UDACITY MACHINE LEARNING NANODEGREE 2020

CAPSTONE PROJECT REPORT

Predicting Life Expectancy of a Country

Submitted

by

Peyala Samarasimha Reddy **June, 2020**

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1. INTRODUCTION

1.1 Overview

Although there have been lot of studies undertaken in the past on factors affecting life expectancy considering demographic variables, income composition and mortality rates. It was found that affect of immunization and human development index was not taken into account in the past. Also, some of the past research was done considering multiple linear regression based on data set of one year for all the countries. Hence, this gives motivation to resolve both the factors stated previously by formulating a regression model based on mixed effects model and multiple linear regression while considering data from a period of 2000 to 2015 for all the countries. Important immunization like Hepatitis B, Polio and Diphtheria will also be considered. In a nutshell, this study will focus on immunization factors, mortality factors, economic factors, social factors and other health related factors as well. Since the observations this dataset are based on different countries, it will be easier for a country to determine the predicting factor which is contributing to lower value of life expectancy. This will help in suggesting a country which area should be given importance in order to efficiently improve the life expectancy of its population.

This project relies on accuracy of data. The Global Health Observatory (GHO) data repository under World Health Organization (WHO) keeps track of the health status as well as many other related factors for all countries The data-sets are made available to public for the purpose of health data analysis. The data-set related to life expectancy, health factors for 193 countries has been collected from the same WHO data repository website and its corresponding economic data was collected from United Nation website. Among all categories of health-related factors only those critical factors were chosen which are more representative. It has been observed that in the past 15 years , there has been a huge development in health sector resulting in improvement of human mortality rates especially in the developing nations in comparison to the past 30 years. Therefore, in this project we have considered data from year 2000-2015 for 193 countries for further analysis. The individual data files have been merged together into a single data-set. On initial visual inspection of the data showed some missing values. As the data-sets were from WHO, we found no evident errors. Missing data was handled in R software by using Missmap command. The result indicated that most of the missing data was for population, Hepatitis B and GDP. The missing data were from less known countries like Vanuatu, Tonga, Togo, Cabo Verde etc. Finding all data for these countries was difficult and hence, it was decided that we exclude these countries from the final model data-set. The final merged file(final dataset) consists of 22 Columns and 2938 rows which meant 20 predicting variables. All predicting variables was then divided into several broad categories: Immunization related factors, Mortality factors, Economical factors and Social factors.

1.2 Purpose

Project title **:** Predicting Life Expectancy using Machine Learning- SB54135

Category **:** Machine Learning

Skills required : Python, IBM Cloud, IBM Watson

Problem Description

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

Life Expectancy is a statistical measue of the average time a human being is expected to live, Life expectancy depends on various factors : Regional variations, Economic Circumstacnes, Sex Differences, Mental Illnesses ,Physical Illnesses , Education, Year of the ir birth ans other demographic factors. This problem statement provides a way to predict 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.

The purpose of this project is that the people from various places can easily predict their life expectancy by providing the inputs asked by the model. This software can be used by all people in the world because the training part of this model contains inputs and predictions of more number of countries.

Economic growth

Predicting life expectancy would play a vital role in judging the growth and development of the economy. Across countries, high life expectancy is associated with high income per capita. Increase in life expectancy also leads to an increase in the “manpower” of a country. The knowledge asset of a country increases with the number of individuals in a country.

Population Growth

Helps the government bodies take appropriate measures to control the population growth and also direct the utilization of the increase in human resources and skillset acquired by people over many years.

Personal growth

This project would also help an individual assess his/her lifestyle choices and alter them accordingly to lead a longer and healthier life. It would make them more aware of their general health and its improvement or deterioration over time.

Growth in Health Sector

Based on the factors used to calculate life expectancy of an individual and the outcome, health care will be able to fund and provide better services to those with greater need.

Insurance Companies

Insurance sector will be able to provide individualized services to people based on the life expectancy outcomes and factors.

