Project on

Predicfing Compressive Strength of Concrete using IBM Watson AutoAI Experiment.

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RSIP Career Basic ML 170

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1 Introducfion

1.1 Overview

Concrete is a material used in construcfion that has great versafility and which is used across the globe. Concrete has several advantages, including good compressive strength, durability, work ability, construcfion availability, and low cost. Determining accurate concrete strength isa major civil engineering problem. Test results of 28- day concrete cylinder represent thecharacterisfic strength of the concrete that has been prepared and cast to form the concrete work.It is important to wait 28 days to ensure the quality control of the process, although it is veryfime consuming. Machine learning techniques are progressively used to simulate the characterisficof concrete materials and have developed into an important research area. This study proposed acomprehensive study using an advanced machine learning technique to predict the compressivestrength of concrete from early age test results.

1.2 Purpose

An ability to predict the compression strength of concrete early allows constructors to quickly understand the concrete's probable weaknesses and decide to manage a destrucfion process or confinue with construcfion. Further, to the benefit of both user (and purchaser) and producer, reliably and rapidly predicfing the results of a 28-day test would benefit all stakeholders as opposed to waifing the full, convenfional, 28 days.

2 Literature Survey

2.1 Exisfing Problem

This is generally determined by a standard crushing test on a concrete cylinder. This requires engineers to build small concrete cylinders with different combinations of raw materials and test these cylinders for strength variations with a change in each raw material. The recommended wait time for testing the cylinder is 28 days to ensure correct results. This consumes a lot of time and requires a lot of labour to prepare different prototypes and test them. Also, this method is prone to human error and one small mistake can cause the wait time to drastically increase.

2.2 Proposed Solufion

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3 Theorefical Analysis

3.1 Block Diagram

3.2 Sohware Designing

IBM Cloud Compufing

It is a set of cloud compufing services for business offered by the informafion technology company IBM. IBM Cloud includes infrastructure as a service (IaaS), sohware as a service (SaaS) and plaVorm as a service (PaaS) offered through public, private and hybrid cloud delivery models, in addifion to the components that make up those clouds.

IBM Watson Studio

IBM Watson Studio helps data scienfists and analysts prepare data and build models at scale across any cloud. With its open, flexible mulfi cloud architecture, Watson Studio provides capabilifies that empower businesses to simplify enterprise data science and AI, such as:

1. Automate AI lifecycle management with Auto AI.

2. Visually prepare and build models with IBM SPSS Modeler.

3. Build models using images with IBM Watson Visual Recognifion and texts with IBM Watson Natural Language Classifier.

4. Deploy and run models through one-click integrafion with IBM Watson Machine Learning

5. Manage and monitor models through integrafion with IBM Watson Open scale.

Node Red

1. Node-RED is a flow-based development tool for visual programming developed originally by IBM for wiring together hardware devices, APIs and online services as part of the Internet of Things.

2. Node-RED provides a web browser-based flow editor, which can be used to create JavaScript funcfions. Elements of applicafions can be saved or shared for re-use. The runfime is built on Node.is. The flows created in Node-RED are stored using JSON. Since version 0.14, MQTT nodes can make properly configured TLS connecfions.

3. In 2016, IBM contributed Node-RED as an open source JS Foundafion project.

4 Experimental Invesfigafion

The compressive strength data for the present work was obtained from the experiments. For generafing a reliable data bank on concrete compressive strength, he had considered five parameters, namely, water-cemenfifious material rafio, cemenfifious content, water content, workability, and curing ages in the experimental program.

The casfing and tesfing of specimens for generafing the data bank were performed in controlled laboratory condifion.

6 Result

We have analysed the Compressive Strength Data and used Machine Learning to Predict the Compressive Strength of Concrete. We have used Linear Regression and its variations, Lasso, Ridge and Random Forests to make predictions and compared their performance. Random Forest Regressor has highest accuracy and is a good choice for this problem. Random Forest Regressor trains randomly initialized trees with random subsets of data sampled from the training data, this will make our model more robust

7 Advantages & Disadvantages

Advantages

1. Useful for Civil Engineers to predict the strength of Concrete.

2. Decide which infrastructure can be made for strength concrete.

3. Helps to reduce the cost invested in construcfion.

4. Use the best quality cement based on their strength and ensure full safety.

5. Reduced errors and faults in construcfion.

Disadvantages

1. Loss to the low-quality cement manufacturing companies.

2. Loss of money, income, profits, to the middlemen.

3. Reduced work, reduced labour, reducfion in the source of income for labourers as the construcfions made from perfect and the right quality cement will definitely last long.

