

Project Scope

Project Name	PREDICTING LIFE EXPECTANCY USING MACHINE LEARNING
Kick-off Date	9th June, 2020
Project Manager	Ashutosh Sharma

Project Summary:

A typical Regression Machine Learning Project leverages historical data to predict insights into the future. This problem statement is aid at predicting Life Expectancy rate of a country given various features.

Life expectancy is a statistical measure of the average time a human being is expected to live, Life expectancy depends on various factors: Regional variations, Economic Circumstances, Sex differences, Mental illness, Physical illness, Education, Year of their birth and other demographic factors. This problem statement provides a way to predict the average life expectancy of people living in a country when various factors such as year, GDP, education alcohol intake of people in the country, expenditure on healthcare system and some specific disease related deaths that happened in the country are given.

Project Requirements:

- Life Expectancy dataset
- IBM Cloud Services
- Watson Studio
- Building ML Models with Python
- Creating End-points for Node-RED Integration

Functional Requirements:

- Life Expectancy dataset
- IBM Cloud Services
- Jupyter Notebook

Technical Requirements:

- Creating Notebook in IBM Watson
- Importing data to Watson
- Building ML Models with Python
- Creating End-points for Node-RED Integration

Software Requirements:

- IBM Cloud Services
- IBM Watson Studio

Project Deliverables:

- Project Documentation.
- A Machine Learning model that will predict life expectancy.
- IBM Watson Studio Auto AI generated model.
- Node red flow diagram

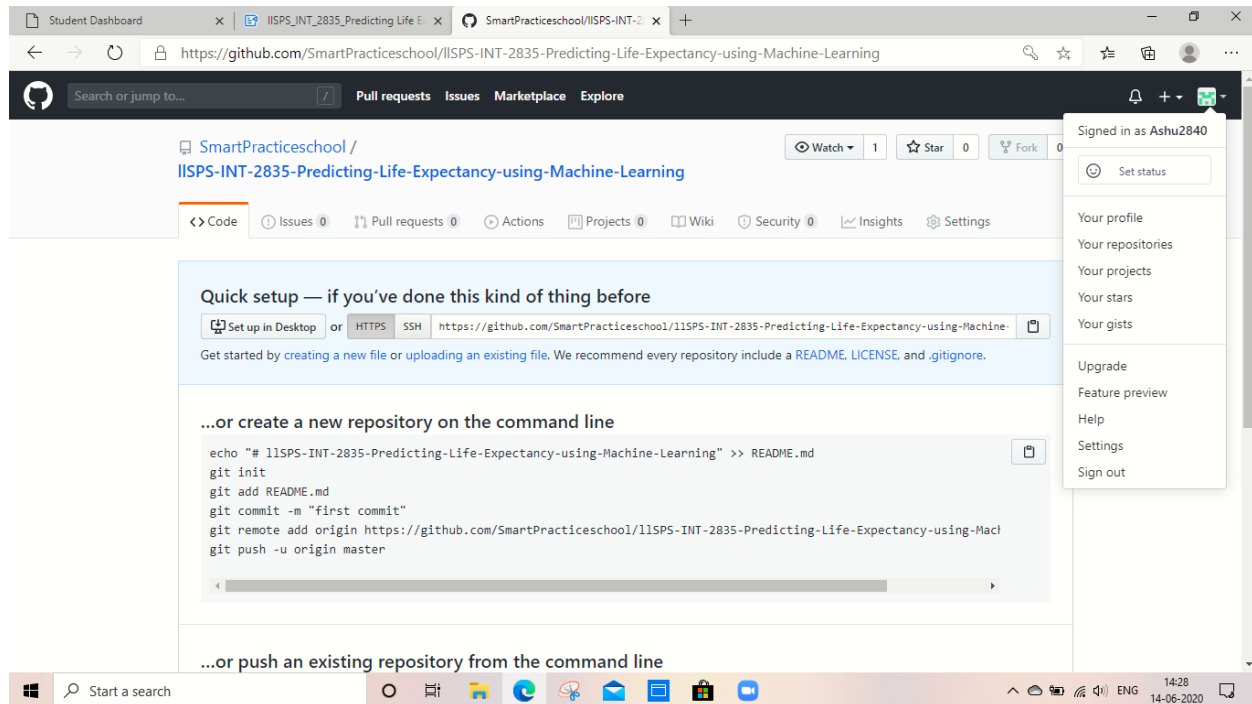
Project Team:

This is a solo project under SmartBridge by Ashutosh Sharma

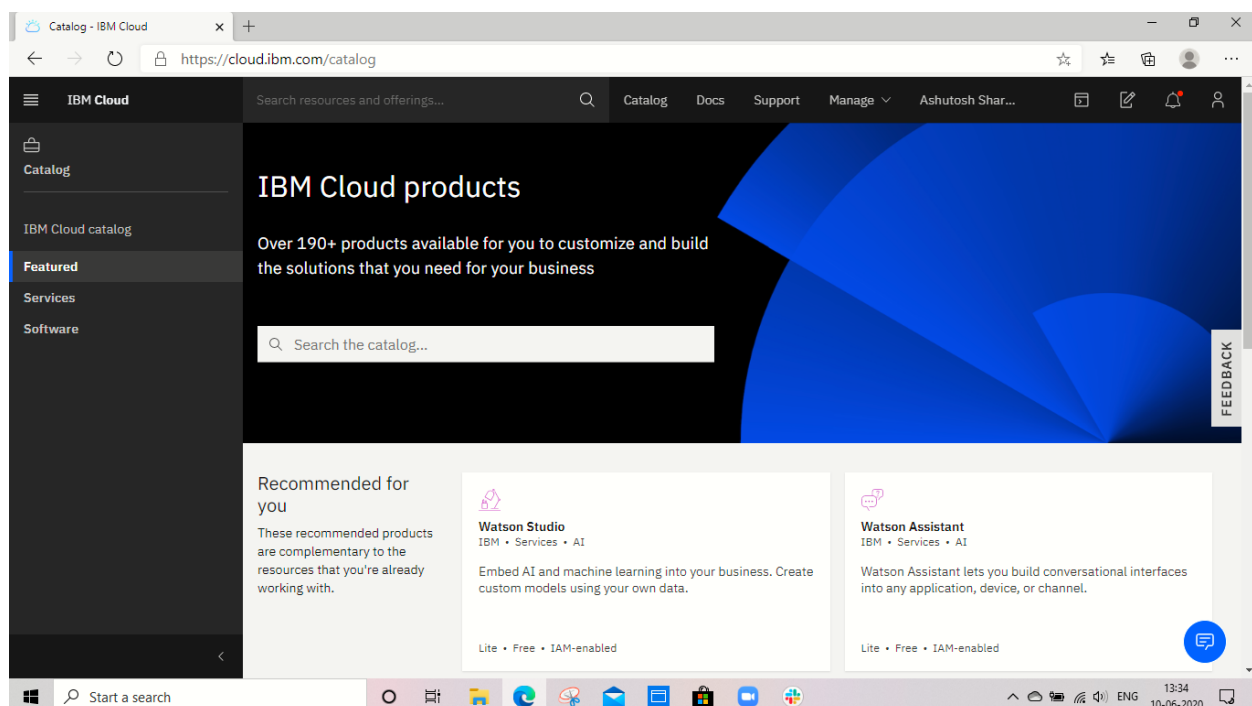
Project Schedule:

This project is scheduled for 30 days. That means we need to build a web application with integration to all these services and deploy all the services on IBM Cloud Platform within 30 days of span i.e., June 9th to July 7th 2020

GitHub Account Screenshot



IBM Account Screenshot



Node-Red Starter Application Screenshot

The screenshot displays the IBM Cloud DevOps console for a pipeline named "LifeExpectancy | Delivery Pipeline". The pipeline is currently in a "STAGE PASSED" state. The BUILD stage shows a last commit by Ashutosh Sharma 4m ago. The DEPLOY stage shows a rolling deployment of Life Expectancy. The interface includes a top navigation bar with links to Catalog, Docs, Support, and Manage, and a bottom taskbar with various application icons.

LifeExpectancy | Delivery Pipeline

Java - JVM has been upgraded to Java 11. [Learn more.](#)

BUILD STAGE PASSED

LAST INPUT Git URL

Last commit by Ashutosh Sha... 4m ago
[Add Node-Red-Dashboard](#)

JOBS View logs and history

Build Passed now

LAST EXECUTION RESULT

Build 2

DEPLOY STAGE PASSED Run Stage

LAST INPUT Stage: BUILD / Job: Build

Build 2

JOBS View logs and history

Rolling Deploy Passed now

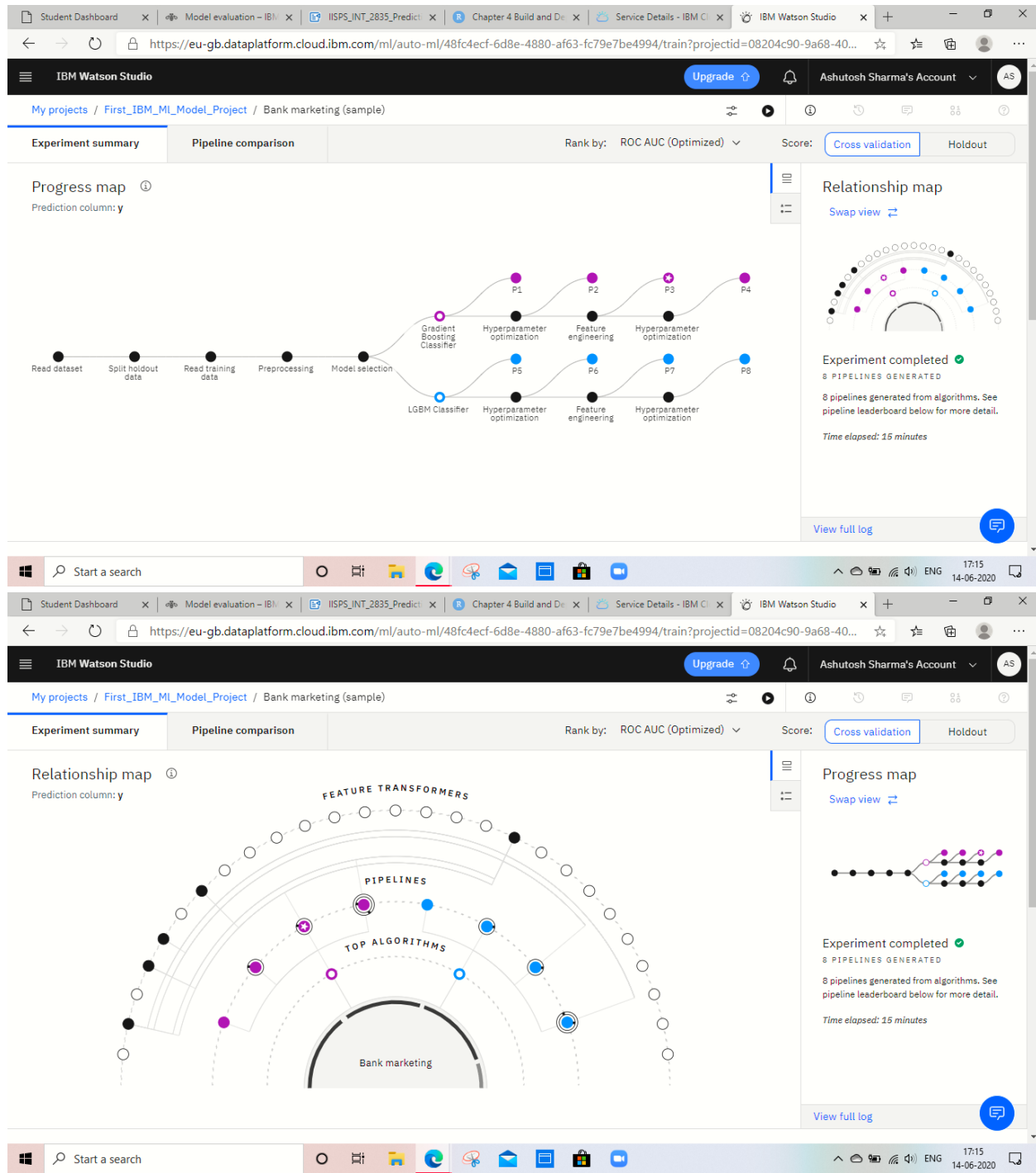
LAST EXECUTION RESULT

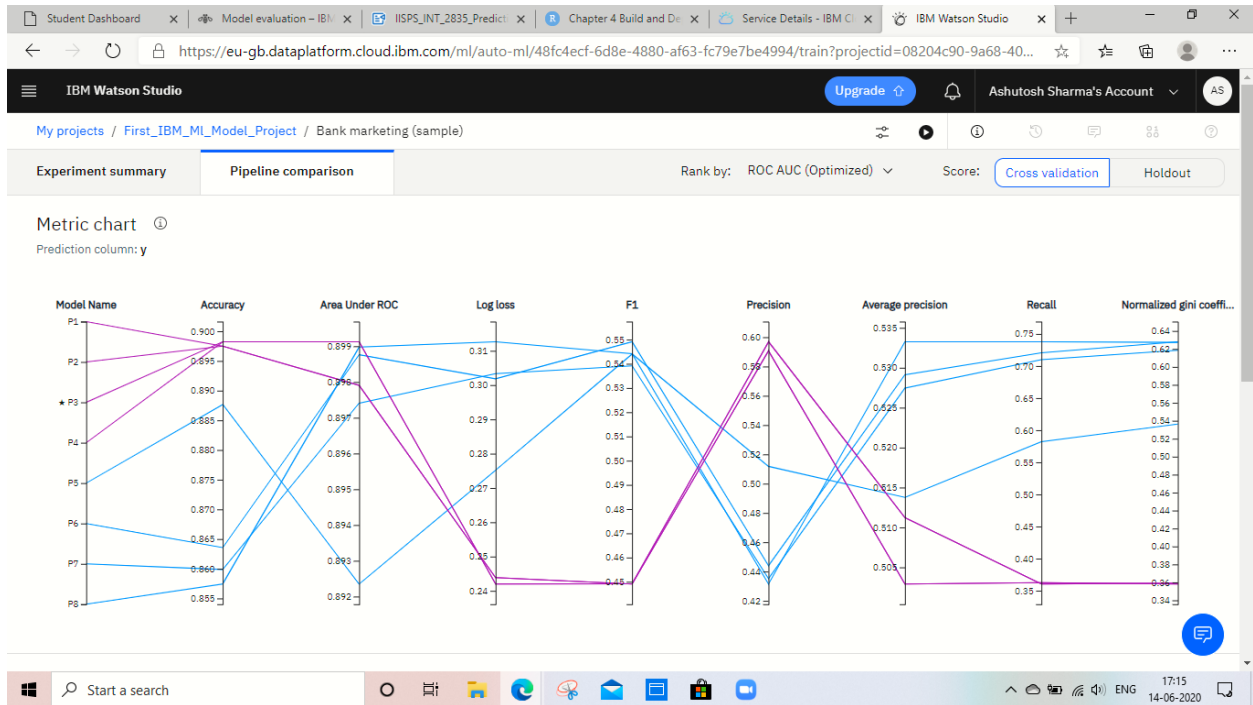
Life Expectancy
[View console](#)

Build 2

15:02 10-06-2020

IBM Model in Watson Studio using Machine Learning And AutoAI Model Screenshot





Student Dashboard | Model evaluation - IBM | IISPS_INT_2835_Predict | Chapter 4 Build and Deploy | Service Details - IBM Cloud | IBM Watson Studio

https://eu-gb.dataplatform.cloud.ibm.com/projects/08204c90-9a68-4041-9618-3b243cbbc8d4/assets?context=wdp

IBM Watson Studio Upgrade Ashutosh Sharma's Account AS

My projects / First_IBM_ML_Model_Project Launch IDE Add to project +

Data assets New data asset +

Name	Type	Created by	Last modified
You don't have any Data assets yet.			

AutoAI experiments New AutoAI experiment +

Name	Status	Model type	Last modified
Bank marketing (sample)	Completed	Binary Classification	Jun 14, 2020, 05:11 PM

Notebooks New notebook +

Name	Shared	Scheduled	Status	Language	Last editor	Last modified
Bank marketing (sample) - P3 notebook				Python 3.6	Ashutosh Sharma	Jun 14, 2020

Student Dashboard xModel evaluation - IBM xIISPS_INT_2835_Predict xChapter 4 Build and DService Details - IBM xIBM Watson Studio x

https://eu-gb.dataplatform.cloud.ibm.com/ml/models/0686fe03-4d22-4103-9f3c-0db1199eb58a/deployments?projectid=08204c90...

IBM Watson StudioUpgradeAshutosh Sharma's AccountAS

My Projects / First_IBM_ML_Model_Project / Bank marketing (sample) - P3 Gr...

Model

Bank marketing (sample) - P3 GradientBoostingClassifierEstimator