2. LITERATURE SURVEY

2.1 Existing Problem

Even though we have enough resources for the latest era of technology, letting us know about the survival chances of a person belonging to particular countries are not available in the today, because this problem many of the people across the facing lots of problems for survival and die with hungry. Many social welfare organisations are helping the people but it has limitations Although there have been lot of studies undertaken in the past on factors affecting life expectancy considering demographic variables, income composition and mortality rates. It was found that affect of immunization and human development index was not taken into account in the past. So, letting us to know about the life expectancy predictions has become a necessity that too user friendly.

2.2 Proposed Solution

The project tries to create a model based on data provided by the World Health Organization (WHO) to evaluate the life expectancy for different countries in years. The data offers a timeframe from 2000 to 2015.

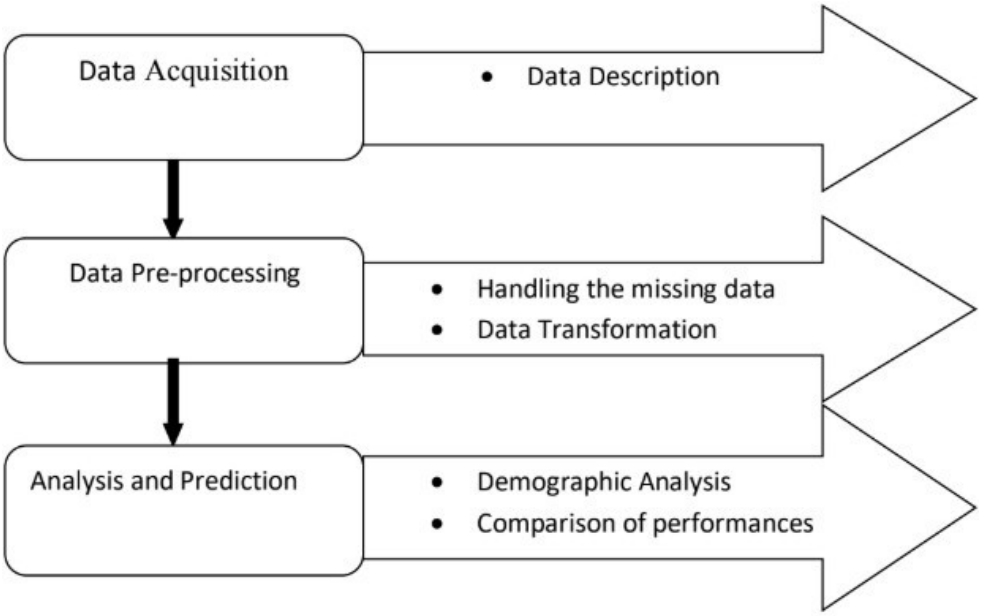
The data originates from here: https://www.kaggle.com/kumarajarshi/life-expectancy-who/data

The output algorithms have been used to test if they can maintain their accuracy in predicting the life expectancy for data they haven't been trained.

So many people were expecting to use a model of life expectancy prediction. In order to that, many institutions and companies are leading their team to build that model in this regard. In my project, I have proposed a solution to predict the life expectancy using machine learning. Machine Learning is the process of training the computer to think and decide solutions like human. The reason why I have chosen this architecture was only with the help of Machine Learning, deep understanding of the data and an ability to create a model can be done. Design a Regression model to predict life expectancy ratio of a given country based on some features provided such as year, GDP (gross domestic product), education, alcohol intake of people in the country, expenditure on healthcare system and some specific disease related deaths that happened in the country.

