help the farmers and the Government bodies to plan for storage, selling, fixing minimum support price, importing /exporting etc.

Limitations: Agriculture is having a great impact on the country's economy. In the last decade India has seen serious natural calamities like drought or flood. Due to such disasters there is a huge loss to crop production and ultimately to the farmers.

TITLE: RICE CROP YIELD PREDICTION USING ARTIFICIAL NEURAL NETWORKS
AUTHOR: NIKETA GANDHI, OWAIZ PETKAR UNIVERSITY DEPT. OF COMPUTER SCIENCE UNIVERSITY OF MUMBAI MUMBAI, MAHARASHTRA, INDIA LEISA J. ARMSTRONG UNIVERSITY DEPT. OF COMPUTER SCIENCE, UNIVERSITY OF MUMBAI AND SCHOOL OF SCIENCE, EDITH COWAN UNIVERSITY PERTH, WESTERN AUSTRALIA

Achieving high crop yields is the principle aim of agricultural production. Over the last decade it has been observed that Artificial Intelligence (AI) techniques provide a more effective approach to predicting crop yield under different cropping scenarios. The use of artificial neural networks can make models with complex inputs easier to interpret. This research describes the development of a rice crop yield prediction model through the use of ANNs.This approach has been demonstrated by forecasting of rice crop yield prediction for Kharif season from year 1998 to 2002 for Maharashtra state of India, on the basis of different predictor variables including precipitation, minimum temperature, average temperature, maximum temperature, reference crop evapotranspiration and yield. Artificial Neural Networks with Multilayer Perceptron were considered for the present research.

Limitations: The recognition and management of factors that influence crop yield assist farmers in decision making. There are a number of crop yield prediction models which use either statistical or crop simulation models.

TITLE: CROP YIELD PREDICTION USING DATA ANALYTICS AND HYBRID APPROACH
AUTHOR: MS. SHREYA V. BHOSALE MS. RUCHITA A. THOMBARE

Indian Economy has Agriculture as its backbone. In India, agricultural yield is primarily depends on weather conditions. Rice cultivation is majorly depends on rainfall. In this context, timely advice to predict the future crop productivity and an analysis is to be made in order to help the farmers to maximize the crop production of crops . Yield prediction is an important agricultural problem. Understanding and evaluating many learning algorithms Bayesian Classification is a useful technique. Practical learning algorithms and prior knowledge can be delivered with Bayes classification. Here observed data can be combined. It calculates explicit probabilities and it is vigorous to noise in input data. Agricultural data is being produced constantly and enourmosly. As a result, agricultural data has come in the era of big data. Smart technologies contribute in data collection using electronic devices. In our project we are going to analyse and mine this agricultural data to get useful results using technologies like data analytics and machine learning and this result will be given to farmers for better crop yield in terms of efficiency and productivity.

Limitations: Earlier Farmers used to predict their yield from past yield experiences. Thus, for such kind of data analytics in crop prediction, there are different techniques or algorithms, and with the help of those algorithms we can predict crop yield.

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TITLE: CROP YIELD PREDICTION USING MACHINE LEARNING ALGORITHM
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The core objective of crop yield estimation is to achieve higher agricultural crop production and many established models are exploited to increase the yield of crop production. Nowadays, ML is being used worldwide due to its efficiency in various sectors such as forecasting, fault detection, pattern recognition, etc. The ML algorithms also help to improve the crop yield production rate when there is a loss in unfavorable conditions. The ML algorithms are applied for the crop selection method to reduce the losses crop yield production irrespective of distracting environment. The present research deals with systematic reviews that extracts and synthesize the features used for CYP and furthermore, there are a variety of methods that were developed to analyze crop yield prediction using artificial intelligence techniques. Many studies were recommended for agriculture development and the goal was to create an accurate and efficient model for crop classification such as crop yield estimation based on the weather, crop disease, classification of crops based on the growing phase etc., This paper explores various ML techniques utilized in the field of crop yield estimation and provided a detailed analysis in terms of accuracy using the techniques.

Limitations: The major limitations of the Neural Network are reduction in the relative error and decreased prediction efficiency of Crop Yield. Similarly, supervised learning techniques were incapable to capture the nonlinear bond between input and output variables faced a problem during the selection of fruits grading or sorting.

