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Quality Prediction in a Mining Process

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Abstract— **Froth flotation is a process that is used to separate the materials hydrophobic and hydrophilic minerals , for the quality prediction of mining process is removal of impurities within the ore concentration in the lab experiment it will take at least one hour for engineers for prediction of impurity so that for every hour engineers will predict the impurity it will be time consuming so that we proposed a model for engineers to help for the prediction of with iron ore and without iron ore concentrate so that engineers will take the corrective actions in the early as possible.**

Keywords: - forth flotation, minerals, slica, iron ore

I. INTRODUCTION

In iron ore Mining industry in order to specified quality within the froth flotation process plant. engineers admit typical laboratory to check the technique for the check impurities, it will take quite two hours to establish the process of flotation in mining process, and how to increase the quantity silica impurity with the extracted of iron ore, silica to increase the quantity of iron within the extracted ore, chemical reagents are more added into the ore pulp so that modify and removal of impurities this method is that the targeted ore quantitative prediction of the quality. the main goal is to predict the percentage of silica concentration of the froth flotation process in plant by using machine learning techniques for the proposed model for prediction percentage of silica concentrate with and without ore concentrate in the froth flotation by using random forest regression algorithm.

Artificial Intelligence and Machine Learning

Artificial intelligence (AI) is the demonstrates of human intelligence processes by machines and feeding the experience of human to machines in the form of data, greatly help in Quality prediction in a Mining Process.

II. LITERATURE SURVEY

1] Author in the paradigm of froth flotation system has explored and discovered the most significant parameters that influence the flotation performance of lead mineral. Seemingly, the new model suggested that grinding time, flotation pH, for comparable collector, solid-in-pulp concentration and the increase of solid-in-pulp concentration have the most significant effect on the ore recovery and selective separation of lead mineral. He concluded that solid-in-pulp concentration was the most important parameter that influences the flotation of lead mineral [4].

2] However, Bergh el [5] all conducted a pilot and industrial research to establish how the characteristics of flotation processes, the quality of measurements of key variables and general lack of robust models are thwarting the appropriate use of predictive control. The authors proposed a multivariate statistics model such as PCA to explain the relationship between operation data for on-line diagnosis and fault detection. It was found that statistical methods seem to provide a general framework to build models in latent variables related to froth characteristics at short sampling internal. The authors further

discovered a supervisory and stabilizing control is a form of sub-optimal expert systems. The only challenge found was the difficulties in replicating a particular solution from one plant to another [5].

III. DATASET COLLECTION

Dataset:
https://www.kaggle.com/edumagalhaes/quality-prediction-in-a-mining-process

We are collected the dataset from Kaggle, Kaggle is a online community for the collection of various research fields datasets from data analytic practitioners. in our dataset contain 24 features, Our model can be pre trained with certain features like date and time, amino flow, froth flotation air level etc..

IV. METHODOLOGY

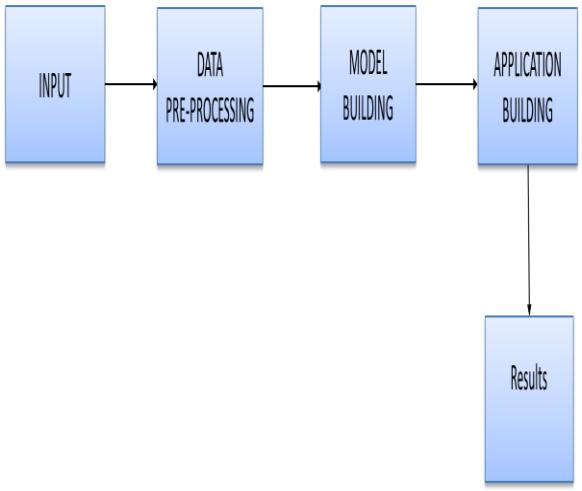

Fig. 1. Methodology For Prediction Silica impurity

A. Data Preprocessing

A real-world data typically contains noises, missing values, and errors in which cannot be directly used for the machine learning models. Data pre-processing is required for the cleaning the data and making it suitable for a machine learning model which also increases efficiency of a machine learning model and the accuracy

B. Importing Libraries

To perform data preprocessing in using Python, we need to import some predefined Python libraries. These libraries are used to perform jobs.

C. Split the Dataset into the Training set and Testing set

Our dataset is divided into a train set and test set. by doing this we can increase the performance of our machine learning model.

Train set is used to train our model and Test set used to check weather our model working correct or not

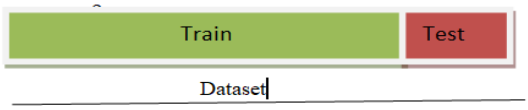

Fig. 2.Train and Test Data Split

D. Building the Model

After the completion of data pre-processing &training and testing of dataset then we have to build the model by using algorithms

Decision trees are fall under the category of supervised machine learning means decision trees construct the model for prediction /decision of given record. Decision tress are fast and accurate

Linear regression is used the finding the co-relation b/w the independent variables and dependent variables

Random forest regression is the combination of many decision trees means it takes average of the all decision trees. random forest is to perform both classification and regression & it improves the accuracy of the model and prevents the over fitting issues.