Methodology used

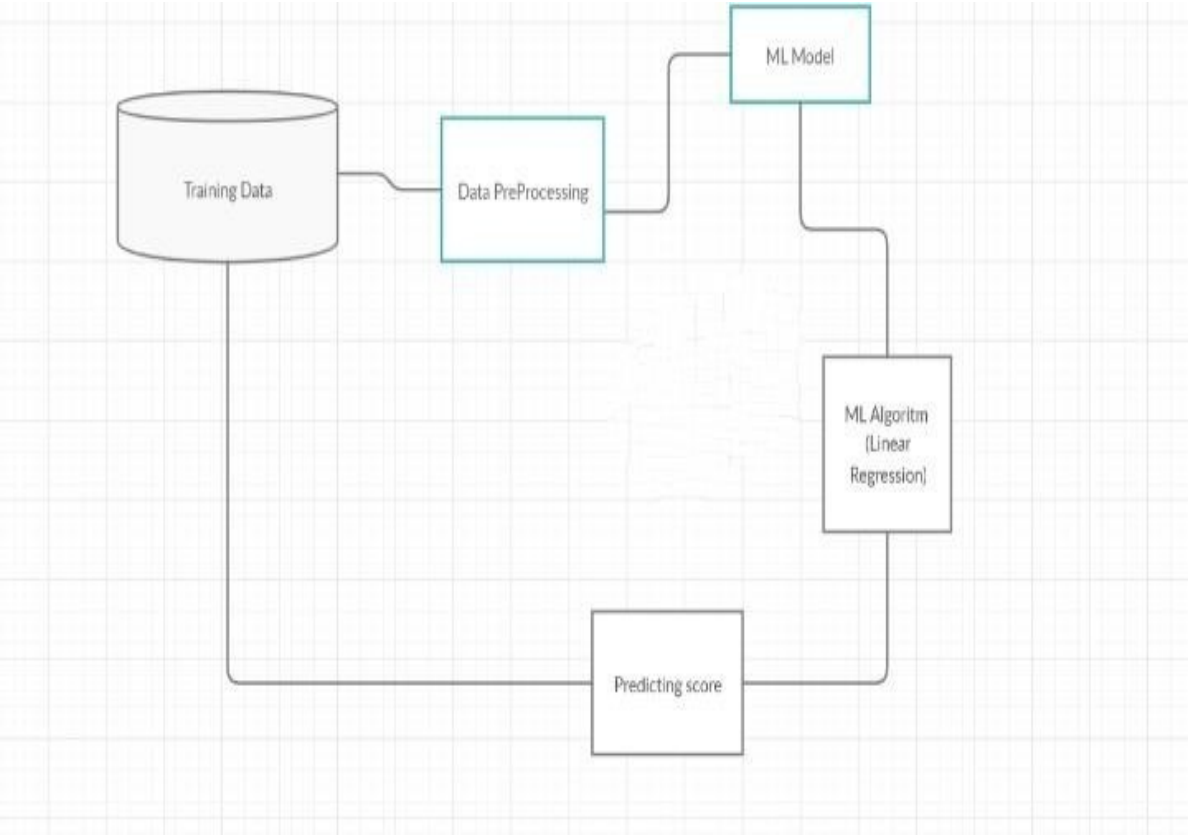
Work flow for this project can be divided into three sub-tasks. These include acquiring the data and understanding various features of the data, preprocessing the data set to align it with our



requirements and remove any inconsistency, and finally analyzing the data using regression based prediction algorithm with the key performance index being accuracy of prediction.

3. THEORITICAL ANALYSIS

3.1 Block diagram



3.2 Hardware / Software designing

Project Planning and Kickoff

- Understanding the project description and analyze the data and attributes in the given dataset.
- Creating GitHub account
- Installing Slack and create account with the mail id
- Learning to use Zoho writer.

Explore IBM Cloud Platform

- Creating IBM cloud account with the mail id

- Creating IBM academic initiative account with the mail id
- a Node-Red starter application.

Explore IBM Watson services

- Exploring IBM Watson use cases.
- Learning about IBM Watson Machine Learning.

Introduction to Watson Studio

- Learning to build own Machine Learning model using IBM Watson.
- Automate the Machine Learning Model

Predicting Life Expectancy with Python

- Collecting Data set from www.kaggle.com
- Creating IBM Watson services
- Create a jupyter notebook and import data from Object storage.

