3D Printer Material Prediction Using IBM Watson Studio

1. INTRODUCTION

1.1 Overview

The 3D printing materials industry is increasing due to the rise in the demand from healthcare, automotive, and other industries, globally.This project aims at building a web App that predict the best suitable 3d Printing material by taking the input values. we created a model from a data set that includes the input parameters are like Layer Height (mm), Wall Thickness (mm), Infill Density (%), Infill Pattern (honeycomb, grid), Nozzle Temperature (Cº), Bed Temperature (Cº), Print Speed(mm/s), Fan Speed (%), Roughness (µm), Tension (ultimate), Strength (MPa), Elongation (%) to predict suitable material. Then user creates an IBM Watson Studio Service, IBM Cloud Object Storage Service on IBM Cloud and deploy the model to ibm cloud.

1.2 Purpose

As Global competition instensify, the competition among various industries become more and more fierce.Using IBM cloud,the aim of the study is to determine the best material which will be perfect for the given use case. Where there are eleven setting parameters and one output parameters. Based on these input parameters we have to predict the best material for model. We have improved the accuracy of prediction by using decision tree algorithm. The accuracy score was high(i.e 92%) while using decision tree so we have implemented the model using decision tree algorithm. After training the model the model must be deployed in the cloud using ibm Watson machine learning tool. And created simple, user friendly and responsive user interface for getting input from the user and predicting the result from ibm deployed model.

2 LITERATURE SURVEY

2.1 Existing problem

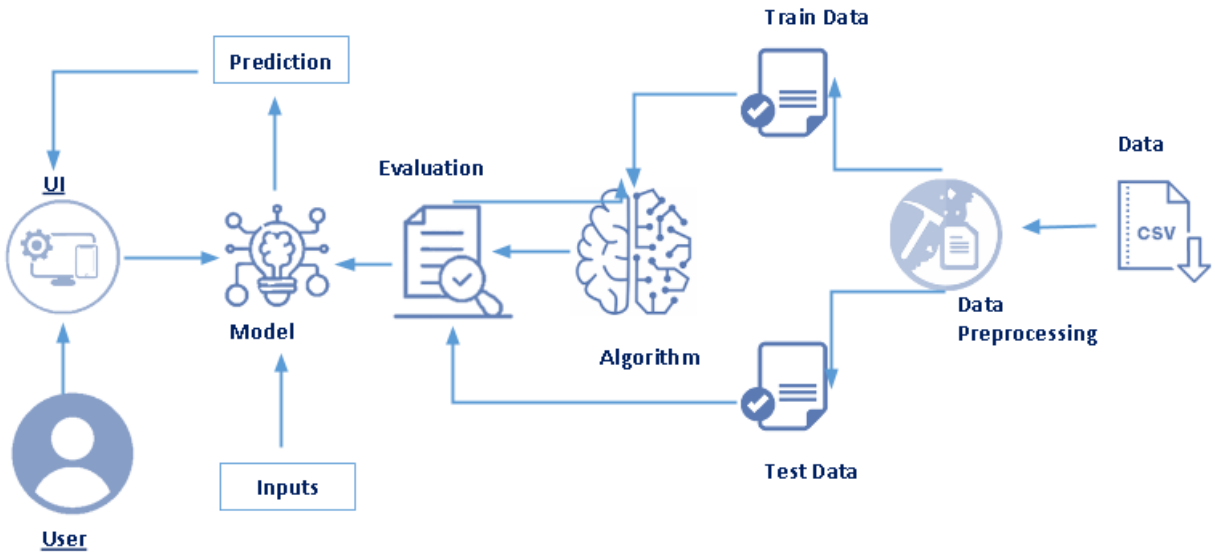
The material accuracy is not as much correct by using the some models.In the charateristic of material are different so that it is not feasible to implement in practical use.The 3d printer material like ABS, the layer height for abs must be 0.05 to 0.1 mm and the layer height is different for pla and for pla the wall thickness must be 0.4mm of nozzle size.So that implement of small precison can't predict best solution.

2.2 Proposed problem

For the given problem we can use 3D material parameters from Kaggle. Kaggle allows users to find and publish data sets.So that we can get precise data that can be used for predict accuresly by using decison tree classifer algorithm.