Applicafion

1. House, Society, Offices construcfions.

2. Children Parks, Monuments, Sculptures construcfions.

3. Bridges, Highways, Metro Pillars construcfions.

4. Theme parks, Resorts, Amusement Parks construcfions.

8 Conclusion

We have successfully built a Machine Learning model to predict the compressive strength of concrete using IBM Watson Auto AI Machine Learning Service. The model is deployed on IBM cloud to get scoring end point which can be used as API in mobile app or web app building. We

have developed a web applicafion which is built using node red service. We make use of the scoring end point to give user input values to the deployed model. The model predicfion is then showcased on User Interface with minimum RMSE (root mean square value metrics evaluafion technique)

9 Future Scope

This model can predict the outcome with many different inputs within seconds. The model will save a lot of fime of the construcfion companies and the civil engineers. Experiment cost is also reduced with creates a bigger opportunity for construcfion companies in cost effecfiveness work.

10 Bibliography

h 5ps://archive.ics.uci.edu/ml/machine-learning-databases/concrete/compressive/

h5ps://cloud.ibm.com/

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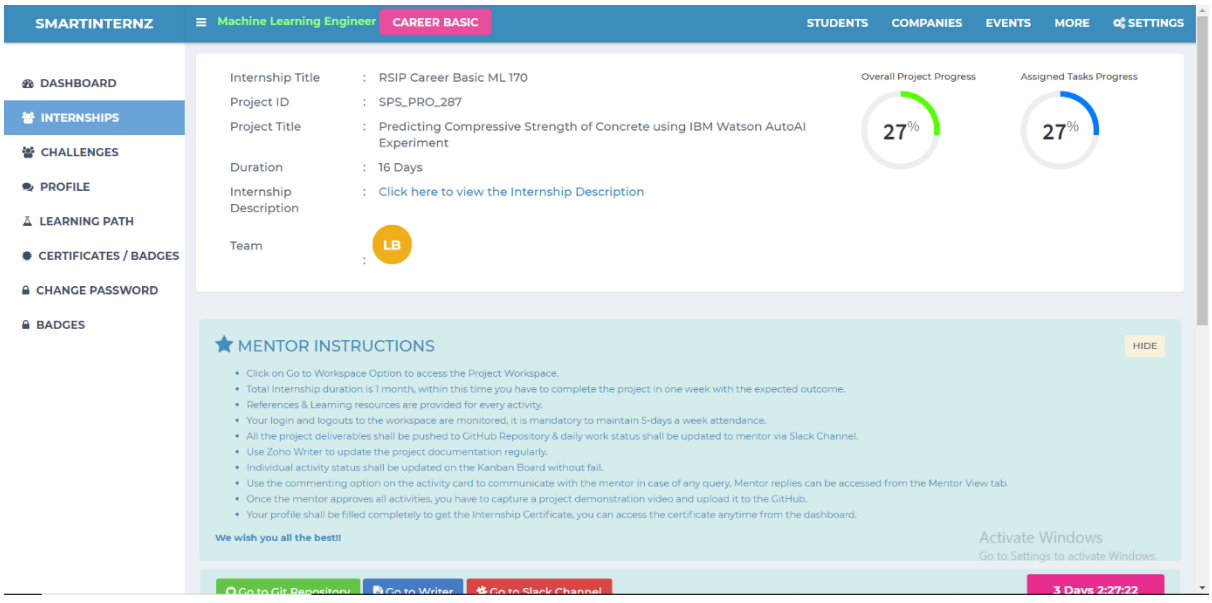