Predicting Life Expectancy without Python

- Import data set and create AutoAI experiment
- Created Node-Red model and integrated with AutoAI

4. EXPERIMENTAL INVESTIGATIONS

Machine Learning Model

Algorithm Formulated to solve the given Problem Statement

Algorithm steps:

Step 1 : Import the Data set

Step 2 : Read and Understand the data

Step3 : Explore the Data set

Step4 : Decide the amount of data for training data and testing data

Step5 : Give 70 percent data for training and remaining data for testing.

Step6 : Assign train data set to the models

Step7 : Choose the algorithm and create the model

Step8 : Make predictions for test data set.

Step9 : Calculate accuracy for the algorithm

Step 10 : Apply the model for further predictions.

Setting Up the Environment

An IBM cloud account was set up to access various services to create and deploy

the model. The following services have been used in the project:

1. Watson Studio - This is where the notebook has been created in a project to write the regression code along with the data set.

2. Node Red - Node Red is the front end application that uses interconnecting nodes to interact with machine learning services of the cloud and the model to show predictions when inputs are given

Data Acquisition

The data set on Statistical Analysis on factors influencing Life Expectancy is provided in the smart internz platform . The below link helps in downloading the data set required to complete this project

https://www.kaggle.com/kumarajarshi/life-expectancy-who

Model Requirements

Python

Python is a multi-paradigm, general purpose, high level programming language, which focuses on code read- ability. It has a large library, which provides tools for many tasks and has a wide support base. This project uses python 3.5.

Python Libraries

Pandas : Pandas is used for data manipulation and analysis through operations and data structures on numerical tables and time series.

Numpy : It adds support as well as contains high-level mathematical functions to operate on large multidimensional arrays and matrices.

Matplotlib : It is a plotting library that that enables 2d diagramming and begetting of bar charts, histograms and so forth.

Sci-kit learn : It is a free software machine learning library that features various regression, clustering and classification algorithms. It works in conjunction with numPy and python scientific library sciPy.

Data Preprocessing

Data preprocessing is an essential step in order to increase the accuracy of machine learning models. It involves handling inaccurate and missing data, noisy data in the form of outliers, and inconsistent data in the form of duplication and others.

Data Cleaning

Data was often not consistent; missing values or values out of range was common. The methods used for cleaning is to replace the missing or noisy values by forward filling them using mean of the feature.

Analysis and Prediction

Linear Regression and Random Forest algorithm has been applied to the data set to train the model and increase the accuracy for prediction of the the life expectancy of any given country.

Data Transformation

Scaling : Scaling is required to standardize the independent feature in the dataset to a fixed range. Primarily, two types of feature scaling methods:

1. Min-max scaling (Normalization) (value - min)/(max - min) Sklearn provides a class called MinMaxScaler for this
2. Standardization (value - mean)/std Sklearn provides a class called StandardScaler for this

Evaluation Metrics

Evaluation metrics calculated are:

1. Mean Squared error
2. $R^2 score$

Linear Regression

Linear Regression is a machine learning algorithm based on *supervised learning*. It performs a *regression task*. Regression models a target prediction value based on independent variables. It is mostly used for finding out the relationship between variables and forecasting. Different regression models differ based on – the kind of relationship between dependent and independent variables, they are considering and the number of independent variables being used. Linear regression performs the task to predict a dependent variable value (y) based on a given independent variable (x). So, this regression technique finds out a linear relationship between x (input) and y(output). Hence, the name is Linear Regression.