TITLE: CRY – AN IMPROVED CROP YIELD PREDICTION MODEL USING BEE HIVE CLUSTERING APPROACH FOR AGRICULTURAL DATA SETS
AUTHOR: M. GUNASUNDARI ANANTHARA MOTHER TERESA UNIVERSITY TAMIL NADU, INIDA DR. T. ARUNKUMAR VIT UNIVERSITY VELLORE, TN, INIDA MS. R. HEMAVATHY VIT UNIVERSITY VELLORE, TN, INDIA

Agricultural researchers over the world insist on the need for an efficient mechanism to predict and improve the crop growth.. This research paper suggests a crop yield prediction model (CRY) which works on an adaptive cluster approach over dynamically updated historical crop data set to predict the crop yield and improve the decision making in precision agriculture. CRY uses bee hive modeling approach to analyze and classify the crop based on crop growth pattern, yield. CRY classified dataset had been tested using Clementine over existing crop domain knowledge. The results and performance shows comparison of CRY over with other cluster approaches. Majority of research works in agriculture focus on biological mechanisms to identify crop growth and improve its yield. It had been understood that crop yield often thrives only in specific region or country, while few crops fail at yield in few regions. The outcome of crop yield primarily depends on parameters such as variety of crop, seed type and environmental parameters such as sunlight (Temperature), soil (ph), water (ph), rainfall and humidity.

Limitations: The need for an integrated crop growth control with accurate predictive yield management methodology is highly felt among farming community. The complexity of predicting the crop yield is highly due to multi dimensional variable metrics and unavailability of predictive modeling approach, which leads to loss in crop yield.

TITLE: FUZZY LOGIC BASED CROP YIELD PREDICTION USING TEMPERATURE AND RAINFALL PARAMETERS PREDICTED THROUGH ARMA, SARIMA, AND ARMAX MODELS
AUTHOR: SHIVAM BANG

Agriculture is one of the most important economic sectors in India. It plays an important role in rural development and sustainability. The level of agriculture may decrease due to factors like unpredicted rainfall, climate change, use of excessive pesticides etc. The main aim of this study is to provide a methodology for crop yield production based on the historical climatic and production data. Crop yield prediction based on the previous years of temperature and rainfall can help farmers take necessary steps to improve crop yield in the coming season. Understanding crop yield can help ensure food security and reduce impacts of climate change. We have tried to develop a method such that the crop yield can be predicted beforehand using only temperature and rainfall of previous years. Accurate rainfall prediction is a difficult task because rainfall depends on various features such as cloud cover, evapotranspiration, and many other climatic factors but we wanted to extract useful information about crop yield using only two features i.e. temperature and rainfall. The proposed method uses Auto Regressive Moving Average and Seasonal ARIMA models to predict temperature. We decided to use the ARMAX model in case of rainfall so that other factors such as cloud cover, temperature and evapotranspiration can also be taken into account. We used a fuzzy logic system to predict yield. The fuzzy model takes in the predicted values from the model with least errors and gives the yield for that season.

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Limitations: Since we want to predict temperature from past values, these models suit our needs. A time-series created from the dataset is fed into the model to predict temperature. Similarly, ARMA and ARMA with exogenous variables (ARMAX) models are used to predict rainfall..

TITLE: MACHINE LEARNING CONVERGENCE FOR WEATHER BASED CROP SELECTION
AUTHOR: SONAL JAIN

Owing to increasing population, the demand for crop pro- duction is increasing. On the other hand, the available land area for agriculture is decreasing day by day. Moreover, one- third of the total food is wasted due to various factors such as climate change, selection of unsuitable crop, low fertile soil, pest, etc. Hence, techniques that provide maximum yield using optimal quantity of resources in limited land areas need to be adopted. This concept is widely known as precision agriculture (PA) Precision agriculture is a site-specific crop management technique that collects and analyzes the crop data, and based upon this analysis action such as application of appropriate amount of water, fertilizer and pesticides are taken. In recent years, various data mining models are used in agriculture for prediction and decision making based upon weather and soil condition. ML is used for solving various issues such as selection of suitable crops, weather prediction, crop disease prediction, crop yields prediction and developing automated irrigation system.