OverviewEvaluationDeploymentsLineage

Add Deployment +

NAME	STATUS	TYPE	ACTIONS
model	Ready	Web Service	

Start a search

17:1814-06-2020

Predicting Life Expectancy

Collect the data set for project:-

Country	Year	Status	Life expect	Adult Mor	infant de	Alcohol	percentag	Hepatitis	Measles	BMI	under-fiv	Polio	Total exp	Diphtheri	HIV/AIDS	GDP	Populatio	thinness	thinness: Income
Afghanistan	2015	Developir	65	263	62	0.01	71.27962	65	1154	19.1	83	6	8.16	65	0.1	584.2592	33736494	17.2	17.3
Afghanistan	2014	Developir	59.9	271	64	0.01	73.52358	62	492	18.6	86	58	8.18	62	0.1	612.6965	327582	17.5	17.5
Afghanistan	2013	Developir	59.9	268	66	0.01	73.21924	64	430	18.1	89	62	8.13	64	0.1	631.745	31731688	17.7	17.7
Afghanistan	2012	Developir	59.5	272	69	0.01	78.18422	67	2787	17.6	93	67	8.52	67	0.1	669.959	3696958	17.9	18
Afghanistan	2011	Developir	59.2	275	71	0.01	7.097109	68	3013	17.2	97	68	7.87	68	0.1	63.53723	2978599	18.2	18.2
Afghanistan	2010	Developir	58.8	279	74	0.01	79.67937	66	1989	16.7	102	66	9.2	66	0.1	553.3289	2883167	18.4	18.4
Afghanistan	2009	Developir	58.6	281	77	0.01	56.76222	63	2861	16.2	106	63	9.42	63	0.1	445.8933	284331	18.6	18.7
Afghanistan	2008	Developir	58.1	287	80	0.03	25.87393	64	1599	15.7	110	64	8.33	64	0.1	373.3611	2729431	18.8	18.9
Afghanistan	2007	Developir	57.5	295	82	0.02	10.91016	63	1141	15.2	113	63	6.73	63	0.1	369.8358	26616792	19	19.1
Afghanistan	2006	Developir	57.3	295	84	0.03	17.17152	64	1990	14.7	116	58	7.43	58	0.1	272.5638	2589345	19.2	19.3
Afghanistan	2005	Developir	57.3	291	85	0.02	1.388648	66	1296	14.2	118	58	8.7	58	0.1	25.29413	257798	19.3	19.5
Afghanistan	2004	Developir	57	293	87	0.02	15.29607	67	466	13.8	120	5	8.79	5	0.1	219.1414	24118979	19.5	19.7
Afghanistan	2003	Developir	56.7	295	87	0.01	11.08905	65	798	13.4	122	41	8.82	41	0.1	198.7285	2364851	19.7	19.9
Afghanistan	2002	Developir	56.2	3	88	0.01	16.88735	64	2486	13	122	36	7.76	36	0.1	187.846	21979923	19.9	2.2
Afghanistan	2001	Developir	55.3	316	88	0.01	10.57473	63	8762	12.6	122	35	7.8	33	0.1	117.497	2966463	2.1	2.4
Albania	2000	Developir	54.8	321	88	0.01	10.42496	62	6532	12.2	122	24	8.2	24	0.1	114.56	293756	2.3	2.5
Albania	2015	Developir	77.8	74	0	4.6	364.9752	99	0	58	0	99	6	99	0.1	3954.228	28873	1.2	1.3
Albania	2014	Developir	77.5	8	0	4.51	428.7491	98	0	57.2	1	98	5.88	98	0.1	4575.764	288914	1.2	1.3
Albania	2013	Developir	77.2	84	0	4.76	430.877	99	0	56.5	1	99	5.66	99	0.1	4414.723	289592	1.3	1.4
Albania	2012	Developir	76.9	86	0	5.14	412.4434	99	9	55.8	1	99	5.59	99	0.1	4247.614	2941	1.3	1.4
Albania	2011	Developir	76.6	88	0	5.37	437.0621	99	28	55.1	1	99	5.71	99	0.1	4437.179	295195	1.4	1.5
Albania	2010	Developir	76.2	91	1	5.28	41.82276	99	10	54.3	1	99	5.34	99	0.1	494.3588	291321	1.4	1.5