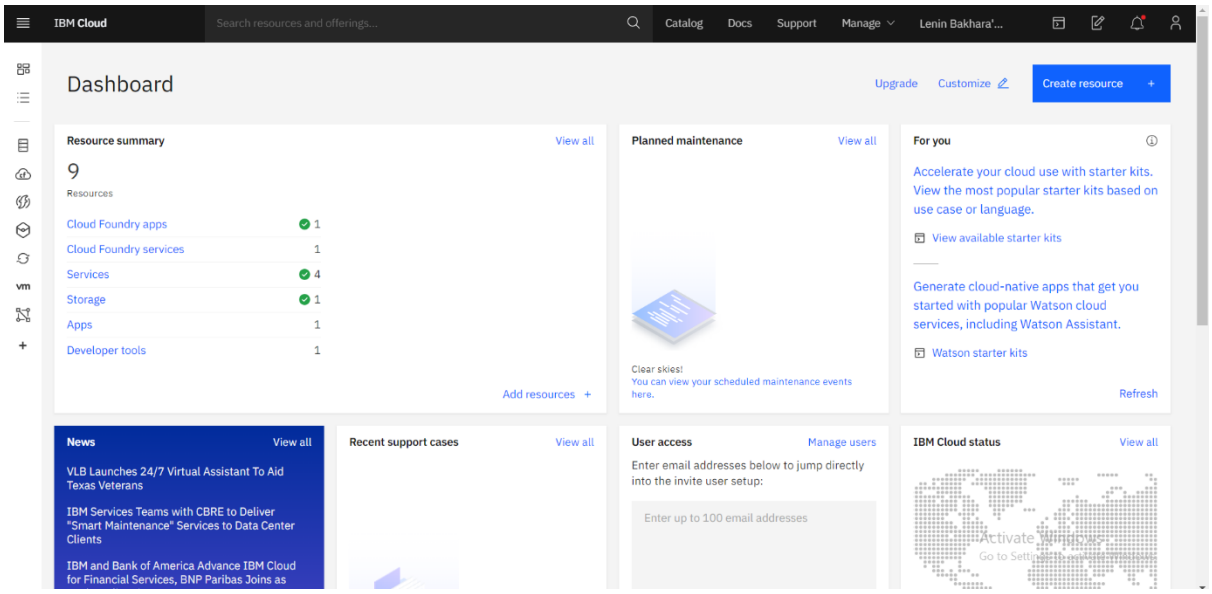
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Customize
Create resource
Resource summary
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Resources
Cloud Foundry apps 1
Cloud Foundry services 1
Services 4
Storage 1
Apps 1
Developer tools 1
Add resources
Planned maintenance
View all
Clear skies!
You can view your scheduled maintenance events here.
For you
Accelerate your cloud use with starter kits. View the most popular starter kits based on use case or language.
View available starter kits
Generate cloud-native apps that get you started with popular Watson cloud services, including Watson Assistant.
Watson starter kits
Refresh
News
View all
VLB Launches 24/7 Virtual Assistant To Aid Texas Veterans
IBM Services Teams with CBRE to Deliver "Smart Maintenance" Services to Data Center Clients
IBM and Bank of America Advance IBM Cloud for Financial Services, BNP Paribas Joins as
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Enter up to 100 email addresses
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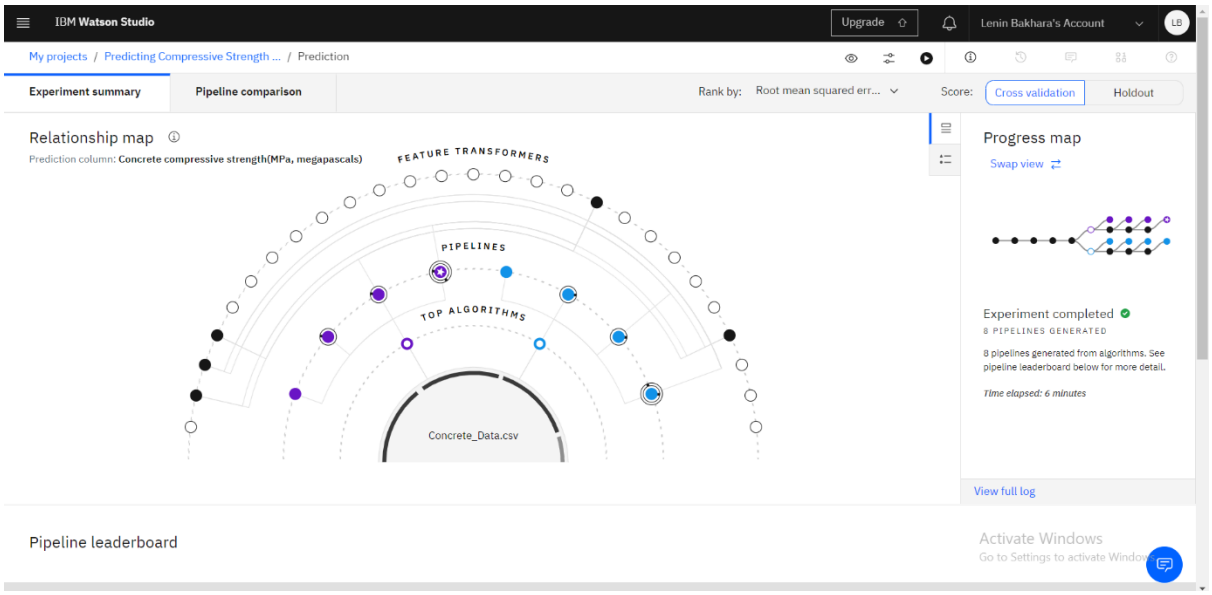
View all