Limitations: Furthermore, Various such methods can be classified into two categories: First is statistics model such as multiple linear regression method, in which the structure of data need to be known or assumed in advance, and second is machine learning (ML) algorithms that map input data to output and learns from data itself.

TITLE: PREDICTION OF MAJOR CROP YIELDS OF TAMILNADU USING K-MEANS AND MODIFIED KNN
AUTHOR: MR A SURESH

Agriculture is the principal source of livelihood for more than 40 percent of the population of this state. According to Food and Agricultural Organization (FAO) researchers, between 2010 and 2050 the world population will increase by one third. The demand for crop production will increase by 60percent higher than the current production. Hence prediction plays a major role to find out the demand of crop production for maximizing the yield. For that in this paper we propose a prediction method for the major crops of TamilNadu using K-means and Modified K Nearest Neighbor (KNN). Mat lab and WEKA are used as the tool for clustering and classification respectively. The number result shows that our method is better than traditional data mining approach. Smart agriculture is the way of conveying information from traditional farmers to the educated farmers. To obtain estimates of aggregate physical production functions for the yields of various crops in specified states, considering various technological factors and a newly developed weather index as inputs. Different Data mining techniques were used to predict the crop yield for maximizing the crop productivity Accurate and timely monitoring of agricultural crop conditions and estimating potential crop yields are essential processes for operational programs Because of the importance of predicting crop yield, the purpose of this study is to apply several forecasting methods for evaluating crop yield estimates in Ghana. Crop yield forecasting, which provides information for decision Makers.

Limitations Regression and coefficient of determination analysis along with Average Error rate were carried out to make a decent comparison between our actual result which is called target and prediction model that is our network outputs the main aim is to create a user friendly interface for farmers, which gives the analysis of rice production based on available data.

TITLE: RICE CROP YIELD PREDICTION IN INDIA USING SUPPORT VECTOR MACHINES
AUTHOR: NIKETA GANDHI

Food production in India is largely dependent on cereal crops including rice, wheat and various pulses. Machine learning techniques can be used to improve prediction of crop yield under different climatic scenarios. This paper presents the review on use of such machine learning technique for Indian rice cropping areas. This paper discusses the experimental results obtained by applying SMO classifier using the WEKA tool on the dataset of 27 districts of Maharashtra state, India. The dataset considered for the rice crop yield prediction was sourced from publicly available Indian Government records. The parameters considered for the study were precipitation, minimum temperature, average temperature, maximum temperature and reference crop evapotranspiration, area, production and yield for the Kharif season (June to November) for the years 1998 to 2002. For the present study the mean absolute error (MAE), root mean squared error (RMSE), relative absolute error (RAE) and root relative squared error (RRSE) were calculated. The experimental results showed that the performance of other techniques on the same dataset was much better compared to SMO.

Limitations: The sustainability and productivity of rice growing areas is dependent on suitable climatic conditions. Variability in seasonal climate conditions can have detrimental effect, with incidents of drought reducing

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production. Developing better techniques to predict crop productivity in different climatic conditions can assist farmer and other stakeholders in better decision making in terms of agronomy and crop choice.

TITLE: RICE CROP YIELD PREDICTION USING ARTIFICIAL NEURAL NETWORKS
AUTHOR: NIKETA GANDHI, OWAIZ PETKAR

crop production contributes to the food security of India, more than 40% to overall crop production. Its production is reliant on favorable climatic conditions. Variability from season to season is detrimental to the farmer's income and livelihoods.. Data were sourced from publicly available Indian Government's records for 27 districts of Maharashtra state, India. The parameters considered for the present study were precipitation, minimum temperature, average temperature, maximum temperature and reference crop evapotranspiration, area, production and yield for the Kharif season (June to November) for the years 1998 to 2002. The dataset was processed using WEKA tool. A Multilayer Perceptron Neural Network was developed. Cross validation method was used to validate the data. The results showed the accuracy of 97.5% with a sensitivity of 96.3 and specificity of 98.1. Further, mean absolute error, root mean squared error, relative absolute error and root relative squared error were calculated for the present study. The study dataset was also executed using Knowledge Flow of the WEKA tool. The performance of the classifier is visually summarized using ROC curve.

Limitations: Improving the ability of farmers to predict crop productivity in under different climatic scenarios, can assist farmers and other stakeholders in making important decisions in terms of agronomy and crop choice. This study aimed to use neural networks to predict rice production yield and investigate the factors affecting the rice crop yield for various districts of Maharashtra state in India.