Create IBM Service:-

IBM Cloud

Search resources and offerings...

IBM Cloud products

Over 190+ products available for you to customize and build the solutions that you need for your business

Search the catalog...

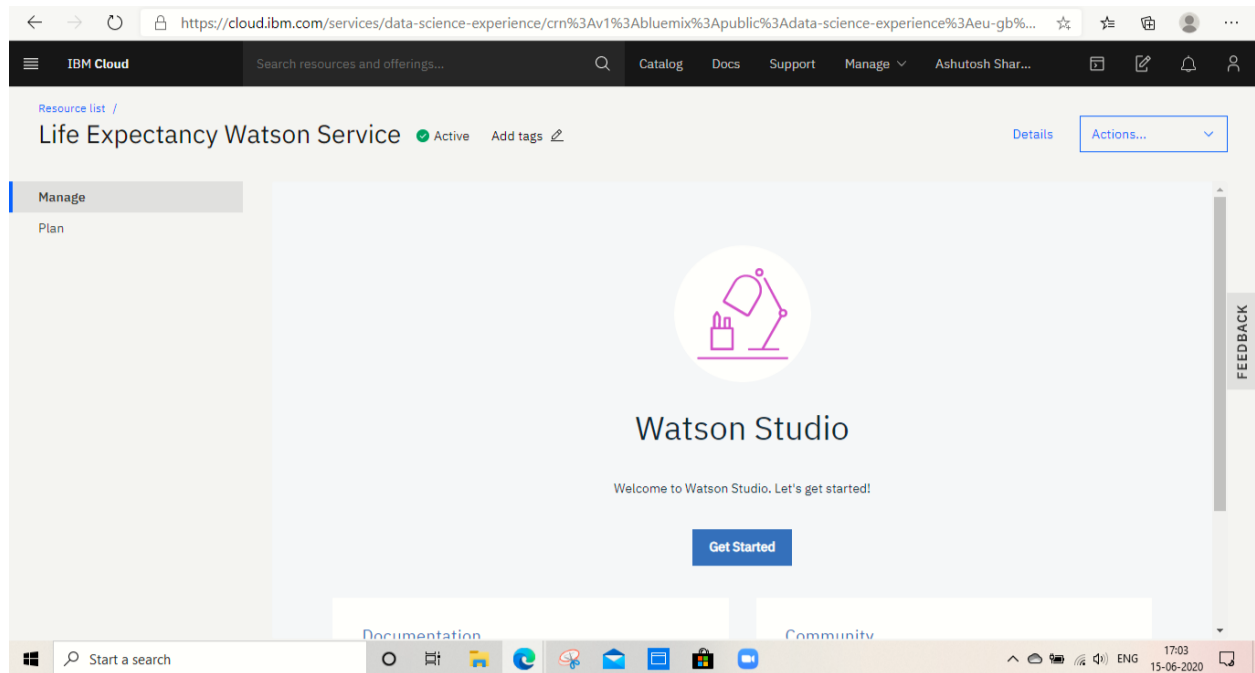
Recommended for you

These recommended products are complementary to the resources that you're already working with.

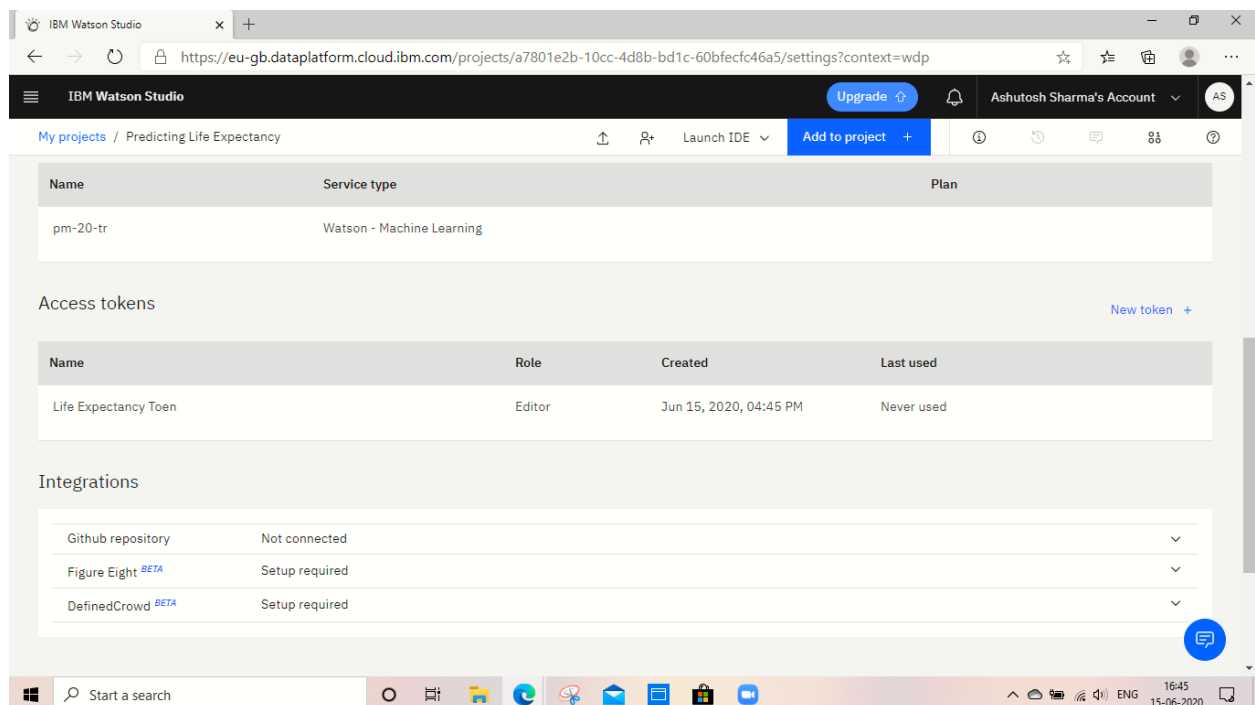
Watson Studio
IBM • Services • AI
Embed AI and machine learning into your business. Create custom models using your own data.
Lite • Free • IAM-enabled

