

1. Introduction:-

1.1 Overview -

Any country spends lot's of amount of its GDP on health care, and the cost of health insurance is rising faster than wages or inflation. Per year, employers spend \$500 billion on health premiums for their employees. One important question these employers must always consider is if the coverage they are getting is worth what they are paying. The health insurance providers have their proprietary actuarial methods and complex models to determine these premiums, but they are hidden from the public.

1.2 Purpose -

The purpose of this project is to explore the use of machine learning algorithms to predict the prices of annual health insurance premiums given the specifications of the contract and the company's demographics. That is, given a health insurance contract and information about a company's employees, can we accurately predict how much it will cost per year? Using IBM cloud and it's services like Watson Studio and Machine learning service also provided by the IBM cloud, we can try to predict the premium costs of a contract, as well as determine the optimal set of features using feature selection. For providing the model to use widely we integrate this machine learning model with Node RED app, provided by IBM cloud, which provide very good user interface for any person to predict their expenses.

2. LITERATURE SURVEY:-

2.1 Existing problem:-

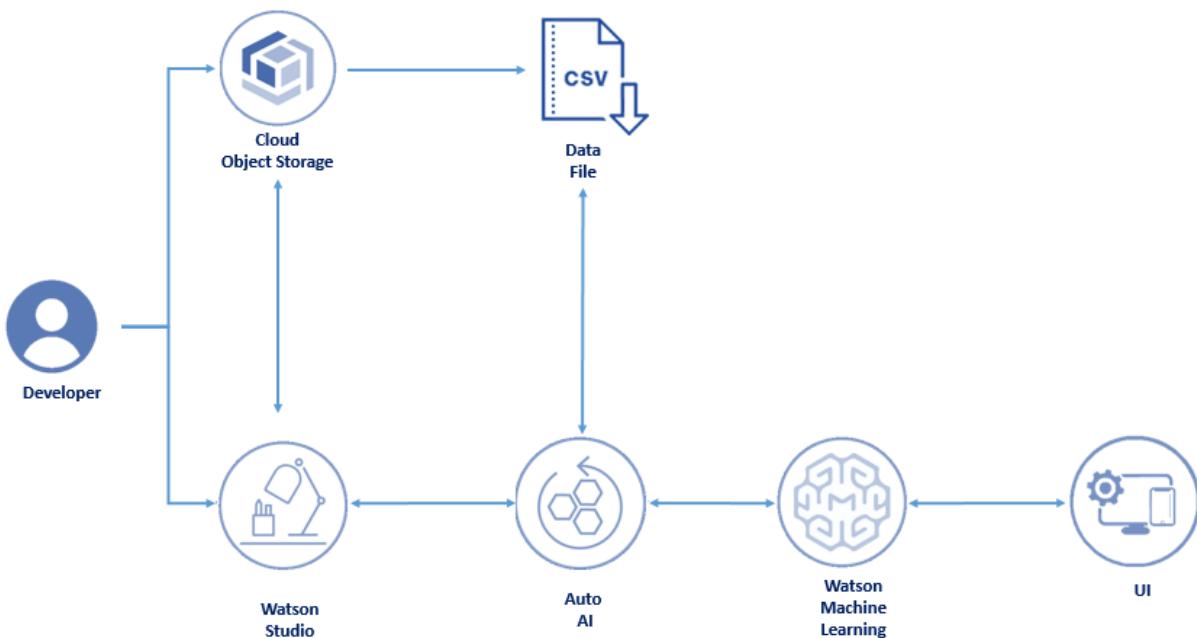
Rising health care costs are a major economic and public health issue worldwide. According to the World Health Organization, health care accounted for 7.9% of Europe's gross domestic product (GDP) in 2015. In Switzerland, the health care sector contributes substantially to the national GDP, and has increased from 10.7 to 12.1% between 2010 and 2015. Moreover, because health care utilisation costs may serve as a surrogate for an individual's health status, understanding which factors contribute to increases in health expenditures may provide insight into risk factors and potential starting points for preventive measures.

2.2 Proposed solution:-

In this study, we aimed to predict changes in patients' health care costs in the subsequent year and to identify factors contributing substantially to this prediction. In particular, we focused on the role of age ,gender of the person, how many children person have and there region and whether a person is a smoker or not. We approached the problem as a binary classification task, predicting whether patient's total costs would increase or decrease, based on their characteristics.

3. THEORITICAL ANALYSIS:-

3.1 Block diagram:-



3.2 Hardware / Software designing:-

For our project we are using IBM cloud services which provide us the software to train the model and use them to predict the cost for the health Insurance cost Prediction. The services are listed below which we are using in making the app for prediction-

1. **IBM Watson Studio**- IBM Watson Studio helps data scientists and analysts prepare data and build models at scale across any cloud.
2. **IBM Watson Machine Learning**- IBM Watson Machine Learning helps data scientists and developers accelerate AI and machine-learning deployment
3. **Node-RED** - Creates User interface and control the flow of the response that provided by the user and use the machine learning model to predict and then provide us the result.
4. **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:-

Flow Description for creating Insurance cost Prediction app

1. The user creates an IBM Watson Studio Service on IBM Cloud.
2. The user creates an IBM Cloud Object Storage Service and adds that to Watson Studio.
3. The user uploads the insurance premium data file into Watson Studio.
4. The user creates an AutoAI Experiment to predict insurance premium on Watson Studio
5. AutoAI uses Watson Machine Learning to create several models, and the user deploys the best performing model.
6. The user uses the Flask web-application to connect to the deployed model and predict an insurance charge.

Steps to be followed -

- Download the data set
- Explore the data
- Create IBM Cloud services
- Create and Run AutoAI experiment

- Create a deployment and test your model
- Create Node-RED service
- Integrate Node-RED to the machine learning model

1. Download the Dataset: We will use an insurance data set from Kaggle. You can find it here. [Click here](#) and download the dataset. you should see insurance.csv. This is the data set we will use for the remainder of the example.

2. Explore the data- We would explore the data before create any machine learning models. We should have to understand the data, and find any trends between insurance premiums charges and the data's features.

3.Create IBM Cloud services-

First login to your IBM Cloud account.

- After logging into IBM Cloud, click Proceed to show that you have read your data rights.
- Click on IBM Cloud in the top left corner to ensure you are on the home page.
- Within your IBM Cloud account, click on the top search bar to search for cloud services and offerings. Type in Watson Studio and then click on Watson Studio under Catalog Results.
- This takes you to the Watson Studio service page. There you can name the service as you wish. For example, one may name it Watson-Studio-trial. You can also choose which data center to create your instance in. The gif above shows mine as being created in Dallas.
- For this guide, you choose the Lite service, which is no-charge. This has limited compute; it is enough to understand the main functionality of the service.
- Once you are satisfied with your service name, and location, and plan, click on create in the bottom-right corner. This creates your Watson Studio instance.
- To launch your Watson Studio service, go back to the home page by clicking on IBM Cloud in the top-left corner. There you see your services, and under there you should see your service name. This might take a minute or two to update.

- Once you see your service that you just created, click on your service name, and this takes you to your Watson Studio instance page, which says Welcome to Watson Studio. Let's get started!. Click on the Get Started button.

The screenshot shows the IBM Cloud dashboard. On the left, there's a sidebar with icons for various services like Cloud Foundry, Watson Assistant, Watson Studio, and Watson Discovery. The main area has a "Quick start" section with five cards:

- Build**: Explore IBM Cloud with this selection of easy starter tutorials and services. (10 min)
- Get started with machine learning + Watson Studio**: Build, run and manage AI models. Prepare data and build models anywhere using open source code or visual modeling. Predict and optimize your outcomes. (1 min)
- Visit the IBM Cloud catalog**: Explore our unique product catalog that contains 190+ services and software for your business solutions. (5 min)
- Create and deploy an application**: Browse our starter kits, and then select one to jump start the process to create and deploy your app. (2 min)
- Explore IBM Cloud Shell**: Try a command-driven approach for creating, developing, and deploying a web project. (3 min)

Below this is a "Resource summary" section showing 9 resources, including Cloud Foundry apps (1), Cloud Foundry services (1), and Services (4). There are also sections for "Planned maintenance" and "For you".

The screenshot shows the IBM Cloud catalog. The left sidebar has a "Catalog" section with categories: IBM Cloud catalog, Featured, Services, Software, and Consulting. A search bar at the top has "watson studio" typed into it. Below the search bar, a list of products is shown:

- Watson Studio**: IBM • Services • AI / Machine Learning. Lite • Free • IAM-enabled.
- Watson Discovery**
- Watson OpenScale**
- Knowledge Studio**
- Machine Learning**: IBM • Services • AI / Machine Learning. Lite • Free • IAM-enabled.

On the right side, there are two boxes. The top one is for "Watson Assistant" and the bottom one is for "Speech to Text". Below these is a large warning message from "Quick Heal AntiVirus Pro" stating: "Website you are visiting may be harmful. Website https://aiopenscale-dev.us-south.containers.appdomain.cloud". It also says "Access to website is blocked for your protection. If you still wish to visit the website click here and try again. If you think this is a mistake, to report click here."

Catalog / Services /

Watson Studio

IBM • Date of last update: 12/06/2020 • Docs

Create About

Select a location

Select a location

London (eu·gb)

Select a pricing plan

Displayed prices do not include tax. Monthly prices shown are for country or location: [United States](#)

Plan	Features	Pricing
Lite	1 authorized user 50 capacity unit-hours monthly limit Environment = # of capacity units required per hour <ul style="list-style-type: none"> • 1 vCPU + 4 GB RAM = 0.5 • 2 vCPU + 8 GB RAM = 1 • 4 vCPU + 16 GB RAM = 2 • Decision Optimization = Environment + 5 	Free

The Lite plan for Watson Studio offers everything you need to become a better data scientist or domain expert in a collaborative environment.

Summary

Watson Studio
 Location: London
 Plan: Lite
 Service name: Watson Studio-hy
 Resource group: Default

Feedback

Service Details - IBM Cloud

Watson Studio-o3

Active Add tags

Details Actions...

Manage

Watson Studio

Welcome to Watson Studio. Let's get started!

Get Started

Documentation

Learn about tools, features and how to perform a wide variety of Data and AI tasks.

<https://dataplatform.cloud.ibm.com/docs>

Gallery

Check out sample projects, notebooks and data sets to get you up and running quickly.

- This takes you to the Watson Studio tooling. There you see a heading that says Start by creating a project and a button that says Create Project. Click on Create a Project. Next click on Create an Empty project.
- On the create a new project page, name your project. One may name the project - insurance-demo. You also need to associate an IBM Cloud Object store instance,

so that you store the data set.

- Under Select Storage service click on the Add button. This takes you to the IBM Cloud Object Store service page. Leave the service on the Lite tier and then click the Create button at the bottom of the page. You are prompted to name the service and choose the resource group. Once you select a name, click the resource group Confirm button.
- Once you've confirmed your IBM Cloud Object Store instance, you are taken back to the project page. Click on refresh and you should see your newly created Cloud Object Store instance under Storage. That's it! Now you can click Create at the bottom right of the page to create your first IBM Watson Studio project
- Once you have created your Watson Studio Project, you see a blue Add to Project button on the top-right corner of your screen. Click on Add to Project and then select Data. This brings up a column on the right-hand side that says Data.
- In the Data column, click on browse to add data from a file. Go into where you downloaded your dataset from Step 0 and then navigate to the data folder, and then select insurance.csv.
- Watson Studio takes a couple of seconds to load the data, and then you should see the import has completed. To make sure it has worked properly, you can click on Assets on the top of the page, and you should see your insurance file under Data Assets

Service Details - IBM Cloud IBM Watson Studio

dataplatform.cloud.ibm.com/projects/?context=cpdaas

IBM Watson Studio All Search Upgrade Sudha Kumari's Account

Welcome, Sudha!

Watson Studio • Watson Machine Learning

Learn by example
Step through solving a specific business problem in a sample project.

Work with data
Create a project for your team to prepare data, find insights, or build models.

Create a guided tutorial

Extend your capabilities
Add tools, databases, or other features by creating services instances.

Create a project

Create a service

Feedback

Quick navigation

- Projects
- Deployments

Support

- Documentation
- FAQ
- What's new
- Give feedback

Waiting for dataplatform.cloud.ibm.com...

Type here to search

16:09 17-03-2021

Service Details - IBM Cloud IBM Watson Studio

dataplatform.cloud.ibm.com/projects/new-project?context=cpdaas

IBM Watson Studio All Search Upgrade Sudha Kumari's Account

Projects

Which project are you looking for?