2. METHODOLOGY

2.1 EXISTING SYSTEM

Variations in weather, climate, and other such environmental conditions have become a major risk for the healthy existence of agriculture. The major limitations of the Neural Network are reduction in the relative error and decreased prediction efficiency of Crop Yield. Similarly, supervised learning techniques were incapable to capture the nonlinear bond between input and output variables faced a problem during the selection of fruits grading or sorting. Many studies were recommended for agriculture development and the goal was to create an accurate and efficient model for crop classification such as crop yield estimation based on the weather, crop disease, classification of crops based on the growing phase etc.,

2.2 PROPOSED SYSTEM

The middle objective of reap yield appraisal is to achieve higher cultivating yield creation and many spread out models are exploited to assemble the yield of gather creation. Nowadays, ML is being involved in general due to its capability in various regions like deciding, weakness disclosure, plan affirmation, etc. The ML estimations moreover help to additionally foster the gather yield creation rate when there is a hardship in inconvenient conditions. The ML computations are applied for the gather decision technique to lessen the disasters crop yield creation autonomous of redirecting environment. Man-made intelligence (ML) accepts a basic part as it has decision assist mechanical assembly for Crop With yielding Prediction (CYP) recalling supporting decisions for what harvests to create and what to do during the creating season of the harvests. The ongoing investigation oversees systematic reviews that concentrates and integrate the features used for CYP and also, there are an arrangement of methodologies that were made to examine crop yield gauge using man-made thinking techniques. It explores different ML techniques utilized in the field of gather yield appraisal and gave a low down assessment to the extent that precision using the strategies.

The Agriculture Data is utilized for the reap yield estimate.

- The data is gone through for pre-dealing with to dispose of the boisterous data.
- The pre-taken care of data is gone through for feature extraction process that consolidates components, for instance, soil information, supplements; field the chiefs, etc which are used to play out the portrayal using ML computations.
- Assumption is Accurate.
- This leads a High Yield of Crop and Yield Percentage.

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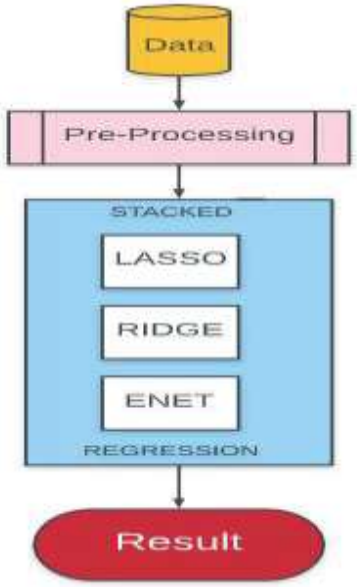

Fig 1 System Architecture

2.2 DECISION TREES

Decision tree learning uses a decision tree as a farsighted model to go from insights about a thing (tended to in the branches) to choices about the thing's objective worth (tended to in the leaves). It is one of the farsighted showing approaches used in estimations, data mining, and AI. Tree models where the objective variable can take a discrete game plan of values are called portrayal trees; in these tree structures, leaves address class stamps and branches address conjunctions of features that lead to those class names.

2.3 REGRESSION ANALYSIS

Backslide assessment encompasses an immense combination of authentic methods to evaluate the association between input factors and their connected features. Its most viewed as not unexpected construction is straight backslide, where a single line is drawn to best fit the given data according to a mathematical premise like standard least squares. The last choice is oftentimes connected by regularization (number-crunching) methods to lighten over fitting and inclination, as in edge backslide.

2.4 PRECISION AGRICULTURE

The demonstration of precision agriculture has been engaged by the presence of GPS and GNSS. The farmer's and also expert's ability to find what is going on in a field thinks about the development of guides of the spatial irregularity of anyway many elements as can be assessed Relative data is assembled by sensor displays mounted on GPS-arranged combine gatherers. These displays include constant sensors that activity everything from chlorophyll levels to lay out water status, close by multispectral imagery. This data is used connected with satellite imagery by factor rate development (VRT) including seeders, sprayers, etc to preferably convey resources. In any case, late creative advances have engaged the usage of continuous sensors directly in soil, which can remotely send data without the need of human presence. The work will help farmers with growing the yield of their harvests. Limit of colossal data in bunches by using K-suggests batching computation; decline it to reasonable/genuine substance using the estimation. Apriori computation helped with counting a significant part of the time happening features which helped with expecting crop yield for unequivocal region. Similarly completed Naive Bayes estimation for sorting out the particular yield. Thus, we executed a structure which will expect the collect name and estimated yield in a particular farm.