Attribute	MSE	RMSE	R2_SCORE
Silca impurity prediction without iron ore	0.00245	0.0495	0.9941
Silca impurity prediction with iron ore	0.0438	0.00192	0.99391

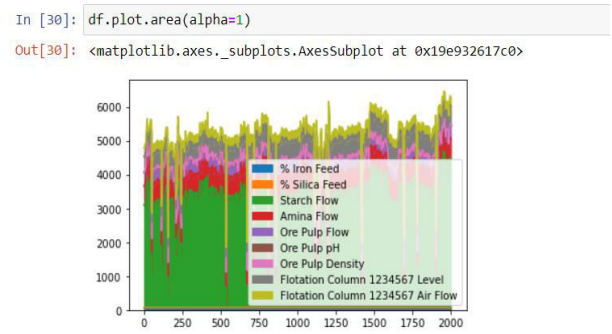

Fig. 3. Dataset Visualisation

V. RESULTS

Mean squared error (MSE) is the average of sum of squared difference between actual value and the predicted or estimated value. It is also termed as mean squared deviation (MSD). This is how it is represented mathematically:

$$MSE = \frac{1}{n}\Sigma\underbrace{\left(y - \hat{y}\right)}^{2}$$

The square of the difference between actual and predicted

Fig. 4. Mean squared error

R-Squared is the ratio of Sum of Squares Regression (SSR) and Sum of Squares Total (SST). Sum of Squares Regression is amount of variance explained by the regression line. R-squared value is used to measure the **goodness of fit**

$$R^2 = \frac{SSR}{SST} = \frac{\sum(\hat{y}_i - \bar{y})^2}{\sum(y_i - \bar{y})^2}$$

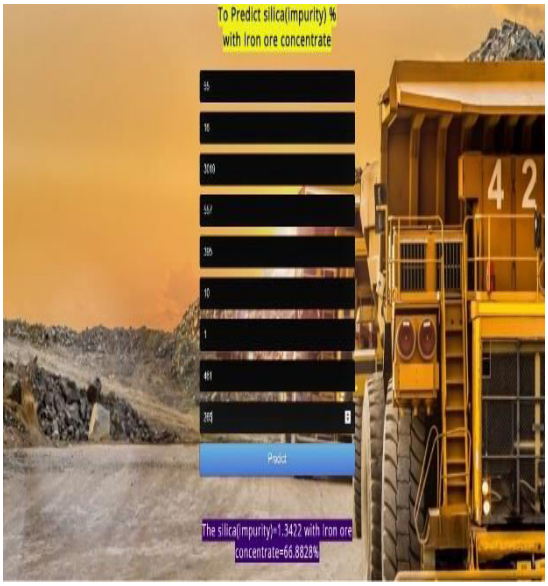

Fig. 5. R-Squared

R2 (coefficient of determination) regression score function.

Best possible score is 1.0 and it can be negative (because the model can be arbitrarily worset). A constant model that always predicts the expected value of y, disregarding the input features, would get a R2 score of 0.0

TABLE I: SUMMARY OF RESULTS

Fig. 6. Home Page

Fig. 7:- To Predict silica (impurity) % with Iron Ore

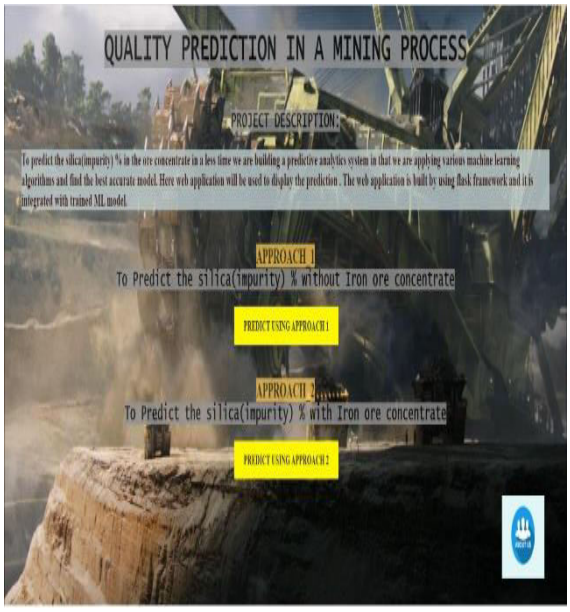

Fig. 8. To Predict silica (impurity) % without Iron Ore

VI. CONCLUSIONS

The introduction of contemporary technologies like cloud computing, artificial intelligence and machine learning and these technologies are used in a different area such as soil classification, disease identification and classification and automated irrigation system and also going to be helpful for prediction of the crop. this paper includes an overview of machine learning approach for prediction of crops & fruits like wheat, mango, rice, coconut etc. We proposed the model that predicts a best suitable for the crop/fruits for land which gives the high yield production based on a machine learning approach, our model used the concept of random forest regression & we also observe random forest regression algorithm which gives results/accuracy is high compare to other machine learning algorithms.

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