Watson Assistant
IBM • Services • AI
Watson Assistant lets you build conversational interfaces into any application, device, or channel.
Lite • Free • IAM-enabled

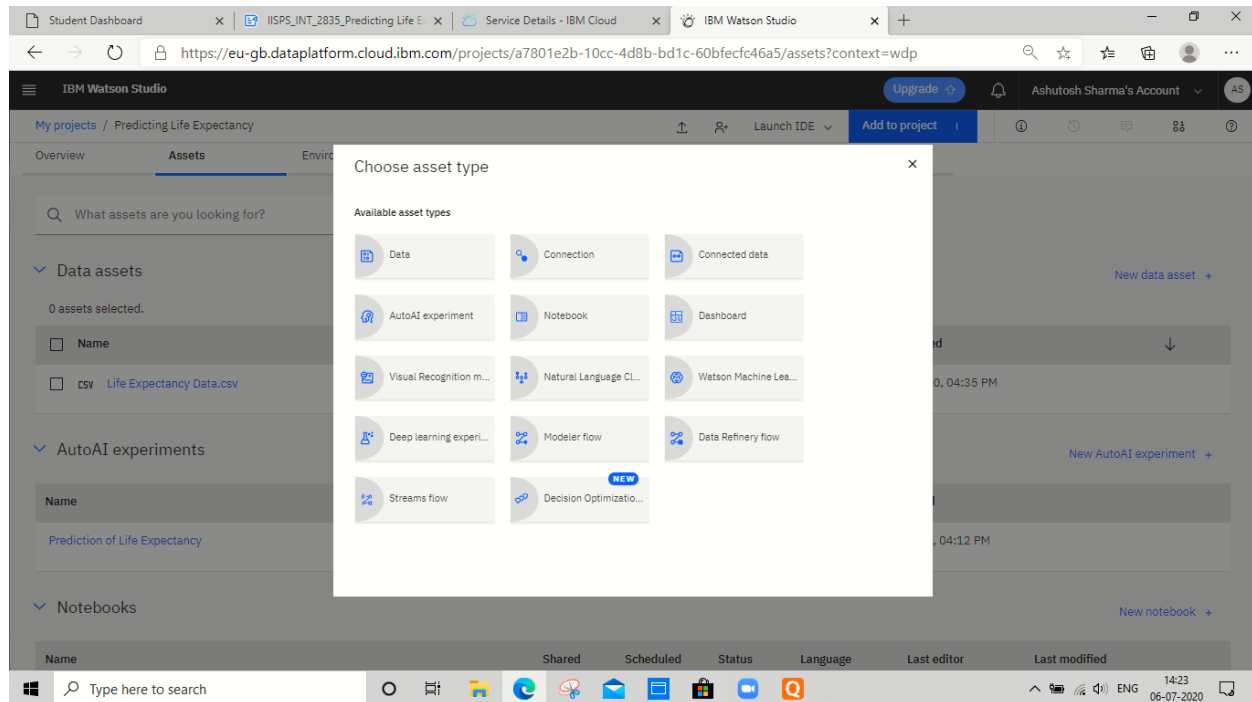
Create Watson Studio:-



Configure Watson Studio and Creating Machine Learning Service:-

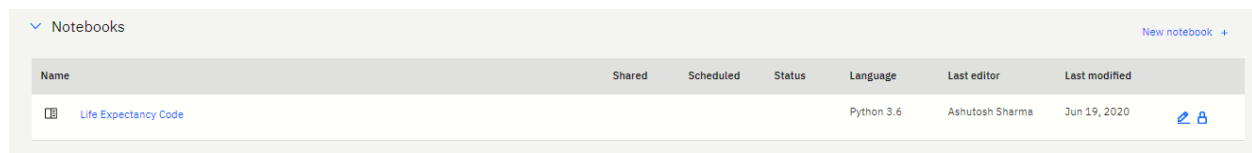


Adding Service in Assest to make model:-



With Python:-

Creating Jupyter Notebook and Importing Data In It:-



Resource list - IBM Cloud x Service Details - IBM Cloud x Life Expectancy Code - IBM Wat... x

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/0d28d4e5-90d8-45da-93fc-a552bb273991/view?projectid=...

IBM Watson Studio Upgrade v Ashutosh Sharma's Account

My projects / Predicting Life Expectancy / Life Expectancy Code

Loading packages

```
In [1]: import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.ensemble import RandomForestRegressor
from sklearn.tree import DecisionTreeRegressor
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
from sklearn.preprocessing import LabelEncoder
```

Importing data

```
In [2]: import types
import pandas as pd
from boto3.client import Config
import boto3

def __iter__(self): return 0

#@hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
client_b0dd268e7ab4b6f653921db0b6d9ca = boto3.client(service_name='s3',
ibm_api_key_id='...',
ibm_auth_endpoint='...',
config=Config(signature_version='auth'),
endpoint_url='https://...')
body = client_b0dd268e7ab4b6f653921db0b6d9ca.get_object(Bucket='predictinglifeexpectancy-donotdelete-pr-c2fohucnilybca', Key='Life Expectancy Data.csv')['body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, '__iter__'): body.__iter__ = types.MethodType(__iter__, body)

df = pd.read_csv(body)
df.head()
```

Out[2]:

Type here to search

df = pd.read_csv(body)
df.head()

Out[2]:

	Country	Year	Status	Life expectancy	Adult Mortality	infant deaths	Alcohol	percentage expenditure	Hepatitis B	Measles	...	Polio	Total expenditure	Diphtheria	HIV/A
0	Afghanistan	2015	Developing	65.0	263.0	62	0.01	71.279624	65.0	1154	...	6.0	8.16	65.0	0.1
1	Afghanistan	2014	Developing	59.9	271.0	64	0.01	73.523582	62.0	492	...	58.0	8.18	62.0	0.1
2	Afghanistan	2013	Developing	59.9	268.0	66	0.01	73.219243	64.0	430	...	62.0	8.13	64.0	0.1
3	Afghanistan	2012	Developing	59.5	272.0	69	0.01	78.184215	67.0	2787	...	67.0	8.52	67.0	0.1
4	Afghanistan	2011	Developing	59.2	275.0	71	0.01	7.097109	68.0	3013	...	68.0	7.87	68.0	0.1

5 rows x 22 columns

Build A Machine Learning Model And Create Endpoints For Node-RED Integration

```
In [37]: metadata = {  
        client.repository.ModelMetaNames.AUTHOR_NAME : "Ashutosh Sharma",  
        client.repository.ModelMetaNames.AUTHOR_EMAIL : "ashutosh28420@gmail.com",  
        client.repository.ModelMetaNames.NAME : "LifeExpectancyPrediction"  
        }  
  
In [38]: stored_data = client.repository.store_model(rfr,meta_props=metadata)  
  
In [39]: model_uid = client.repository.get_model_uid(stored_data)  
  
In [40]: # Model deployment  
        deploy = client.deployments.create(model_uid)  
  
        #####  
        Synchronous deployment creation for uid: 'XXXXXXXXXXXXXXXXXXXX' started  
        #####  
  
        INITIALIZING  
        DEPLOY_SUCCESS  
  
        .....  
        Successfully finished deployment creation, deployment_uid='XXXXXXXXXXXXXXXXXXXX'  
        .....  
  
In [41]: scoring_endpoint = client.deployments.get_scoring_url(deploy)  
  
In [42]: scoring_endpoint
```

Without Python:-

Creating AutoAI Experiment and Importing Data In It:-

New AutoAI experiment

Define details

From blank From sample

Name *

Prediction of Life Expectancy

Description

Here we are using IBM(s) **AutoAI** experiment to create Machine Learning model with the help of data.