3 THEORITICAL ANALYSIS

3.1 Block diagram



3.2 Hardware / Software designing

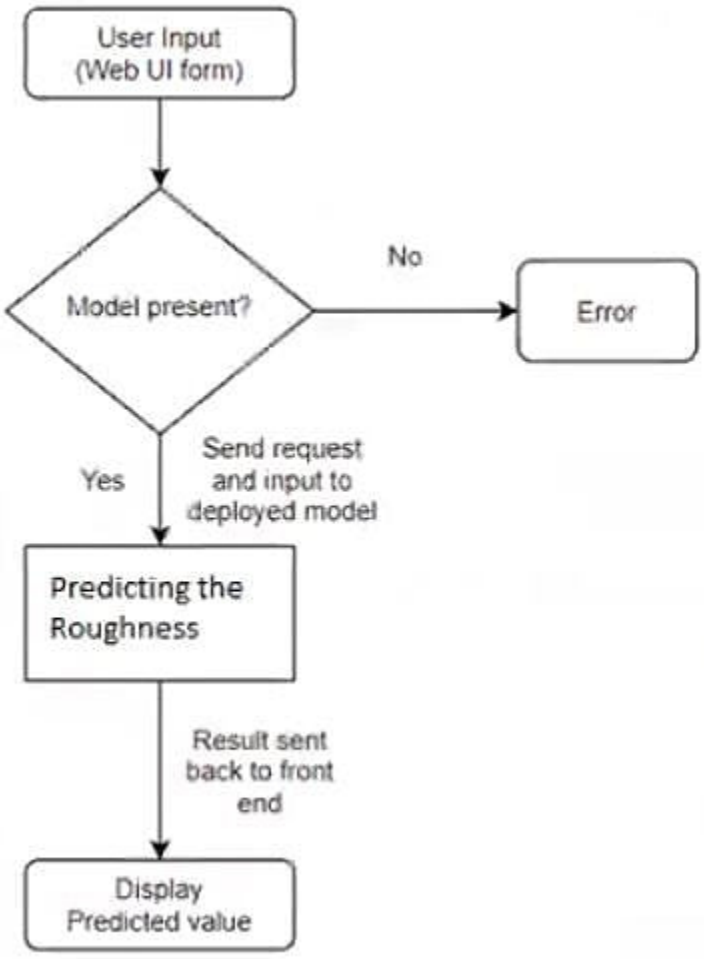
- IBM Watson Studio - IBM Watson Studio helps data scientists and analysts prepare data and build models at scale across any cloud.
- IBM Watson Machine Learning - IBM Watson Machine Learning helps data scientists and developers accelerate AI and machine-learning deployment.
- IBM Cloud Object Storage - IBM Cloud Object Storage makes it possible to store practically limitless amounts of data, simply and cost effectively.

4 EXPERIMENTAL INVESTIGATIONS

We have used Decision Tree for this model ,which comes under classification,regression algorithms.After making predictions using logistic regression,svm,random forest ,decision tree algorithms ,we have chosen decision tree as it gives the highest accuracy score. 1. The general motive of using Decision Tree is to create a training model which can use to predict class or

value of target variables by learning decision rules inferred from prior data(training data).The understanding level of Decision Trees algorithm is so easy compared with other classification algorithms. The decision tree algorithm tries to solve the problem, by using tree representation.
we have done label encoding for 3 rd column and 7 th column proceeded with it.With an accuracy score of 0.92857 ,we have finally chosen decion tree classifier and trained the model with 67 datasets.

5 FLOWCHART



6 RESULT

The given values are input to form areLayer Height (mm)=.02, Wall Thickness(mm)=10, Infill Density(%)=22, Infill Pattern (honeycomb, grid)=1, Nozzle Temperature (C°)=200, Bed Temperature (C°)=80, Print Speed(mm/s)=40, Fan Speed(%)=50, Roughness(µm)=44, Tension (ultimate)=44, Strength (MPa)=33, Elongation (%)=1.5. The result of prediction is ABS(Acrylonitrile butadiene styrene).

HOME PREDICT

3D Printer Material Prediction

A Machine Learning Flask Application

Layer Height(range 0.02-0.2)

.02

Wall Thickness(range 1-12)

10

Infill Density(range 10-100)

22

Infill Pattern: 0 for grid, 1 for honeycomb

1

Nozzel Temperature(range 200-250)

200

Fan Speed(range 0-100)

Roughness(range 25-369)

Tension Strength(range 5-40)

Elongation(0.95-2.9)

Predict

The Suggested Material is ABS.(Acrylonitrile butadiene styrene is a common thermoplastic polymer typically used for injection molding applications)

7 ADVANTAGES & DISADVANTAGES

7.1 Advantages

The model is fast and accurate (around 90 percent accuracy).On which biggest advantage of 3d printing is rapid prototyping as per industrial standards. so that this ability to design , manufautring and test customised parts can be possible in little time.For small protyping needed for startup companies can be implement quick protype by as soon predicting sutiable material for 3d Printing.And also allows printing any complex design can be achieved.It is enable as to reduce the wastage of material and heavy unconditional purchase of stock in industry.

7.2 Disadvantages

The dataset used for model building is negligible data so that there is hight chance of getting incorrect output.3d Printer consumes approxmiately 50 to 100 times more energy needed for molding when use the plastics.while 3d printing cost is unlike conventional techniques lke injection moulding where large volumes ma be more effective to produce.The Algorithm may not work if large parameter as passed that out of field.

8 APPLICATIONS

- Predict the average roughness of 3d printer based on many variables.
- Predict the 3d Printing material in aerospace & defense.
- Predict the 3d Printing material in Medical equipments.

9 CONCLUSION

We have used Watson Machine Learning for saving and deploying our model in ibm cloud.While our model may be inaccurate in some cases, we talked about how our dataset can contain inaccurate values for the elogation and less amount of data due to avaliablity, and oftentimes, our predictions are more accurate than the values in the dataset.

10 FUTURE SCOPE

The model can be easily implemented under various situations, we can add more attributes for better understanding the features relation and correlation can be done.The adding more data will make the model more accurate and finite.3D printers or additive manufaturing, has the potential to democratize the production of goods, from various industries such as aerospace & defense, healthcare, consumer goods, and automotive. Future Advancements in technology and diverse applications characterize the supply side also.

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