IBM Watson Studio
Upgrade
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My projects / Predicting Compressive Strength ... / Prediction
Experiment summary
Pipeline comparison
Rank by: Root mean squared err...
Score: Cross validation Holdout
Relationship map
Prediction column: Concrete compressive strength(MPa, megapascals)
FEATURE TRANSFORMERS
PIPELINES
TOP ALGORITHMS
Concrete_Data.csv
Progress map
Swap view
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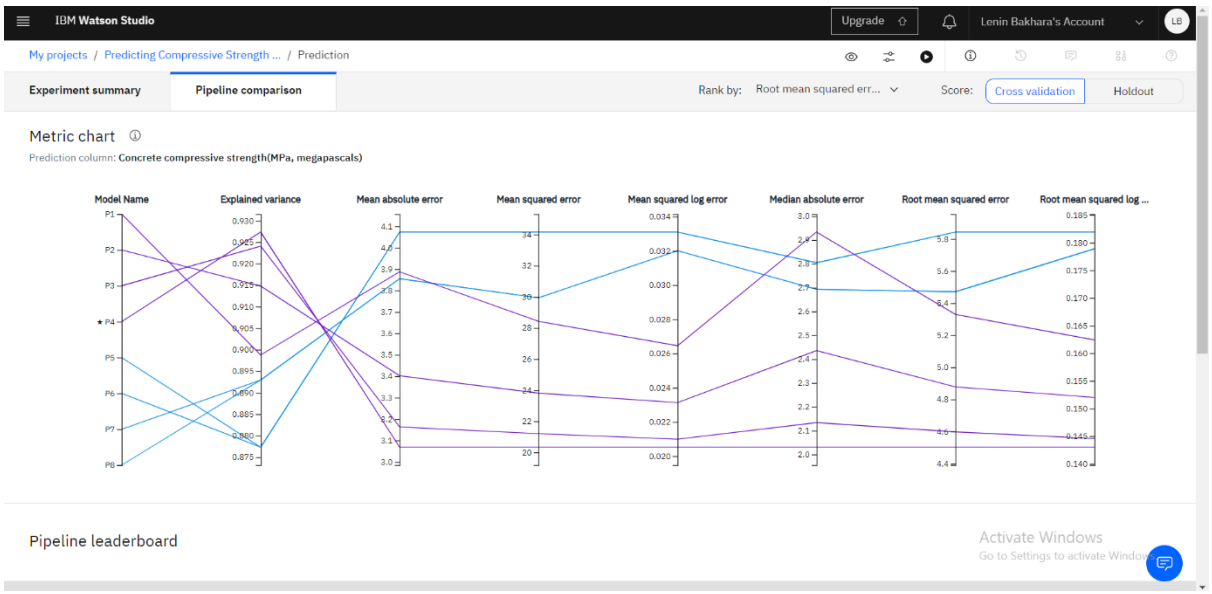
Time elapsed: 6 minutes
View full log
Pipeline leaderboard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Pipeline comparison
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Metric chart
Prediction column: Concrete compressive strength(MPa, megapascals)
Model Name
Explained variance
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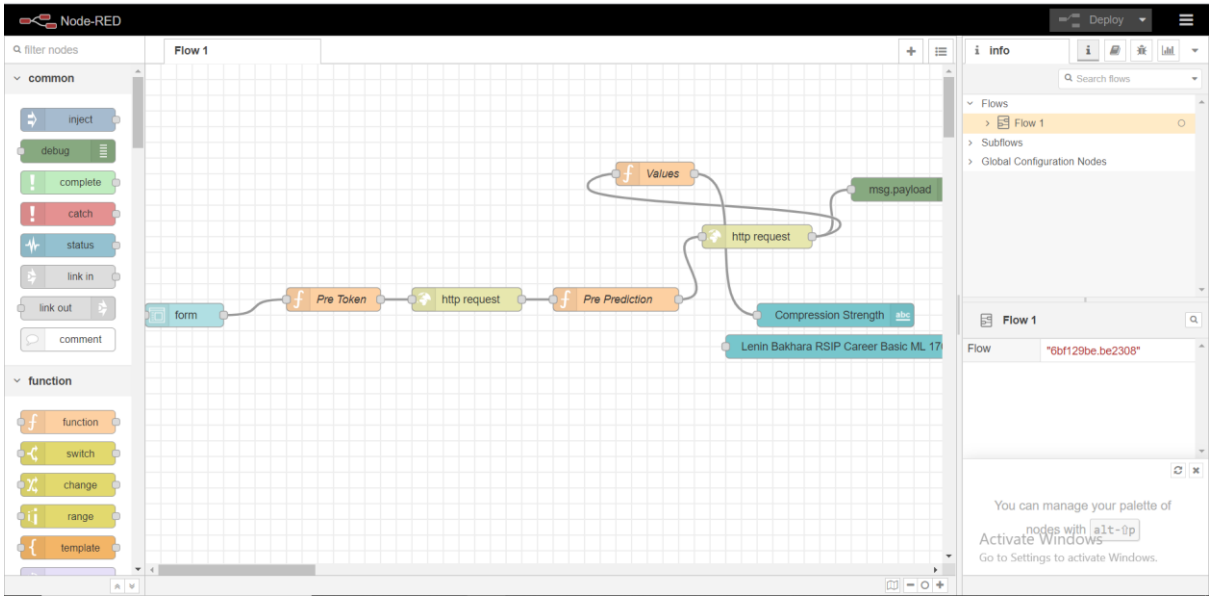
Mean squared error
Mean squared log error
Median absolute error
Root mean squared error
Root mean squared log ...
Pipeline leaderboard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complete