All my projects

New +

Name	Role	Storage	Collaborators	Creator	Date created
Health insurance cost prediction	Admin	COS	SK	Sudha Kumari	Mar 15, 2021

Show more

https://dataplatform.cloud.ibm.com/projects/new-project?context=cpdaas

Type here to search

16:09 17-03-2021

Service Details - IBM Cloud IBM Watson Studio

dataplatform.cloud.ibm.com/projects/new-project?context=cpdaas

IBM Watson Studio All Search Sudha Kumari's Account Upgrade Incognito (2) SK

[Back](#)

Create a project

Choose whether to create an empty project or to preload your project with data and analytical assets. Add collaborators and data, and then choose the right tools to accomplish your goals. Add services as necessary.

Create an empty project



Add the data you want to prepare, analyze, or model. Choose tools based on how you want to work: write code, create a flow on a graphical canvas, or automatically build models.

NEW AutoAI experiment tool: Fully automated approach to building a classification or reg...

USE TO

- Prepare and visualize data
- Analyze data in notebooks
- Train models

Create a project from a sample or file



Get started fast by loading existing assets. Choose a project file from your system, or choose a curated sample project.

USE TO

- Learn by example
- Build on existing work
- Run tutorials

https://dataplatform.cloud.ibm.com/projects/new-project?context=cpdaas

Type here to search

16:09 17-03-2021

Service Details - IBM Cloud IBM Watson Studio

dataplatform.cloud.ibm.com/projects/create-project?context=cpdaas

IBM Watson Studio All Search Sudha Kumari's Account Upgrade Incognito (2) SK

New project

Define project details

Name

Description

Choose project options

Restrict who can be a collaborator ①

Project includes integration with [Cloud Object Storage](#) for storing project assets.

Storage
Cloud Object Storage-dd

Cancel Create

https://dataplatform.cloud.ibm.com/projects/create-project?context=cpdaas

Type here to search

16:09 17-03-2021

The screenshot shows the IBM Cloud Object Storage creation interface. At the top, there are three tabs: 'Service Details - IBM Cloud', 'IBM Watson Studio', and 'Cloud Object Storage - IBM Cloud'. The current tab is 'Cloud Object Storage - IBM Cloud'. The URL in the address bar is cloud.ibm.com/objectstorage/create. The top navigation bar includes 'Catalog', 'Docs', 'Support', 'Manage', and a user profile for 'Sudha Kumar's...'. A search bar says 'Search resources and offerings...'. On the left, a sidebar has 'Catalog / Services /' and a 'Create' button. The main content area is titled 'Cloud Object Storage' with a subtitle 'Author: IBM • Date of last update: 2021-03-17 3:33 AM • Docs • API docs'. Below this is a 'Create' button and an 'About' link. A warning message in a yellow box states: 'Warning You can have only one instance of a Lite plan per service. To create a new instance, [delete](#) your existing Lite plan instance.' The central part of the page displays a table comparing 'Plan', 'Features', and 'Pricing'. The 'Lite' plan is selected, showing 1 COS Service Instance, storage up to 25 GB/month, and various request limits. It is labeled as 'Free'. The 'Standard' plan is also listed with a note: 'There is no minimum fee, so you pay only for what you use.' Below the table, a note states: 'The Lite service plan for Cloud Object Storage includes Regional and Cross Regional resiliency, flexible data classes, and built-in security. Lite plan services are deleted after 30 days of inactivity.' On the right side, there is a 'Summary' section with details: 'Cloud Object Storage', 'Region: Global', 'Plan: Lite', 'Service name: Cloud Object Storage-c0', and 'Resource group: Default'. Below this are 'Create', 'Add to estimate', and 'View terms' buttons. The bottom of the screen shows a Windows taskbar with icons for File Explorer, Task View, Start, and Google Chrome.

The screenshot shows the 'New project' creation interface in IBM Watson Studio. The browser tab is 'Cloud Object Storage - IBM Cloud'. The URL is dataplatform.cloud.ibm.com/projects/create-project?context=cpdaas. The top navigation bar includes 'Upgrade', a user profile for 'Sudha Kumar's Account', and a search bar. On the left, a sidebar has 'All' and a 'Search' bar. The main content area is titled 'New project'. It has two sections: 'Define project details' and 'Choose project options'. In 'Define project details', there is a 'Name' field containing 'new' and a 'Storage' dropdown set to 'Cloud Object Storage-dd'. In 'Choose project options', there is a checkbox 'Restrict who can be a collaborator' which is checked. A note below it says: 'Project includes integration with Cloud Object Storage for storing project assets.' At the bottom right are 'Cancel' and 'Create' buttons. The bottom of the screen shows a Windows taskbar with icons for File Explorer, Task View, Start, and Google Chrome.

new
Last Updated: Mar 17, 2021
[Readme](#)

Overview
Date created: Mar 17, 2021
Description: No description available
Storage: 0 Byte used (Cloud Object Storage)
Collaborators: Sudha Kumari (Admin)

Recent activity
Alerts related to this project appear here when the project is active.

Readme
Document your project using standard Markdown syntax. See the [Markdown cheatsheet](#).

Assets
1 asset selected.
CSV insurance.csv (Data Asset) - Created by Sudha Kumari on Mar 15, 2021, 03:52 PM

AutoAI experiments
Health insurance auto (Completed, Regression) - Last modified Mar 15, 2021, 04:00 PM

Deep learning experiments
New deep learning experiment +

4. Create and Run AutoAI experiment-

Student Dashboard | smartinternz02/SPS-9085-Health | SPS-9085-Health insurance cost | Service Details - IBM Cloud | IBM Watson Studio

IBM Watson Studio | Sudha Kumari's Account

Choose asset type

AutoAI experiment
Fully automated approach to building a classification or regression model.

Connection
Connected data
Notebook
Dashboard
Visual Recognition m...
MDM Configuration
Model from file
DataStage flow
Federated Learning e...
Deep learning experi...
Modeler flow
Data Refinery flow
Decision Optimizatio...

0 Assets 1 Collaborators

Health Insurance Cost Prediction

Last Updated: Mar 18, 2021

Readme

Overview

Date created: Mar 18, 2021

Description: No description available

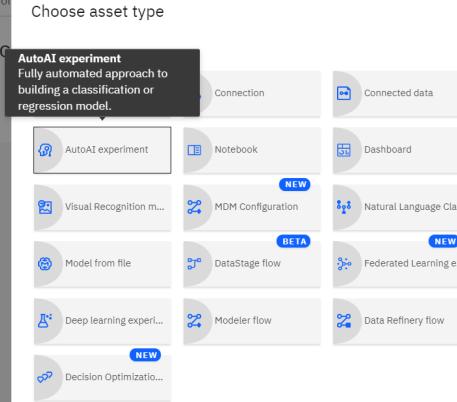
Storage: 0 Byte used (Cloud Object Storage)

Collaborators: Sudha Kumari (Admin)

View all (1)

Readme

Back to top ↑



Student Dashboard | smartinternz02/SPS-9085-Health | SPS-9085-Health insurance cost | Service Details - IBM Cloud | IBM Cloud Pak for Data

IBM Cloud Pak for Data | Sudha Kumari's Account

New AutoAI experiment

+ New

Gallery sample

Define details

Name *

Description

Description of AutoAI experiment

Associate services

Watson Machine Learning Service Instance *

No Machine Learning service instances associated with your project.
[Associate a Machine Learning service instance](#) with your project on the project settings page, then click the reload button below to refresh the instances available for association with your new model builder instance.

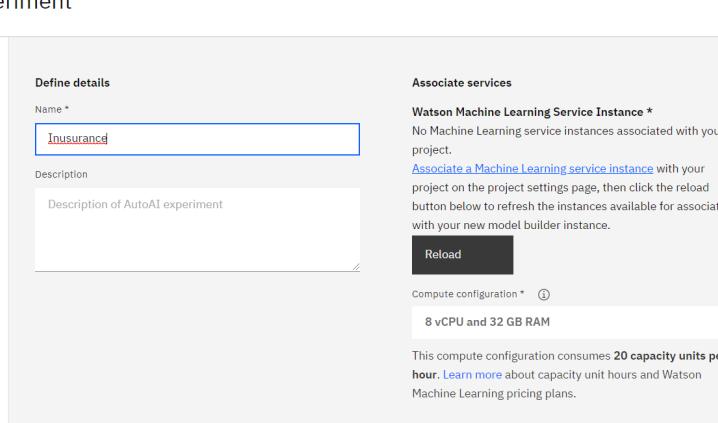
Reload

Compute configuration *

8 vCPU and 32 GB RAM

This compute configuration consumes **20 capacity units per hour**. [Learn more](#) about capacity unit hours and Watson Machine Learning pricing plans.

Create



Student Dashboard | smartinternz02/SPS-9085-Healt | SPS-9085-Health insurance | Service Details - IBM Cloud | IBM Cloud Pak for Data | IBM Cloud Pak for Data

IBM Cloud Pak for Data | All | Search | Upgrade | Sudha Kumari's Account | SK

Associate service

Choose an existing or add a new service to associate with your project.

Filter by: 1 Default | 2 Locations | None

1 item selected						Associate service	Cancel
Name	Type	Plan	Location	Status	Group		
<input type="checkbox"/> Language Translator-rx	Language Translator	Lite	Dallas	Not associated	Default	Associate	
<input checked="" type="checkbox"/> Machine Learning-rl ⓘ	Machine Learning	Lite	Dallas	Not associated	Default	Associate	

Type here to search

Student Dashboard | smartinternz02/SPS-9085-Healt | SPS-9085-Health insurance cost | Service Details - IBM Cloud | IBM Cloud Pak for Data

IBM Cloud Pak for Data | All | Search | Upgrade | Sudha Kumari's Account | SK

New AutoAI experiment

+ New

Gallery sample

Define details

Name *

Description

Description of AutoAI experiment

Associate services

Watson Machine Learning Service Instance*

Machine Learning-rl

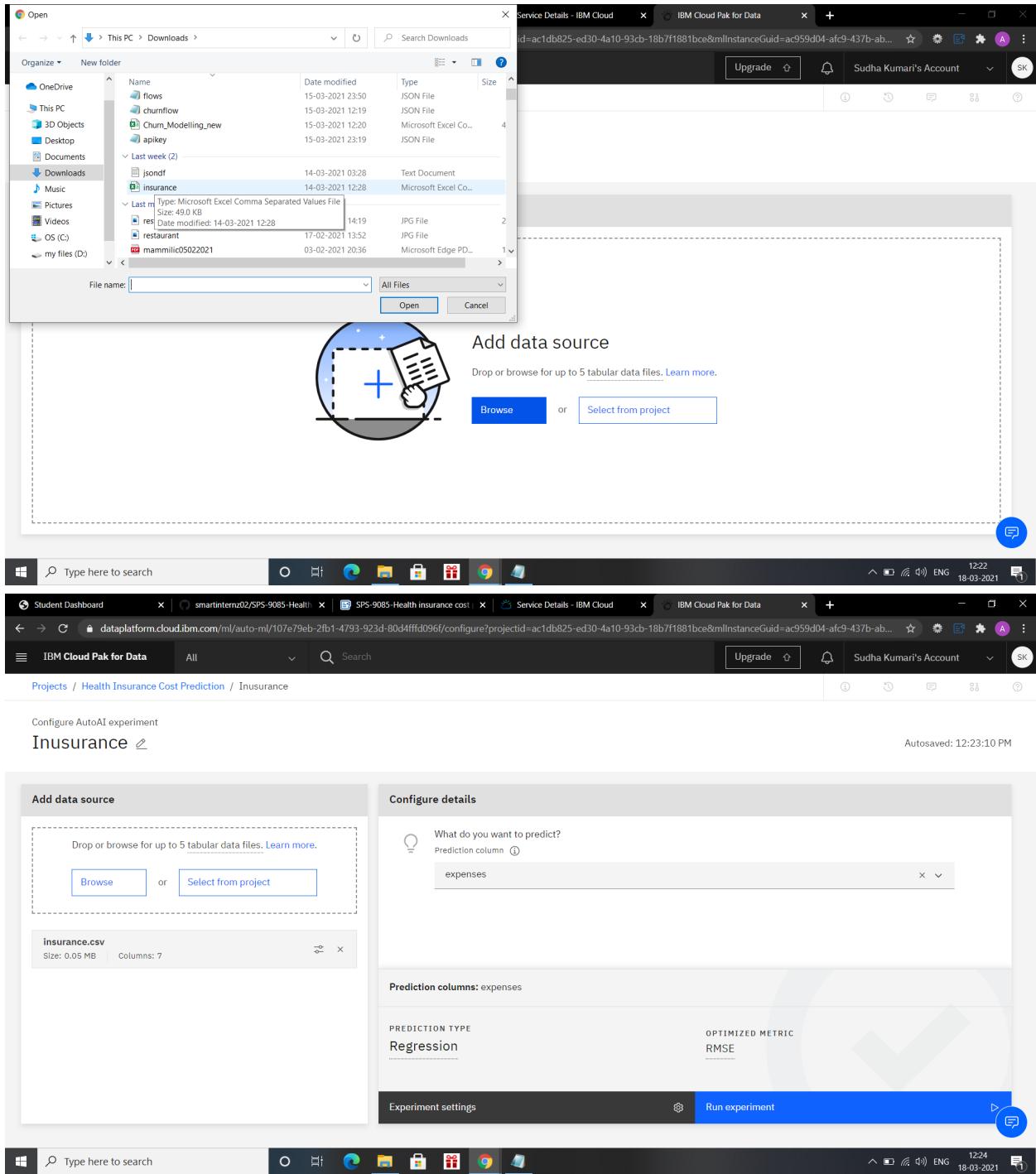
Compute configuration *

8 vCPU and 32 GB RAM

This compute configuration consumes **20 capacity units per hour**. Learn more about capacity unit hours and Watson Machine Learning pricing plans.