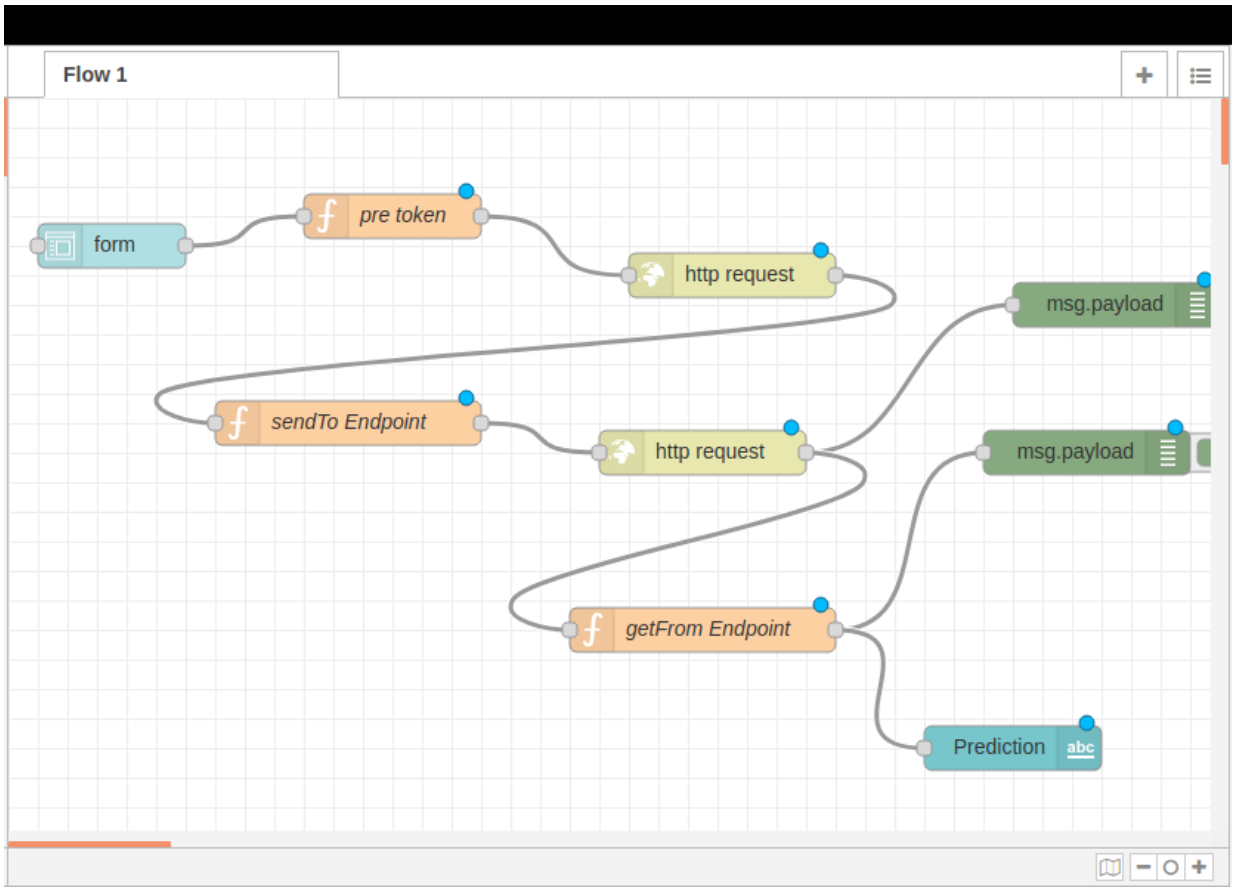
Extra Tree Regression Method

Extra Trees is an ensemble machine learning algorithm that combines the predictions from many decision trees. It is related to the widely used random forest algorithm. It can often achieve as-good or better performance than the random forest algorithm, although it uses a simpler algorithm to construct the decision trees used as members of the ensemble. It is also easy to use given that it has few key hyperparameters and sensible heuristics for configuring these hyperparameters.