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3. K-MEANS ALGORITHM

The k-suggests packing computation tries to partition a given strange instructive list (a set containing no information as to class character) into a legitimate number (k) of gatherings. At first k amounts of supposed centroid are picked. A centroid is a significant snippet of data (nonexistent or real) at the point of convergence of a pack.

Stage 1: Choose the amount of bundles k
Stage 2: Select k sporadic concentrations from the data as centroids
Stage 3: Assign all of the concentrations to the closest bundle centroid
Stage 4: Recomputed the centroids of as of late molded gatherings
Stage 5: Repeat stages 3 and 4
Stage 6: Predict the yield
Stage 7: Stop the Processing

4. STACKED REGRESSION

This is a kind of assembling yet a slight bit of redesign of averaging. In this, we add a Meta model and use the out of wrinkle gauges of various models used to set up the head Meta model.

Step-1: the outright planning set is again divided into two one of a kind sets. (Train and holdout)
Step-2: train the picked base models with introductory fragment (train).
Step-3: Test them with the resulting part. (Holdout)
Step-4: Now, the assumptions obtained from test part are commitments to the train more huge level understudy called meta-model.

5. DATA COLLECTION

The factors which impact agriculture are deluge fall, ground water, created area and soil type. In this paper we consider five huge standard harvests of Tamilnadu for the year 2005-2010. The data's are accumulated from various government workplaces showed in Table I. The huge harvests of Tamilnadu are Rice, Sugarcane, Maize, Ragi, Tapioca, perceived by their yield rate concerning their creation and created locale.

6. K-MEANS CLUSTERING

The rustic data are bunch using K-Means estimation. K-Means is an independent computation for gathering. Country data's are requested into bundles. Where 'k' shows number of gathering. At beginning stage the centroid are believed to be the underlying two characteristics. Then, find out the distance between each datum of interest and bundle center (centroid) using the Euclidian condition Assign the data feature the gathering place whose partition from the pack is least from all the decided centroid. Recalculate the new bundle place until the gathering will not be changed from the beyond one. Data are assembled into particularly low, low, moderate, high and very high gained from the aftereffect of k-suggests estimation. Here the provincial data, for instance, precipitation, ground water, created area and result crop creation are gathered under the referred to arrange.

$$\text{Distance} = \sqrt{(x2-x1)^2 + (y2-y1)^2}$$

7. RESULT

The execution metric used in this adventure is Root mean square bumble. Whenever the models applied solely, for ENet it was around 4%, Lasso had a slip-up around 2%, Kernel Ridge was around 1% ultimately directly following stacking it was under 1%. The client or the farmer can enter the going with nuances over the web application to get the assumption as depicted under in the fig.

7. CONCLUSION

Right when we apply stacked backslide; the result has been so managed than when those models were applied solely. The application where the farmers can use it as application and changing over the whole system in their regional language. The ongoing investigation shows a couple of existing models that think about parts, for instance, temperature, barometrical condition, performing models for the fruitful collect yield estimate. Finally, the exploratory survey showed the blend of ML with the country space field for chipping away at the movement in crop assumption.

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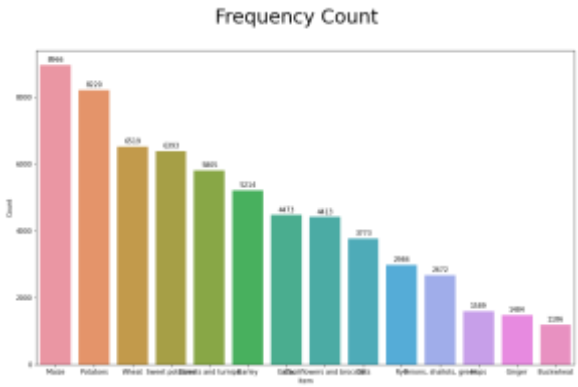

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