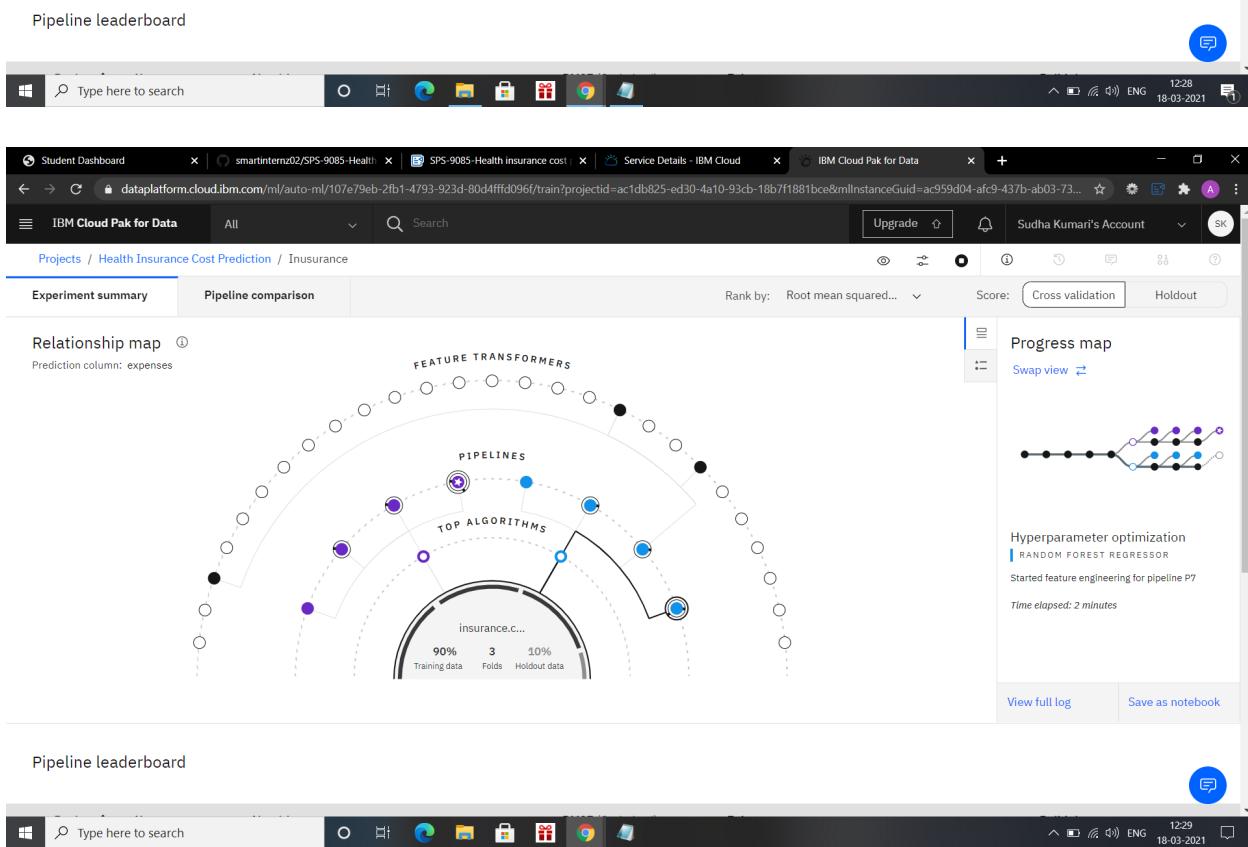
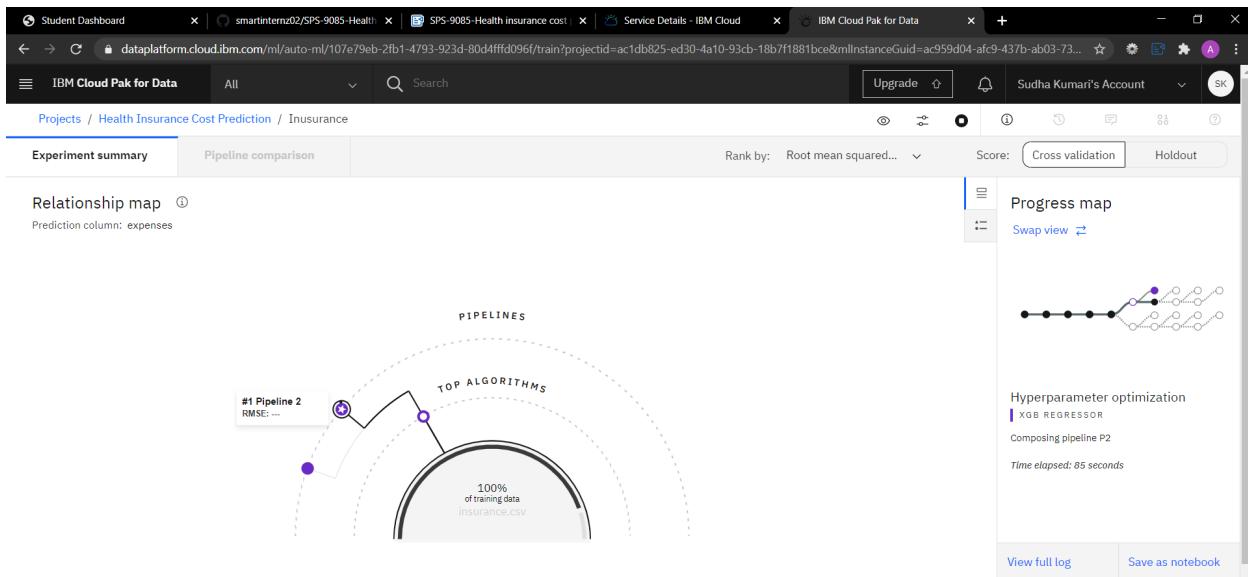
Cancel Create

Type here to search



- Once you've created your project, click on the Add to project at the top-right of your Watson Studio project page. This pops up an image with different assets you can choose to add to your project. Click on AutoAI experiment.

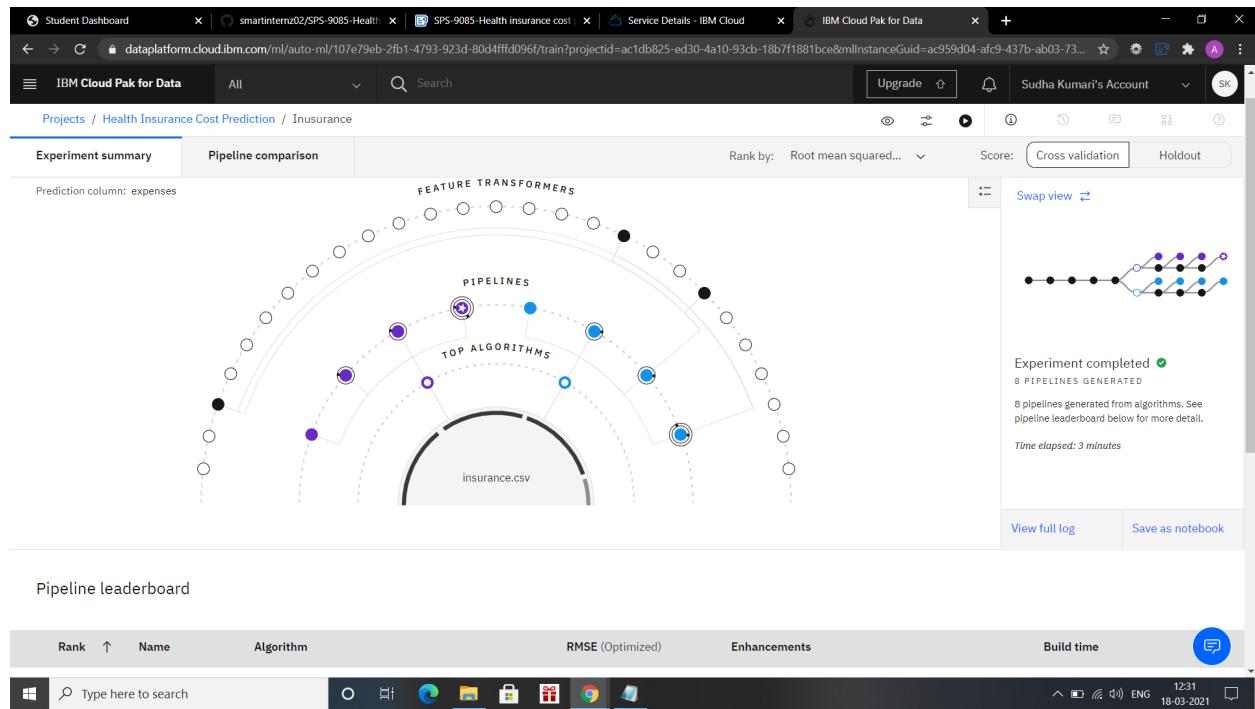
- This takes you to a page which says New AutoAI experiment at the top-left. Name your experiment as you want. One may name it auto-ai-insurance-demo.
- Next, you need to add a Watson Machine Learning instance before you create the Watson AutoAI experiment. On the right side of the screen click on Associate a Machine Learning instance.
- Same as before, select the Lite Tier, and click on the Create button at the bottom of the page. Name your instance as you wish. One may name it named mine machine-learning-free. Choose the location and the resource group and then click on Confirm when you are happy with your instance details.
- Once you create your machine learning service, you are taken back to the new AutoAI experiment page. Click on Reload on the right side of the screen. You should see your newly created machine learning instance.
- After you create your experiment, you are taken to a page to add a data source to your project. Click on Select from project and then add the insurance.csv file. Click on Select asset to confirm your data source.
- Next, you see that AutoAI processes your data, and you see a What do you want to predict section. Select the charges as the Prediction column.
- Next, let's explore the AutoAI settings to see what you can customize when running your experiment. Click on Experiment settings. First, you see the data source tab, which lets you omit certain columns from your experiment. You choose to leave all columns. You can also select the training data split. It defaults to 85% training data. The data source tab also shows which metric you optimize for. For the regression, it is RMSE (Root Mean Squared Error), and for other types of experiments, such as Binary Classification, AutoAI defaults to Accuracy. Either way, you can change the metric from this tab depending on your use case.
- Click on the Prediction tab from within the Experiment settings. There you can select from Binary Classification, Regression, and Multiclass Classification.
- Lastly, you can see the Runtime tab from the Experiment settings this shows you other experiment details you may want to change depending on your use case.