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status
link in
link out
comment
function
function
switch
change
range
template
Values
msg.payload
http request
form
Pre Token
http request
Pre Prediction
Compression Strength
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info
Search flows
Flows
Flow 1
Subflows
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Flow 1
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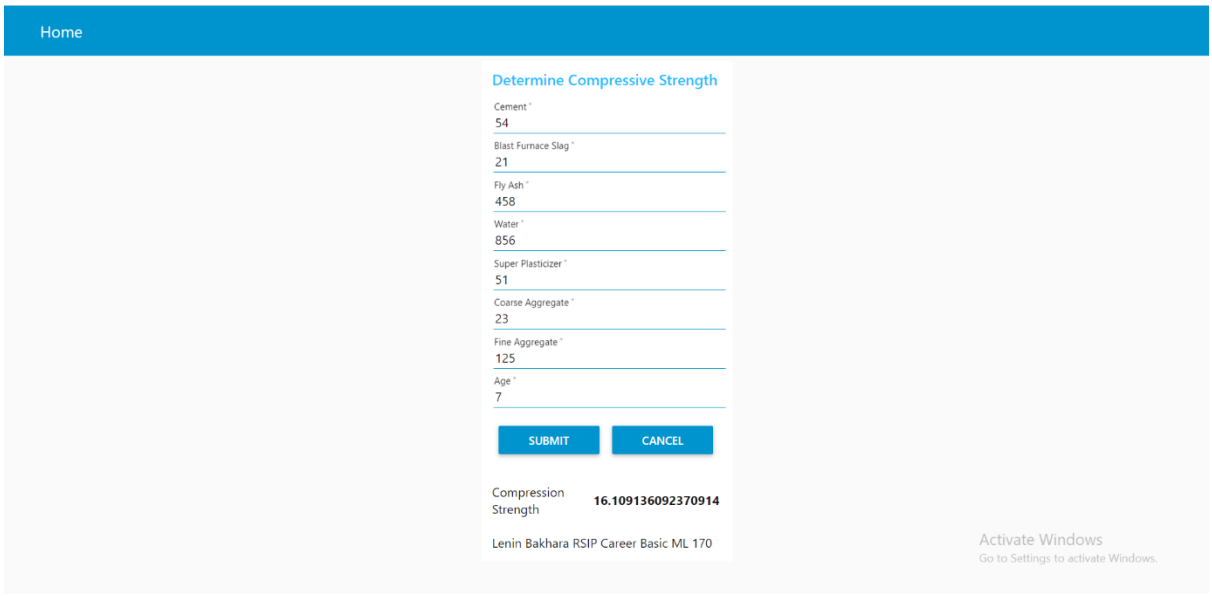
Activate Windows
Go to Settings to activate Windows.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54
Blast Furnace Slag *
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Fly Ash *
458
Water *
856
Super Plasticizer *
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Coarse Aggregate *
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Fine Aggregate *
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Age *
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CANCEL
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Activate Windows
Go to Settings to activate Windows.