Associate services

Watson Machine Learning Service Instance *

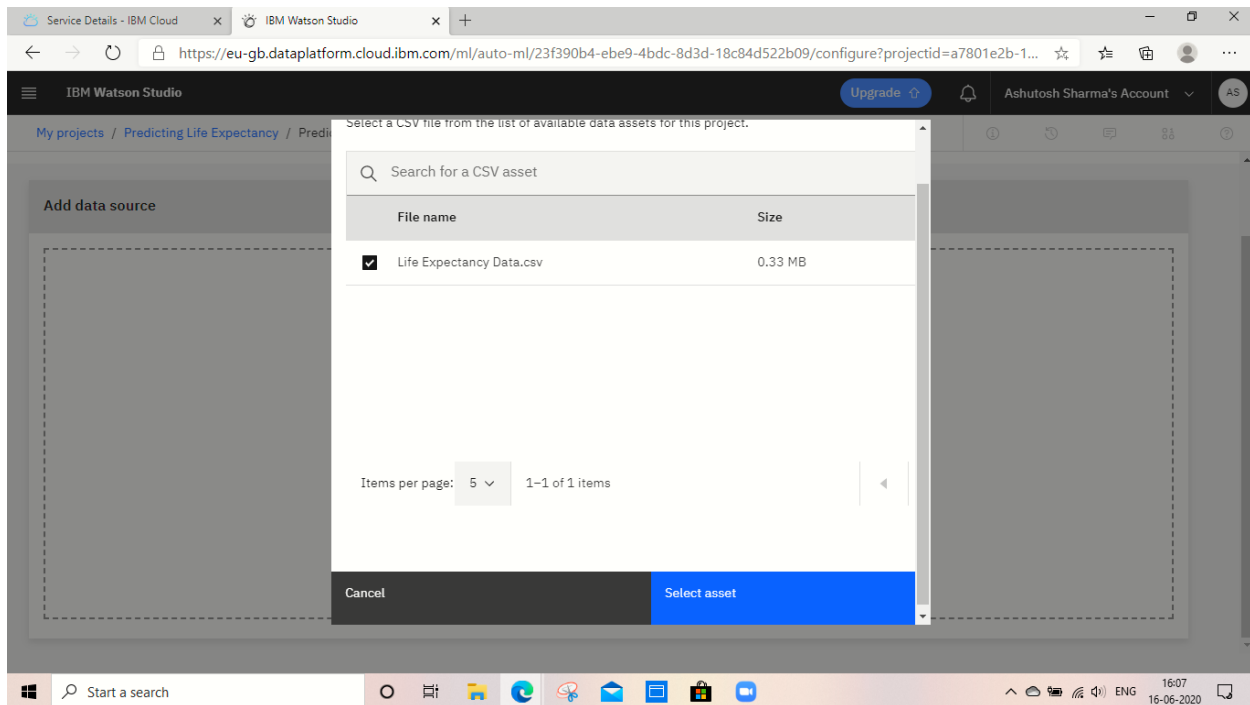
pm-20-tr

Compute configuration * ⓘ

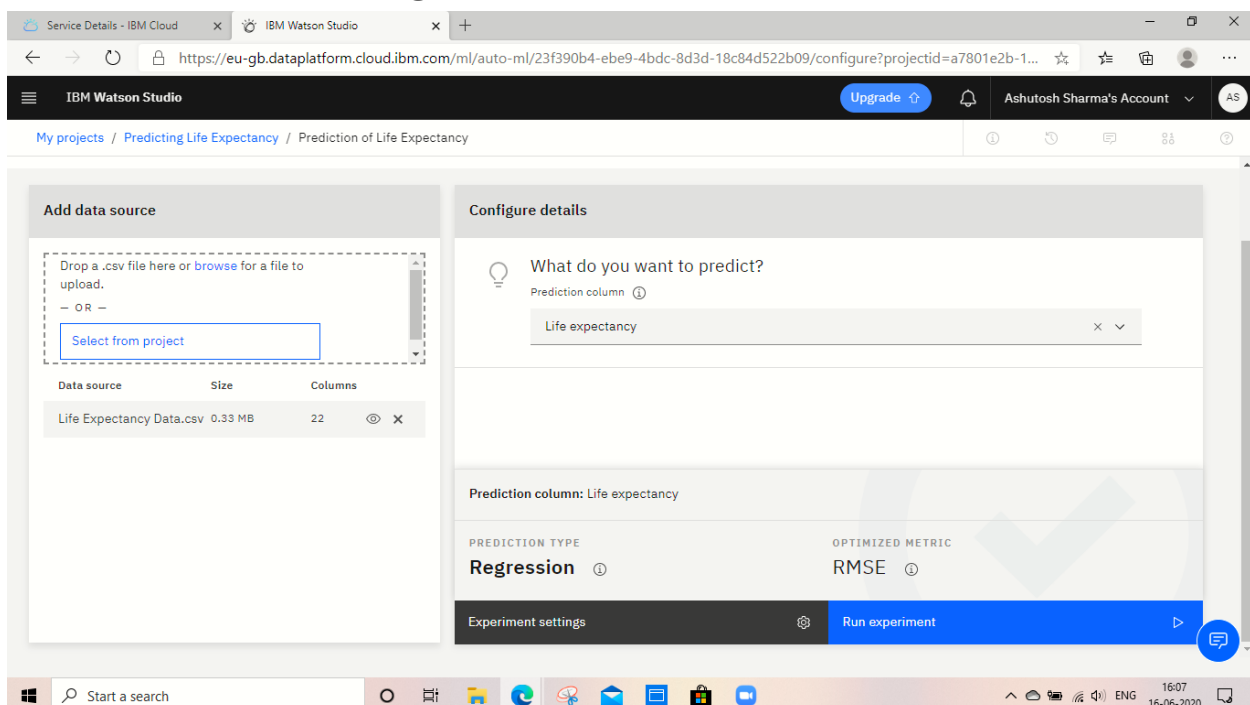
8 vCPU and 32 GB RAM

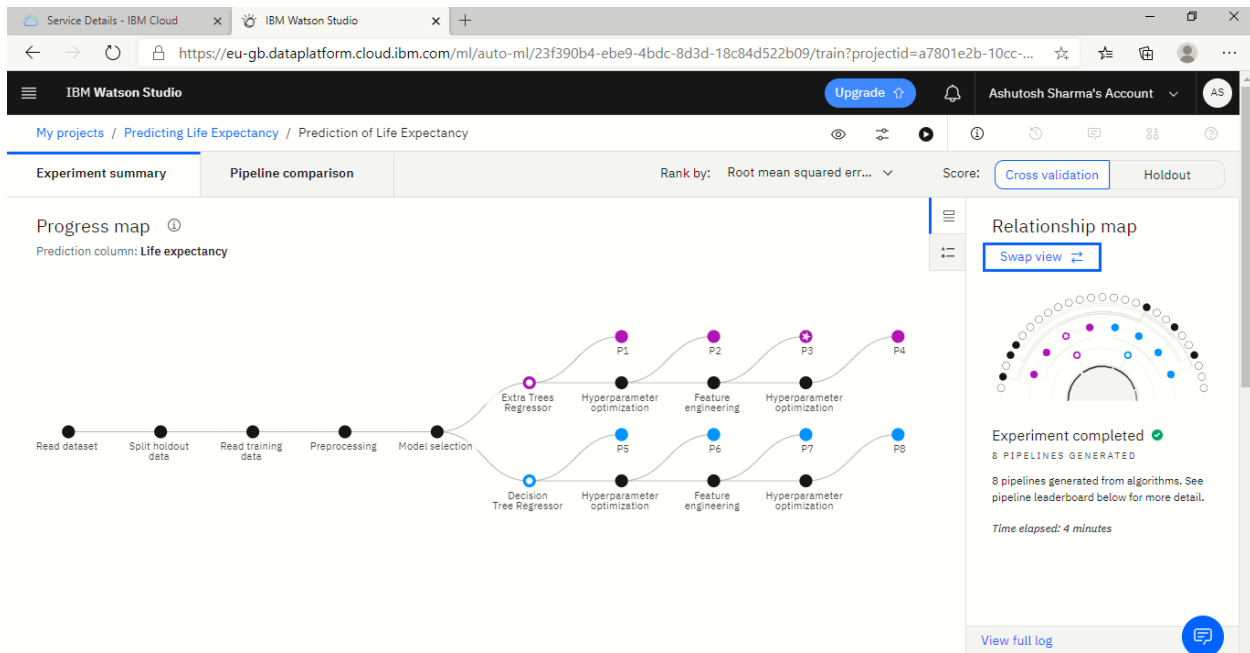
This compute configuration consumes 20 capacity units per hour. [Learn more](#) about capacity unit hours and Watson Machine Learning pricing plans.

Cancel Create



Build A Machine Learning Model And Create Endpoints For Node-RED Integration:-





Start a search

Service Details - IBM Cloud x IBM Watson Studio x +

https://eu-gb.dataplatform.cloud.ibm.com/ml/auto-ml/23f390b4-ebe9-4bdc-8d3d-18c84d522b09/train?projectid=a7801e2b-10cc-...

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Experiment summary Pipeline comparison Rank by: Root mean squared err... Score: Cross validation Holdout

Rank	↑	Name	Algorithm	RMSE (Optimized)	Enhancements	Build time
>	★ 1	Pipeline 3	Extra Trees Regressor	2.005	HPO-1 FE	00:00:47
>	2	Pipeline 4	Extra Trees Regressor	2.005	HPO-1 FE HPO-2	00:00:25
>	3	Pipeline 1	Extra Trees Regressor	2.070	None	00:00:01
>	4	Pipeline 2	Extra Trees Regressor	2.070	HPO-1	00:00:10
>	5	Pipeline 7	Decision Tree Regressor	2.732	HPO-1 FE	00:00:37
>	6	Pipeline 8	Decision Tree Regressor	2.732	HPO-1 FE HPO-2	00:00:06
>	7	Pipeline 5	Decision Tree Regressor	2.807	None	00:00:01
>	8	Pipeline 6	Decision Tree Regressor	2.807	HPO-1	00:00:01

Start a search

16:22 16-06-2020

The image displays two screenshots of the IBM Watson Studio interface, showing the implementation and testing of an ML deployment.

Top Screenshot: ML Prediction on Life Expectancy - Implementation

The interface shows the "Implementation" tab selected. The "Scoring End-point" is `https://eu-gb.ml.cloud.ibm.com/v4/deployments/0447057f-d7e7-47b0-a45e-3c33baedd315/predictions`. The "Authorization" is "Bearer <token>". The "ML-Instance-ID" is noted as required in the HTTP header. The "Content-type" is "application/json".