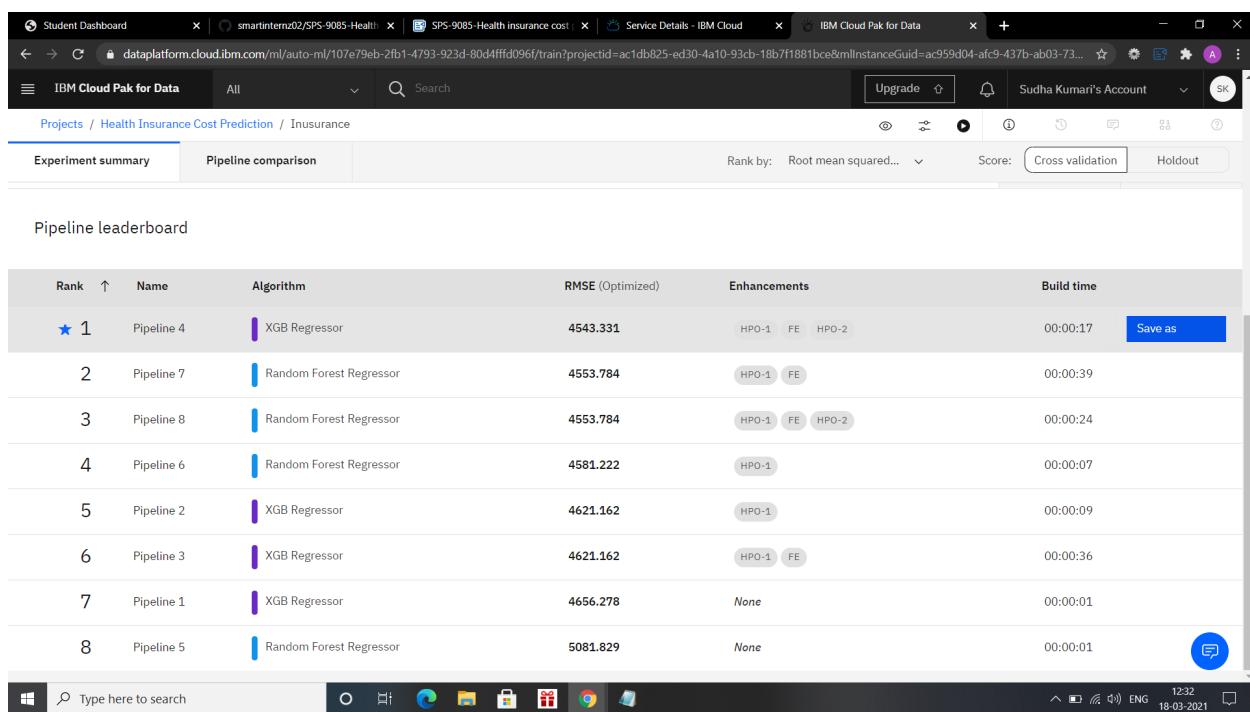
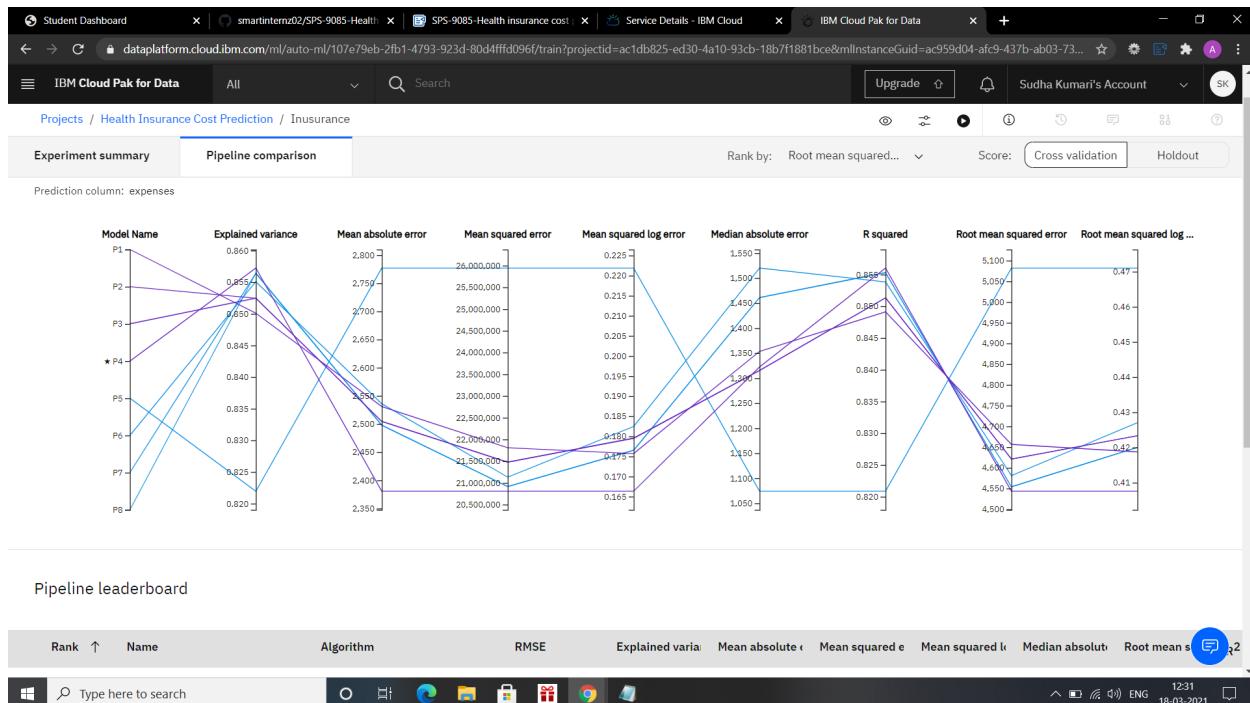


- Next, your AutoAI experiment runs on its own. You see a progress map on the

right side of the screen which shows which stage of the experiment is running. This may be Hyper Parameter Optimization, feature engineering, or some other stage.

- You have different pipelines that are created, and you see the rankings of each model. Each model is ranked based on the metric that you selected. In the specific case that is the RMSE(Root mean squared error). Given that you want that number to be as small as possible, you can see that in the experiment, the model with the smallest RMSE is at the top of the leaderboard.
- Once the experiment is done, you see Experiment completed under the Progress map on the right hand side of the screen.



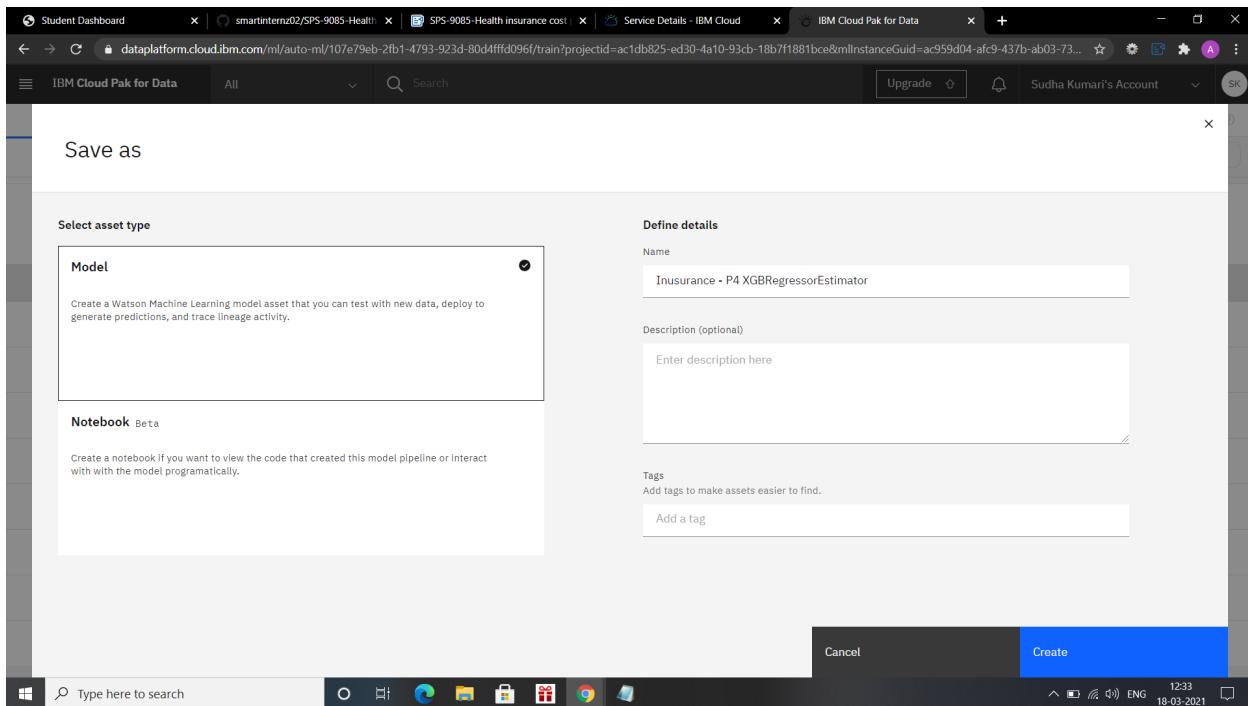


- Now that AutoAI has successfully generated eight different models, you can rank the models by different metrics, such as explained variance, root mean squared error, R-Squared, and mean absolute error. Each time you select a different

metric, the models are re-ranked by that metric.

- Let's pick RMSE as the experiment's metric.
- On the left-hand side, you can see different Model Evaluation Measures. For this particular model, you can view the metrics, such as explained variance, RMSE, and other metrics.
- On the left-hand side, you can also see Feature Transformations, and Feature Importance.
- On the left-hand side, click on Feature Importance. You can see here that the most important predictor of the insurance premium is whether you are a smoker or not-smoker. This is by far the most important feature, with bmi coming in as the second most important. This makes sense, given that many companies offer discounts for employees who do not smoke.

5. Create a deployment and test your model-



Saved model successfully.
Inusurance - P4
XGBRegressorEstimator was successfully saved to Health Insurance Cost Prediction.

View in project

Rank	Name	Algorithm	RMSE (Optimized)	Enhancements	Build time
1	Pipeline 4	XGB Regressor	4543.331	HPO-1 FE HPO-2	00:00:17
2	Pipeline 7	Random Forest Regressor	4553.784	HPO-1 FE	00:00:39
3	Pipeline 8	Random Forest Regressor	4553.784	HPO-1 FE HPO-2	00:00:24
4	Pipeline 6	Random Forest Regressor	4581.222	HPO-1	00:00:07
5	Pipeline 2	XGB Regressor	4621.162	HPO-1	00:00:09
6	Pipeline 3	XGB Regressor	4621.162	HPO-1 FE	00:00:36
7	Pipeline 1	XGB Regressor	4656.278	None	00:00:01
8	Pipeline 5	Random Forest Regressor	5081.829	None	00:00:01

Inusurance - P4 XGBRegressorEstimator

Overview Activities

Input Schema

Input

Column	Type
age	"integer"
bmi	"double"
children	"integer"
region	"other"
sex	"other"
smoker	"other"

Promote to deployment space

Inusurance - P4 XGBRegressorEstimator

Last modified at Mar 18, 2021 12:33 PM

Description
No description provided.

Created
Mar 18, 2021 12:33 PM

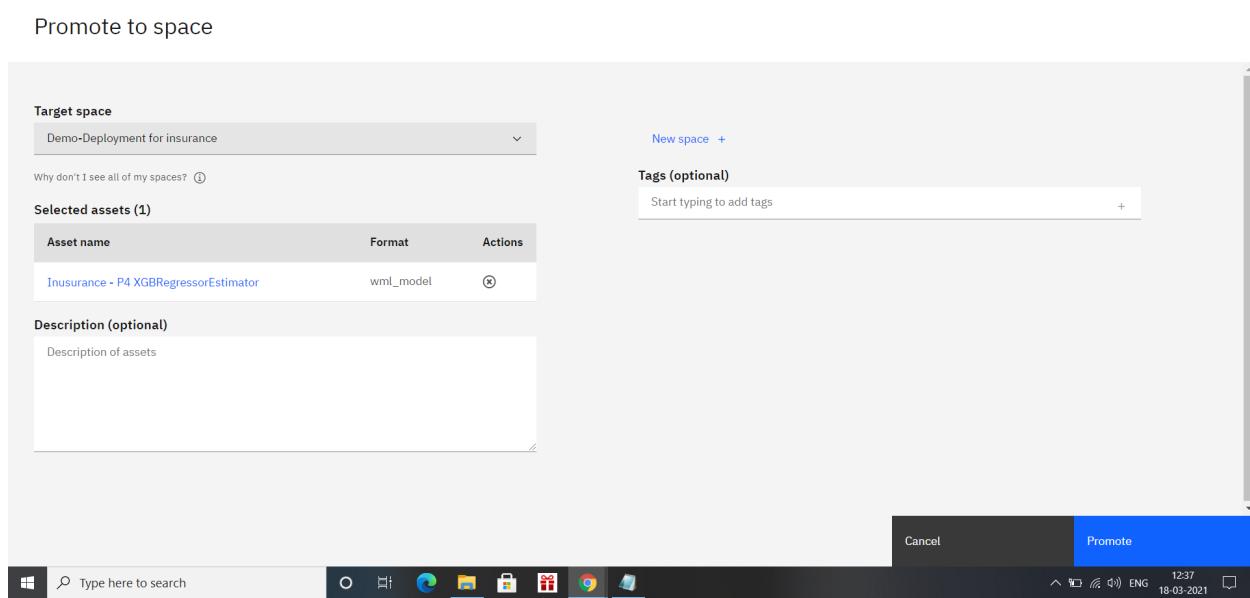
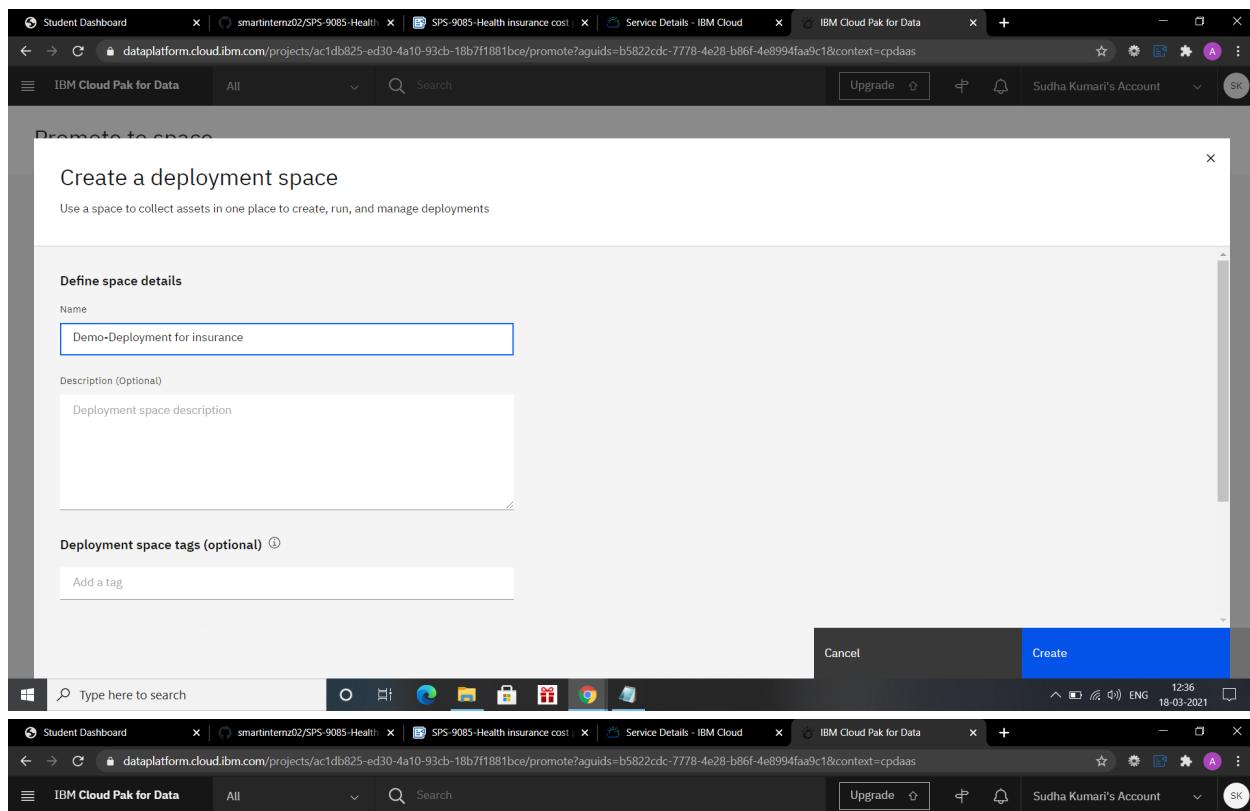
Type
wml-hybrid_0.1

Model ID
b5822cdc-7778-4e28-b86f-4e8994faa9c1

Software specification
[hybrid_0.1](#)

Hybrid pipeline software specifications
[autoai-kb_3.1-py3.7](#)

Tags
Add tags to make assets easier to find.



Screenshot of the IBM Cloud Pak for Data interface showing the successful promotion of a model to a deployment space.

IBM Cloud Pak for Data - Overview

Successfully promoted Inusurance - P4 XGBRegressorEstimator to the associated deployment space. Go to the deployment space to prepare the assets for deployment.

Data assets

Name	Type	Created by	Last modified
insurance.csv	Data Asset	Sudha Kumari	Mar 18, 2021, 12:23 PM

AutoAI experiments

Name	Status	Model type	Last modified
Inusurance	Completed	Regression	Mar 18, 2021, 12:30 PM

Deep learning experiments

Name	Status	Last modified
https://dataplatform.cloud.ibm.com/ml-runtime/spaces/6c8c3eb8-2db3-4646-b849-4c7e40477ce5/assets?context=cpdaas	haven't run any Deep learning experiments yet	12:37 18-03-2021

Deployments / Demo-Deployment for insurance

Demo-Deployment for insurance

Assets

Drop files here or browse for files to upload.

Stay on the page until upload completes. Incomplete uploads are cancelled.

Models (1)

Name	Type	Software specification	Tags	Last modified
Inusurance - P4 XGBRegressorEstimator	wml-hybrid_0.1	hybrid_0.1		Mar 18, 2021 12:37 PM

Deploy

IBM Cloud Pak for Data - Deployments

Associated asset
Ininsurance - P4 XGBRegressorEstimator

Deployment type

Online Run the model on data in real-time, as data is received by a web service.	Batch Run the model against data as a batch process.
--------------------------------------------------------------------------------------------	----------------------------------------------------------------

Name

Description

Software specification
[hybrid_0.1](#)

[Cancel](#) [Create](#)

Type here to search

Student Dashboard | smartinternz02/SPS-9085-Health | SPS-9085-Health insurance cost | Service Details - IBM Cloud | IBM Cloud Pak for Data

IBM Cloud Pak for Data All Search Sudha Kumari's Account

Deployments / Demo-Deployment for insurance / Ininsurance - P4 XGBRegressorE...

Ininsurance - P4 XGBRegressorEstimator

[Create deployment](#)

DEPLOYMENT TYPES			
Online	(1)	Batch	(0)
1 Online Deployment(s)			
Name	Status	Last modified	
Health Insurance	In progress	Mar 18, 2021 12:39 PM	

Ininsurance - P4 XGBRegressorEstimator
Last modified at Mar 18, 2021 12:39 PM

Created
Mar 18, 2021 12:37 PM

Type
wml-hybrid_0.1

Model ID
bb1e7a4f-d153-425f-9a8b-44353bf4035

Software specification
[hybrid_0.1](#)

Hybrid pipeline software specifications
[autoai-kb_3.1-py3.7](#)

Description
No description provided.

Tags
Add tags to make assets easier to find.

Source asset details

Type here to search

The screenshot shows the IBM Cloud Pak for Data interface. A deployment named "Health Insurance" has been successfully deployed. The deployment details are as follows:

- Name:** Health Insurance
- Status:** Deployed
- Last modified:** Mar 18, 2021 12:39 PM
- Type:** wml-hybrid_0.1
- Model ID:** bb1e7a4f-d153-425f-9a8b-44353fbf4035
- Software specification:** hybrid_0.1
- Description:** No description provided.
- Tags:** Add tags to make assets easier to find.

The "Test" tab of the deployment page is selected, showing the API reference and a test input form. The input fields are:

- bmi: Double
- children: Integer
- smoker: other
- region: other

The "Input list (1)" section contains the input list: [34, male, 33.4, 2, yes, northeast]. The "Predict (1)" button is visible. The "Result" section displays the JSON output of the prediction:

```

0 {
1   "predictions": [
2     {
3       "fields": [
4         "prediction"
5       ],
6       "values": [
7         [
8           38580.03515625
9         ]
10      ]
11    }
12  }
13

```

- Once you are ready to deploy one of the models, click on Save As at the top-right corner of the model you want to deploy. Save it as a Model. You show you how to save it as a notebook in step 6.
- Name your model as you want, one may name it Insurance Premium Predictor -

Pattern Demo.

- Once you have finished saving it as a deployment, you see a green notification at the top right of your screen saying that your model has been successfully saved. Click on View in Project on that notification at the top-right corner of your screen.
- Next, you are taken to a screen that has the name of the model you just saved. Click on Deployments from the Tab in the middle of the screen.
- Next, click on the Add Deployment button on the right-side of the screen. Name your deployment as you want. One may name it demo-deployment and then click Save.
- On your saved model overview page, you should see your new deployment demo-deployment being initialized.
- Click on demo-deployment or whatever you named your deployment.
- It takes a few minutes for the deployment to be complete. Once it is complete - you see that a Test tab appears in the top of the screen. Click on the Test tab.
- Here you can test your model. Enter input data such as age, bmi, children, smoker and region, and then click the Predict button at the bottom of the screen.
- As you can see, the model predicted a premium of 4655, when you enter age 27, bmi: 22, children: 0, smoker: no, region: southwest.
- To validate the prediction, you check the data file that you used to train the model, and see a row that has similar inputs to what was inputted. You can find a male, 26 year old, with 0 children, non-smoker to get a premium of 3,900. This is relatively close to the model's prediction, so we know the model is working properly.

5.Create the Node-RED app:-

Go to the IBM cloud main page and then to catalog and search for node red app and then click the Node-RED app and set the location and region for the app you desire and create the node red app.

The screenshot shows the IBM Cloud Catalog interface. On the left, there's a sidebar with categories like Catalog, Featured, Services, Software, and Consulting. The main area has a search bar at the top with the placeholder "Search resources and offerings...". Below it, a large banner says "IBM Cloud products" and "Over 350 products available for you to customize and build the solutions that you need for your business". A search results dropdown is open, showing items starting with "node": "Node Exporter", "Node-RED App", "Node.js", "Node.js Express App", "Natural Language Understanding Node.js App", and "Let's Chat". To the right, there are several service cards: "Watson Assistant" (AI / Machine Learning), "Speech to Text" (AI / Machine Learning), "Machine Learning" (AI / Machine Learning), "Knowledge Studio" (AI / Machine Learning), and "Cloud Foundry". At the bottom, there's a navigation bar with icons for Windows, search, and various applications.

The screenshot shows the "Create app" page for Node-RED in the IBM Cloud Catalog. The URL in the address bar is <https://cloud.ibm.com/developer/appservice/create-app?starterKit=59c9d5bd-4d31-3611-897a-f94eea80dc9f&defaultLanguage=undefined>. The page has a header with tabs for Catalog, Docs, Support, Manage, and Sudha Kumari's... The main content area is titled "Node-RED" and contains sections for "App details" (with fields for App name, Resource group, Tags, and Platform), "Service details", and "Logs". On the right side, there are "FEEDBACK" and "ASK A QUESTION" buttons. The bottom navigation bar includes icons for Windows, search, and various applications.

After the app is created then go to main page of Node-Red and click the "visit app url".

Node RED JWSFH 2021-03-15 • Running • Visit App URL • Add tags

Runtime

SDK for Node.js™

256 Total MB allocation

1.75 GB still available

Free Used

Runtime cost

Current and estimated cost excludes connected services.

\$ 0.00 \$ 0.00

Estimated total for billing period
Mar 1, 2021 - Mar 31, 2021

Connections (1)

node-red-jwsfh-2021--cloudant-1615813866899-94764

Node-RED on IBM Cloud

Node-RED
Flow-based programming for the Internet of Things

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.

This instance is running as an IBM Cloud application, giving it access to the wide range of services available on the platform.

More information about Node-RED, including documentation, can be found at [nodered.org](#).