Code Snippets

The "Code Snippets" section shows the "cURL" tab selected. The snippet is:

```
# TODO: manually define and pass values to be scored below
curl -X POST https://eu-gb.ml.cloud.ibm.com/v4/deployments/0447057f-d7e7-47b0-a45e-3c33baedd315/predictions \
  -H 'Accept: application/json' --header 'Authorization: Bearer $IAM_TOKEN' --header 'ML-Instance-ID: $ML_INSTANCE_ID' --data '{
  "fields": [
    "prediction"
  ],
  "values": [
    [
      63.357400000000014
    ]
  ]
}'
```

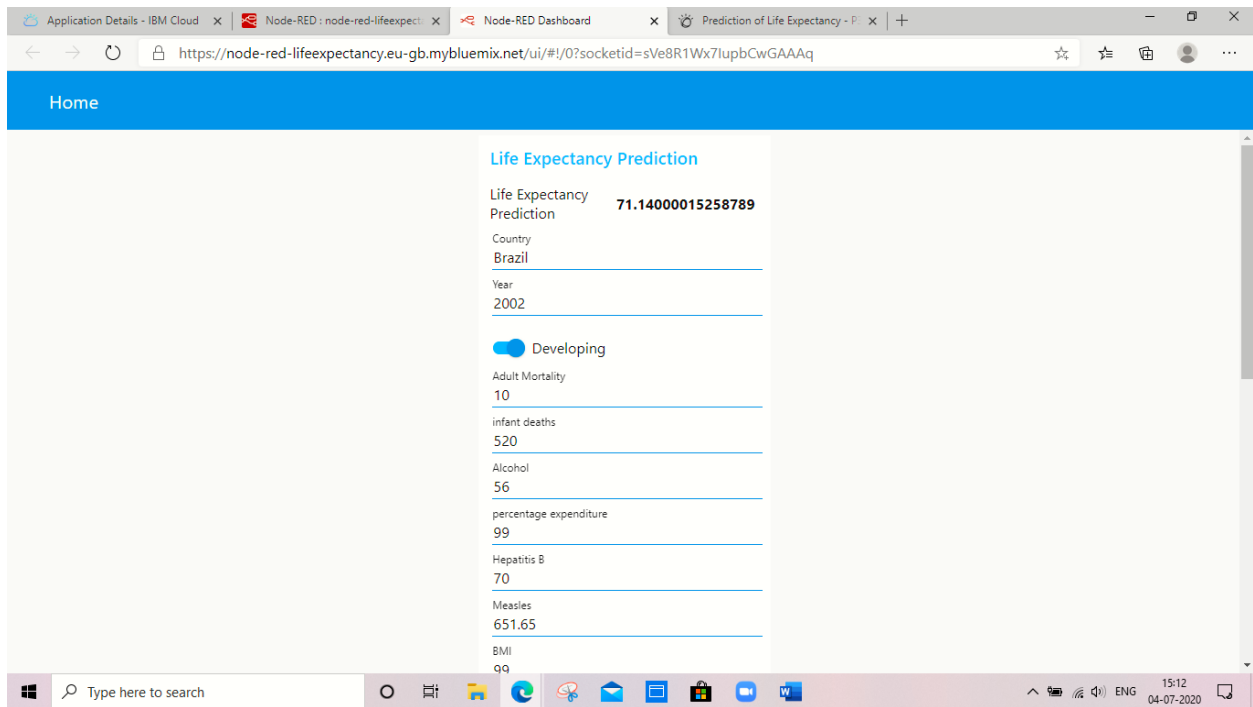
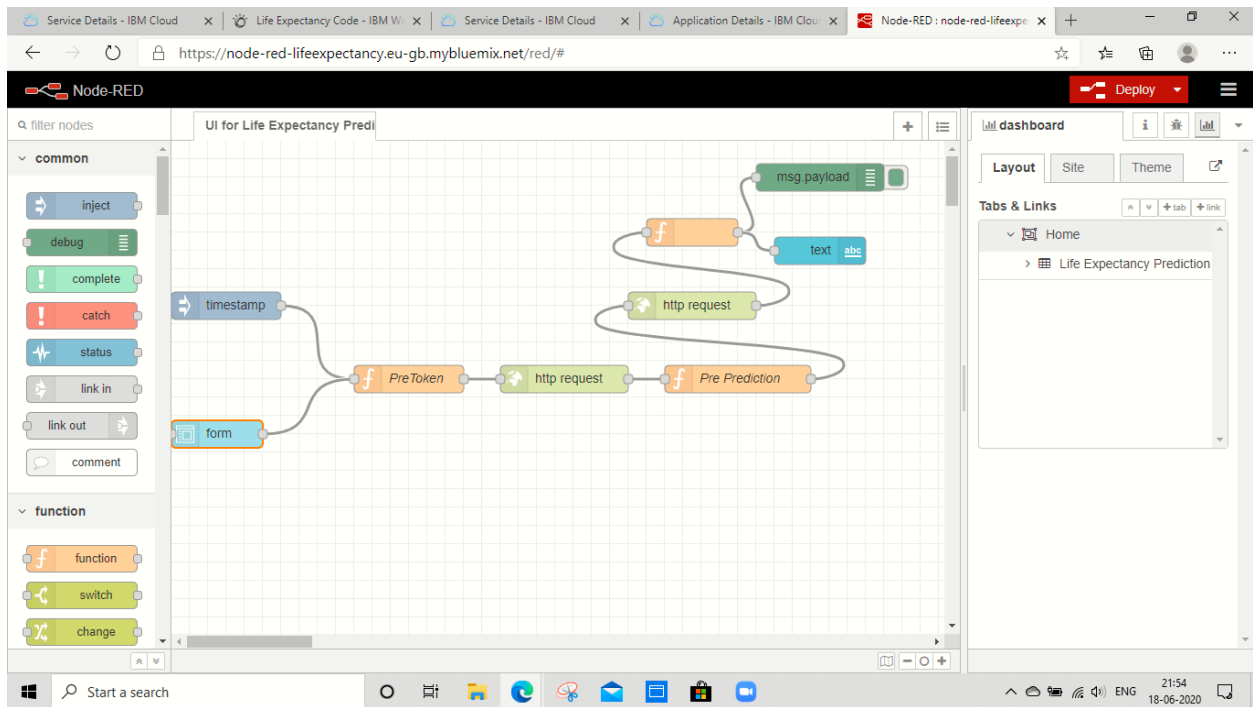
Bottom Screenshot: ML Prediction on Life Expectancy - Test

The interface shows the "Test" tab selected. The "Input data" section displays a JSON object:

```
{
  "fields": [
    "Year",
    "Status",
    "Adult Mortality",
    "infant deaths",
    "Alcohol",
    "percentage expenditure",
    "Hepatitis B"
  ],
  "values": [
    [
      63.357400000000014
    ]
  ]
}
```

The "Predict" button is visible at the bottom left of the input data section.

Build Node-RED Flow To Integrate ML Services



Flask APP Development