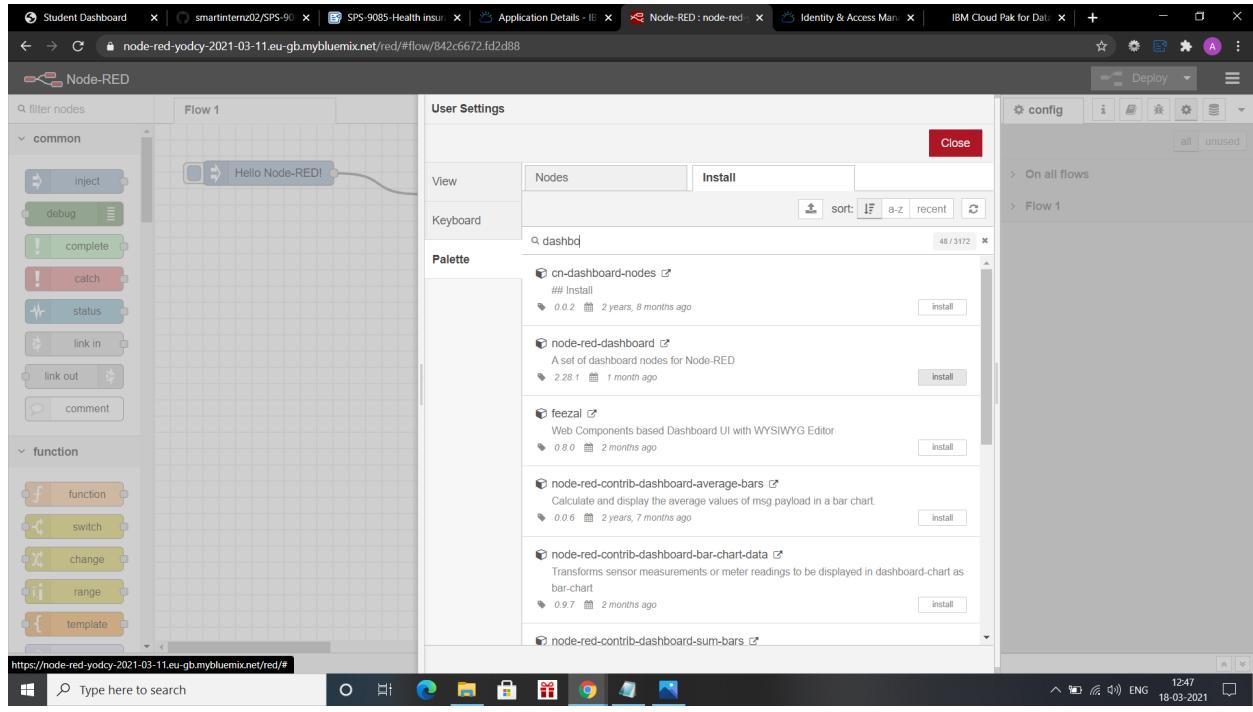
Go to your Node-RED flow editor

Learn how to customise Node-RED

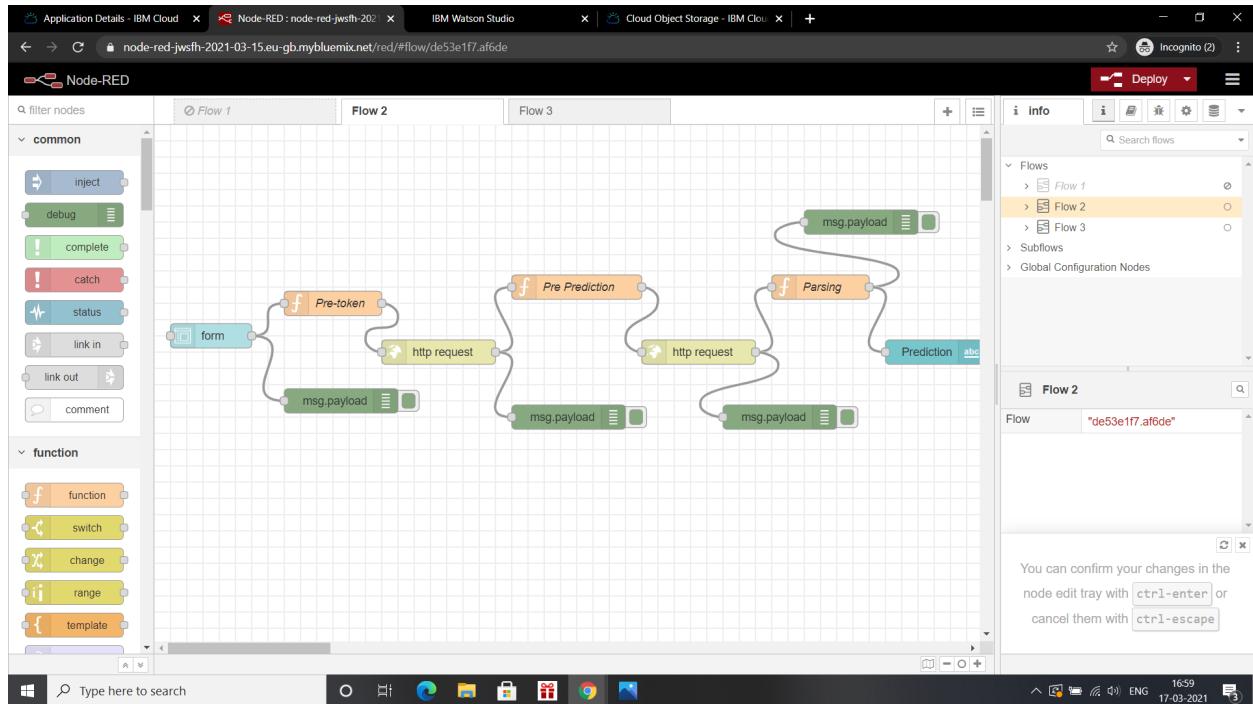
Customising your instance of Node-RED

7. Integrate Node-RED to the machine learning model-

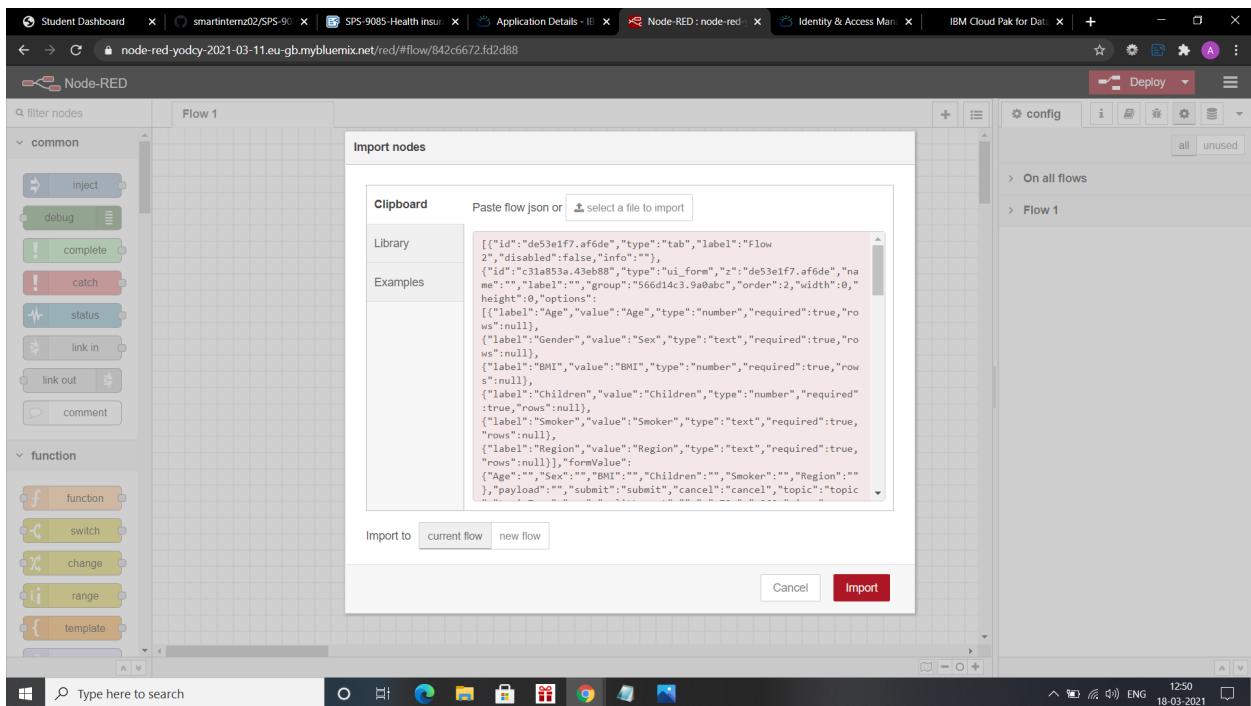
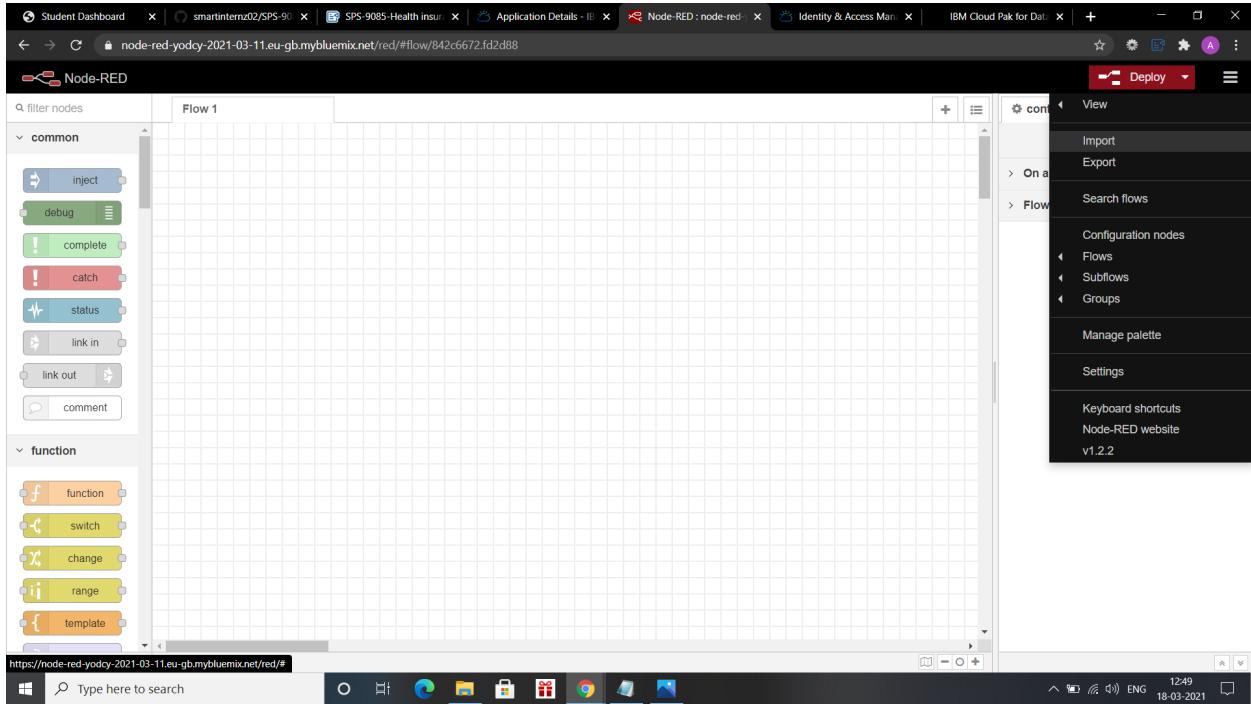
For the first time we have to download some extra package for user interface in Node-red

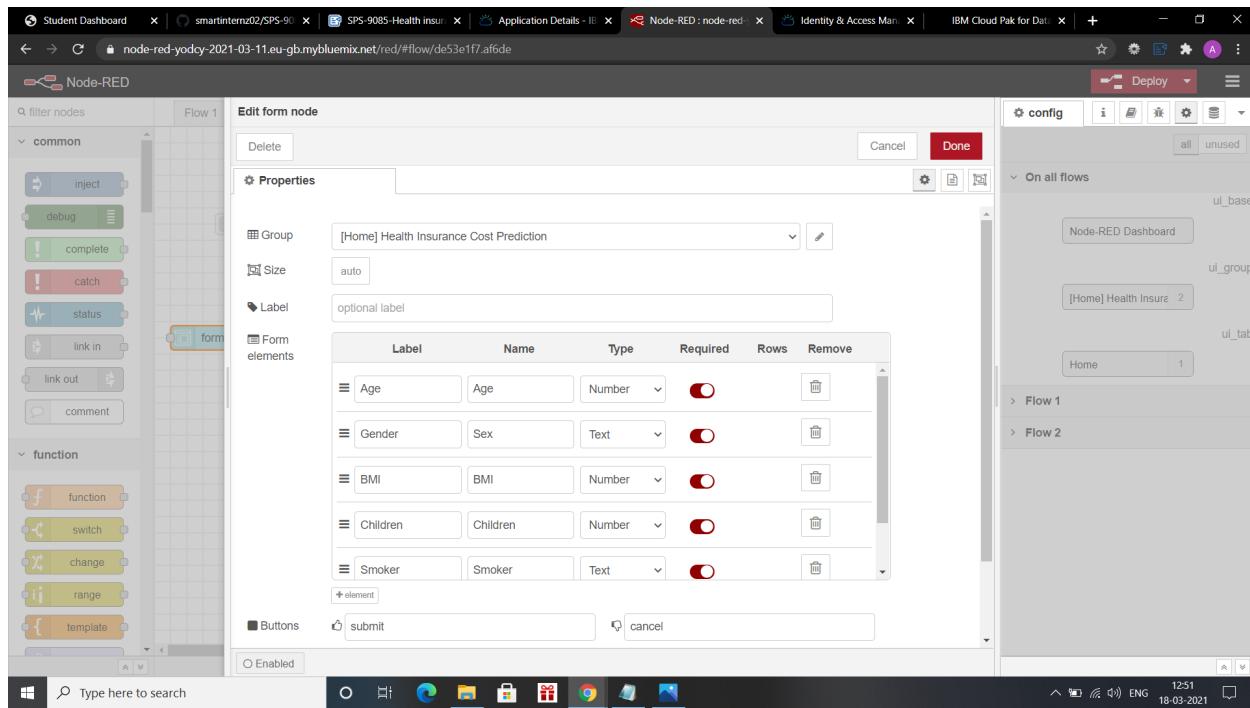


Now we have to create the flow of our application like-



[Click here](#) for downloading the json file for this kind of flow then





We have to create IAM user apikey to access this app-

The screenshot shows the IBM Cloud IAM overview page. The left sidebar lists navigation options: Access (IAM), Users, Access groups, Roles, Service IDs, Authorizations, Identity providers, API keys (selected), and Settings.

The main area displays the following information:

- Total users:** 1 (Active)
- Date:** 16/2010
- Tip:** To minimize the total number of policies, use access groups to assign multiple users the same level of access. [Explore best practices.](#)
- My user details:**

Name: Sudha Kumari	Status: ACTIVE
Account name: Sudha Kumari's Account	Email: 10sudhakumari@gmail.com
Account ID: b03ad73784574cfdb1fb47	IAM ID: IBMid-55000ATE8U0b2fa3f2ec
- My IBM Cloud API keys:**
 - API Key for NodeREDYODCY2021-03-11 (Last updated: 2021-03-11 06:56 GMT)
 - API Key for NodeREDQNHHB2021-03-11 (Last updated: 2021-03-11 06:47 GMT)
 - API Key for NodeREDMAXLS2021-03-11 (Last updated: 2021-03-11 06:35 GMT)
- FAQs:** Search and find answers to the most frequently asked questions.
- Feedback:** A chatbot message from the IBM Cloud Bot: "Hello, I'm the IBM Cloud Bot. Ask me any questions about account, billing, access (IAM), and some technical areas." with a "Let's chat!" button.

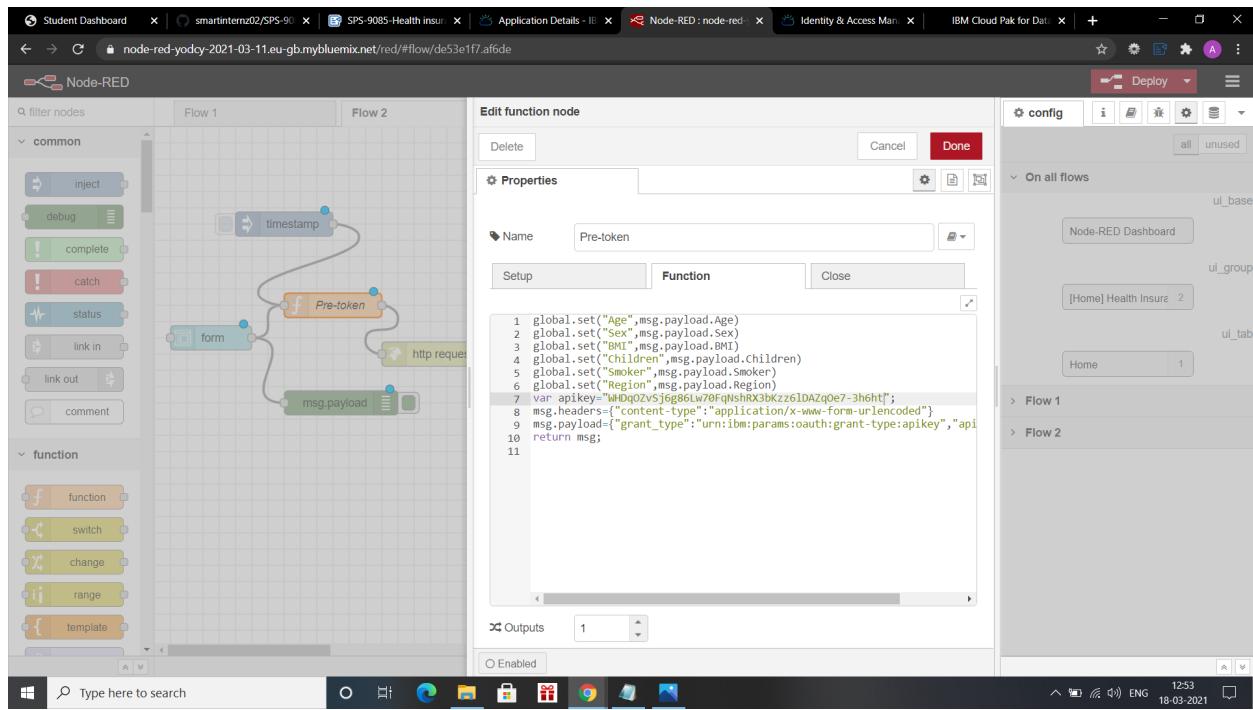
The screenshot shows the IBM Cloud IAM API keys creation interface. On the left sidebar, 'API keys' is selected. In the main area, a 'Create API key' dialog is open, showing fields for 'Name' (set to 'Insurance') and 'Description'. Below the dialog is a table of existing API keys. A message at the bottom indicates the key was successfully created.

Status	Name	Date Created
Created	API Key for NodeREDPIWWZ2021-03-11	2021-03-11 06:18 GMT
Created	API Key for NodeREDNHHB2021-03-11	2021-03-11 06:47 GMT
Created	API Key for NodeREDYODCY2021-03-11	2021-03-11 06:56 GMT

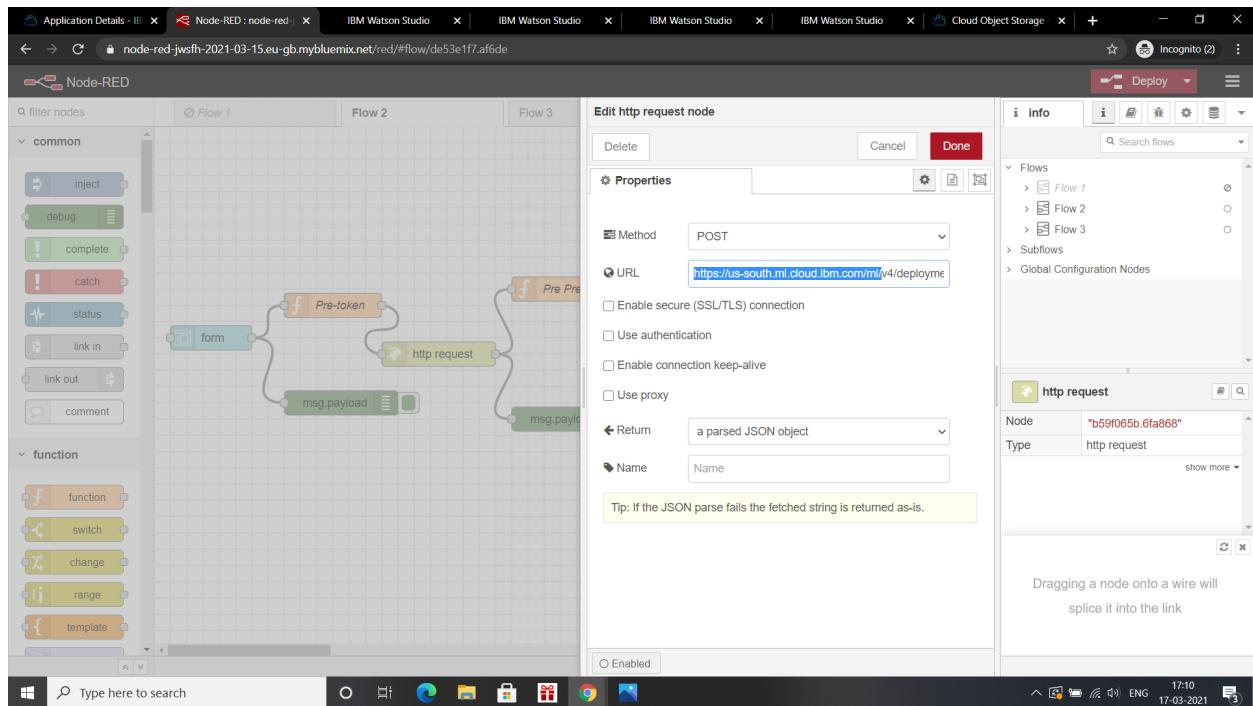
The screenshot shows the IBM Cloud IAM API keys successful creation confirmation. A modal window displays the message 'API key successfully created'. It includes instructions to copy or download the key, which is now listed in the table below. The table shows three API keys, all created on 2021-03-11.

Status	Name	Description	Date Created
Created	API Key for NodeREDMAXLS2021-03-11	for an API	2021-03-11 06:35 GMT
Created	API Key for NodeREDMAXLS2021-03-11	for an API	2021-03-11 06:32 GMT
Created	API Key for NodeREDMAXLS2021-03-11	for an API	2021-03-11 06:30 GMT

Now we have to paste this iam key to the pre token node



We have to Integrate the model with this flow for this we have to do some changes in the http response target means when we test our model at that time we have a url and we have to put that url into the https response like-



The screenshot shows the IBM Cloud Pak for Data interface. In the top navigation bar, there are several tabs: Student Dashboard, smartinternz02/SPS-90, SPS 9085-Health insur..., Application Details - IB..., Node-RED : node-red, Identity & Access Man..., and IBM Cloud Pak for Data. The main content area displays a deployment named "Health Insurance" which is "Deployed" and "online". Below the deployment name, there are sections for "API reference" and "Code snippets". The "API reference" section includes a "Direct link" to the endpoint `https://us-south.ml.cloud.ibm.com/ml/v4/deployments/03f65fec-38f2-4289-a7ed-672a60cf8cf2/` and a "Copied!" button. The "Code snippets" section provides examples for CURL, Java, JavaScript, Python, and Scala. The right side of the screen shows detailed deployment information: Created Mar 18, 2021 12:39 PM, Updated Mar 18, 2021 12:39 PM, Deployment ID 03f65fec-38f2-4289-a7ed-672..., Software specification hybrid_0.1, Hybrid pipeline software specifications autoai-kb_3.1-py3.7, Copies 1, Description No description provided, Tags, Associated asset Insurance - P4 XGBoostRegressorEst..., and a note about IAM.

Now as soon as we deploy our model we will have the url of the app and by that we can open our user interface for predicting the cost for health insurance.

The screenshot shows the Node-RED interface. The left sidebar contains a library of nodes categorized under "common" and "function". The main workspace displays a flow consisting of three parallel "http request" nodes. Each "http request" node is connected to a "msg.payload" node. The first "msg.payload" node is connected to a "Pre-token" function node, which is then connected to a "form" node. The second "msg.payload" node is connected to a "Pre Prediction" function node, which is then connected to another "http request" node. The third "msg.payload" node is connected to a "Parsing" function node, which is then connected to a "Prediction" abc function node. The right sidebar shows the "info" tab with details about the flows: Flow 1, Flow 2, Flow 3, Subflows, and Global Configuration Nodes. A tooltip at the bottom right indicates that selected nodes can be exported with [ctrl-e]. The bottom navigation bar shows the URL `https://node-red-jwsth-2021-03-15.eu-gb.mybluemix.net/red/#`.

Health Insurance Cost Prediction

Age *
34

Gender *
female

BMI *
35.5

Children *
1

Smoker *
no

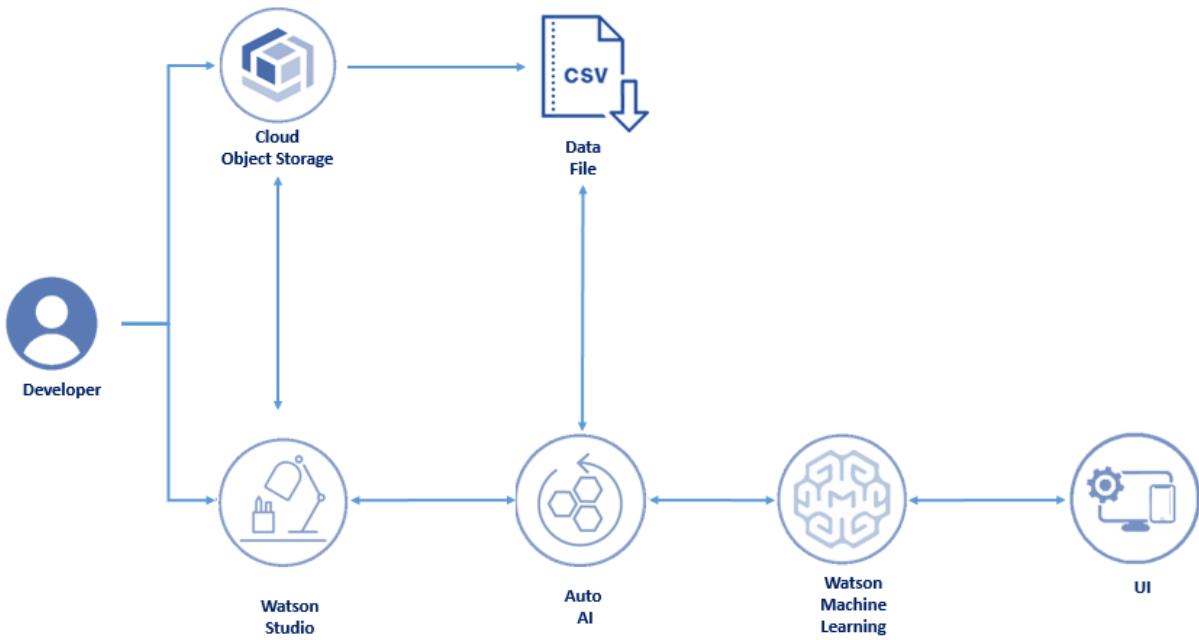
Region *
northeast

SUBMIT CANCEL

Prediction 6890.29443359375

Here's our app complete and user can predict their health insurance cost by filling the form.

5. Flowchart:



6. Result:

The model is when trained gives accuracy of 85% which makes prediction more efficient.

7.1 ADVANTAGES :

- This model can predict the value of your insurance so that you can compare the expenses of your health insurance and can choose the insurance from any company wisely .
- Model provide result with the great speed and with simple and attractive user interface provided by the Node-RED.

7.2 DISADVANTAGES:

The disadvantage of this model is that it's depend on some feature like age, children, body mass index, and smoker , But it's not measure all the possible factor that could

affect the overall expenses of any person's health insurance.

8. APPLICATIONS:-

Health insurance is a necessity nowadays, and almost every individual is linked with a government or private health insurance company. Factors determining the amount of insurance vary from company to company. Also people in rural areas are unaware of the fact that the government of India provide free health insurance to those below poverty line. It is very complex method and some rural people either buy some private health insurance or do not invest money in health insurance at all. Apart from this people can be fooled easily about the amount of the insurance and may unnecessarily buy some expensive health insurance.

Our project does not give the exact amount required for any health insurance company but gives enough idea about the amount associated with an individual for his/her own health insurance.

Here's the application to measures the amount of health insurance cost prediction.

Health Insurance Cost Prediction

Age *
34

Gender *
female

BMI *
35.5

Children *
1

Smoker *
no

Region *
northeast

SUBMIT CANCEL

Prediction 6890.29443359375

Anyone can check their health insurance cost prediction by [clicking this link](#).

9.CONCLUSION:-

Background In this project, regression models are evaluated for individual health insurance data. The health insurance data was used to develop a model and the predicted premiums from these models were compared with actual premiums to compare the accuracies of these models. The model is being built with the help of IBM cloud by using their services like watson studio, Node-RED app, cloud storage from ibm cloud and auto ai also provided by the IBM cloud.

Various factors were used and their effect on predicted amount was examined. It was observed that a persons age and smoking status affects the prediction most in every algorithm applied. Attributes which had no effect on the prediction were removed from the features.

The effect of various independent variables on the premium amount was also checked. The attributes also in combination were checked for better accuracy results.

10. FUTURE SCOPE:

Premium amount prediction focuses on persons own health rather than other companys insurance terms and conditions. The models can be applied to the data collected in coming years to predict the premium. This can help not only people but also insurance companies to work in tandem for better and more health centric insurance amount.

11.BIBIOGRAPHY

- <https://www.kaggle.com/noordeen/insurance-premium-prediction>
- <https://cloud.ibm.com/catalog/services/watson-studio>
- <https://cloud.ibm.com/developer/appservice/create-app?starterKit=59c9d5bd-4d31-3611-897a-f94eea80dc9f&defaultLanguage=undefined>

- https://en.wikipedia.org/wiki/Healthcare_in_India
- <https://economictimes.indiatimes.com/wealth/insure/what-you-need-to-know-before-buying-health-insurance/articleshow/47983447.cms?from=mdr>
- <https://github.com/IBM/predict-insurance-charges-with-autoai>

APPENDIX

Source code for connecting the Node-RED app to model in json format

```
1 [{"id":"de53e1f7.af6de","type":"tab","label":  
  "Flow  
  2","disabled":false,"info":""}, {"id":"c31a853  
  a.43eb88","type":"ui_form","z":"de53e1f7.af6d  
  e","name":"","label":"","group":"566d14c3.9a0  
  abc","order":2,"width":0,"height":0,"options":  
  :[{"label":"Age","value":"Age","type":"number",  
  "required":true,"rows":null}, {"label":"Gend  
  er","value":"Sex","type":"text","required":tr  
  ue,"rows":null}, {"label":"BMI","value":"BMI",  
  "type":"number","required":true,"rows":null},  
  {"label":"Children","value":"Children","type":  
  :"number","required":true,"rows":null}, {"labe  
  l":"Smoker","value":"Smoker","type":"text",  
  "required":true,"rows":null}, {"label":  
  "Region","value":"Region","type":"text",  
  "required":true}
```

```
e,"rows":null}],"formValue":{"Age":"","Sex":"","BMI":"","Children":"","Smoker":"","Region":""},"payload":"","submit":"submit","cancel":"cancel","topic":"topic","topicType":"msg","splitLayout":"","x":70,"y":260,"wires":[[{"id": "27b4532c.68f83c","x": 846418a4.1539f8}]]}, {"id": "27b4532c.68f83c", "type": "function", "z": "de53e1f7.af6de", "name": "Pre-token", "func": "global.set(\\"Age\\",msg.payload.Age)\nglobal.set(\\"Sex\\",msg.payload.Sex)\nglobal.set(\\"BMI\\",msg.payload.BMI)\nglobal.set(\\"Children\\",msg.payload.Children)\nglobal.set(\\"Smoker\\",msg.payload.Smoker)\nglobal.set(\\"Region\\",msg.payload.Region)\nvar\napikey=\"6ko1UipJkxi0DjcioTbxduJ2Uh83JB3e-_4su106pl9\";\\nmsg.headers={\\"content-type\\":\\"application/x-www-form-urlencoded\\"}\\nmsg.payload={\\"grant_type\\":\\"urn:ibm:params:oauth:grant-type:apikey\\",\\"apikey\\":apikey}\\nreturn msg;\\n", "outputs": 1, "noerr": 0, "initialize": "", "finalize": "", "x": 220, "y": 220, "wires": [[{"id": "56ca009e.f580a"}]]}, {"id": "56ca009e.f580a", "type": "http", "request": "de53e1f7.af6de", "name": "", "method": "POST", "ret": "obj", "paytoqs": "ignore", "url": "https://iam.cloud.ibm.com/identity/token", "tls": "", "persist": false, "proxy": "", "authTyp
```

```
e:"", "x":350, "y":280, "wires": [[{"id": "6b7746f2.779c08", "z": "efeb16ba.8bb9a8"}]], {"id": "aea5e53f.336118", "type": "inject", "z": "de53e1f7.af6de", "name": "", "props": [{"p": "payload"}, {"p": "topic", "vt": "str"}], "repeat": "", "crontab": "", "once": false, "onceDelay": 0.1, "topic": "", "payload": "", "payloadType": "date", "x": 160, "y": 120, "wires": [[{"id": "27b4532c.68f83c"}]]}, {"id": "846418a4.1539f8", "type": "debug", "z": "de53e1f7.af6de", "name": "", "active": true, "toSidebar": true, "console": false, "toStatus": false, "complete": "payload", "targetType": "msg", "statusVal": "", "statusType": "auto", "x": 230, "y": 340, "wires": []}, {"id": "6b7746f2.779c08", "type": "function", "z": "de53e1f7.af6de", "name": "Pre Prediction", "func": "var age = global.get(\"Age\")\nvar sex =\nglobal.get(\"Sex\")\nvar bmi =\nglobal.get(\"BMI\")\nvar children =\nglobal.get(\"Children\")\nvar smoker =\nglobal.get(\"Smoker\")\nvar region =\nglobal.get(\"Region\")\n\nvar token=msg.payload.access_token\nmsg.headers={\n'Content-Type':\n'application/json',\n\"Authorization\": \"Bearer \"+token,\n\"Accept\": \"application/json\"\n}\nmsg.payload={\n\"input_data\": [{\n\"fields\": [\n[\"age\", \"sex\", \"bmi\", \"children\", \"smoker\", \"region\"]\n]\n}],\n\"label\": \"Pre Prediction\"\n}\n\nreturn msg", "x": 350, "y": 460, "wires": []}]]
```

```
  \"children\", \"smoker\", \"region\"]], \"values\"
  \"\":
  [[age,sex,bmi,children,smoker,region]]}]\}\nreturn
msg;,\"outputs\":1,\"noerr\":0,\"initialize\":\"\",\"
finalize\":\"\",\"x\":520,\"y\":200,\"wires\":[[\"b59f0
65b.6fa868\"]],{\"id\":\"efeb16ba.8bb9a8\",\"type\"
:\"debug\",\"z\":\"de53e1f7.af6de\",\"name\":\"\",\"acti
ve\":true,\"tosidebar\":true,\"console\":false,\"to
status\":false,\"complete\":false,\"statusVal\":
\"\",\"statusType\":\"auto\",\"x\":510,\"y\":360,\"wires
\":[],{\"id\":\"b59f065b.6fa868\",\"type\":\"http
request\",\"z\":\"de53e1f7.af6de\",\"name\":\"\",\"meth
od\":\"POST\",\"ret\":\"obj\",\"paytoqs\":\"ignore\",\"ur
l\":\"https://us-south.ml.cloud.ibm.com/ml/v4/d
eployments/e47e6df5-b312-4828-a09d-df1effe075
3b/predictions?version=2021-03-15\",\"tls\":\",\"p
ersist\":false,\"proxy\":\",\"authType\":\",\"x\":6
70,\"y\":280,\"wires\":[[\"1706f271.0d603e\",\"5312b
bfa.481fa4\"]],{\"id\":\"1706f271.0d603e\",\"type\"
:\"function\",\"z\":\"de53e1f7.af6de\",\"name\":\"Pars
ing\",\"func\":\"msg.payload=msg.payload.predicti
ons[0].values[0]\nreturn
msg;\n\n\"outputs\":1,\"noerr\":0,\"initialize\":
\"\",\"finalize\":\"\",\"x\":820,\"y\":200,\"wires\":[[\"d
a3b51ba.61fa4\",\"57048718.d97178\"]],{\"id\":\"da
3b51ba.61fa4\",\"type\":\"debug\",\"z\":\"de53e1f7.af
```

```
6de","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":false,"statusVal":"","statusType":"auto","x":870,"y":120,"wires":[]}, {"id": "57048718.d97178", "type": "ui_text", "z": "de53e1f7.af6de", "group": "566d14c3.9a0abc", "order": 3, "width": 0, "height": 0, "name": "", "label": "Prediction", "format": "{{msg.payload}}", "layout": "row-spread", "x": 960, "y": 280, "wires": []}, {"id": "5312bbfa.481fa4", "type": "debug", "z": "de53e1f7.af6de", "name": "", "active": true, "tosidebar": true, "console": false, "tostatus": false, "complete": false, "statusVal": "", "statusType": "auto", "x": 770, "y": 360, "wires": []}, {"id": "566d14c3.9a0abc", "type": "ui_group", "name": "Health Insurance Cost Prediction", "tab": "c21e4c60.62854", "order": 1, "disp": true, "width": "6", "collapse": false}, {"id": "c21e4c60.62854", "type": "ui_tab", "name": "Home", "icon": "dashboard", "disabled": false, "hidden": false}]]
```

Here if anyone want to create the same then you have to make some changes in the apikey and the deployment link.

8

9

CONCLUSION

10

FUTURE SCOPE

11

BIBIOGRAPHY

APPENDIX

A. Source code