Node Red Flow

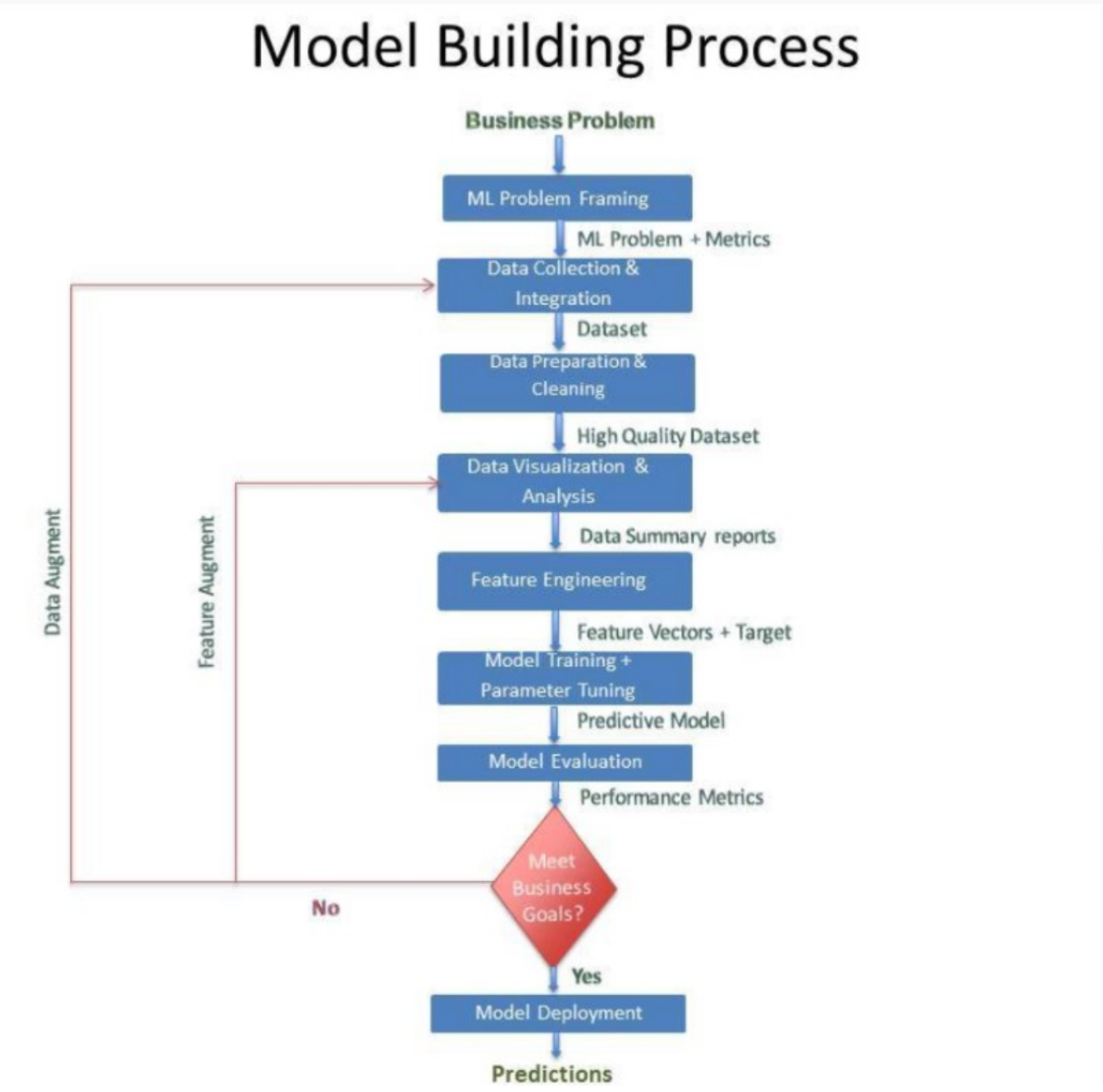
A Node RED starter application was created to implement the front end of the project. In the starter appli- cation, nodes are dragged and dropped to create a flow to integrate the application with the machine learning model.

The following form appears after deployment of the app wherein the user can input values and life expectancy prediction is displayed acccording to the inputs.



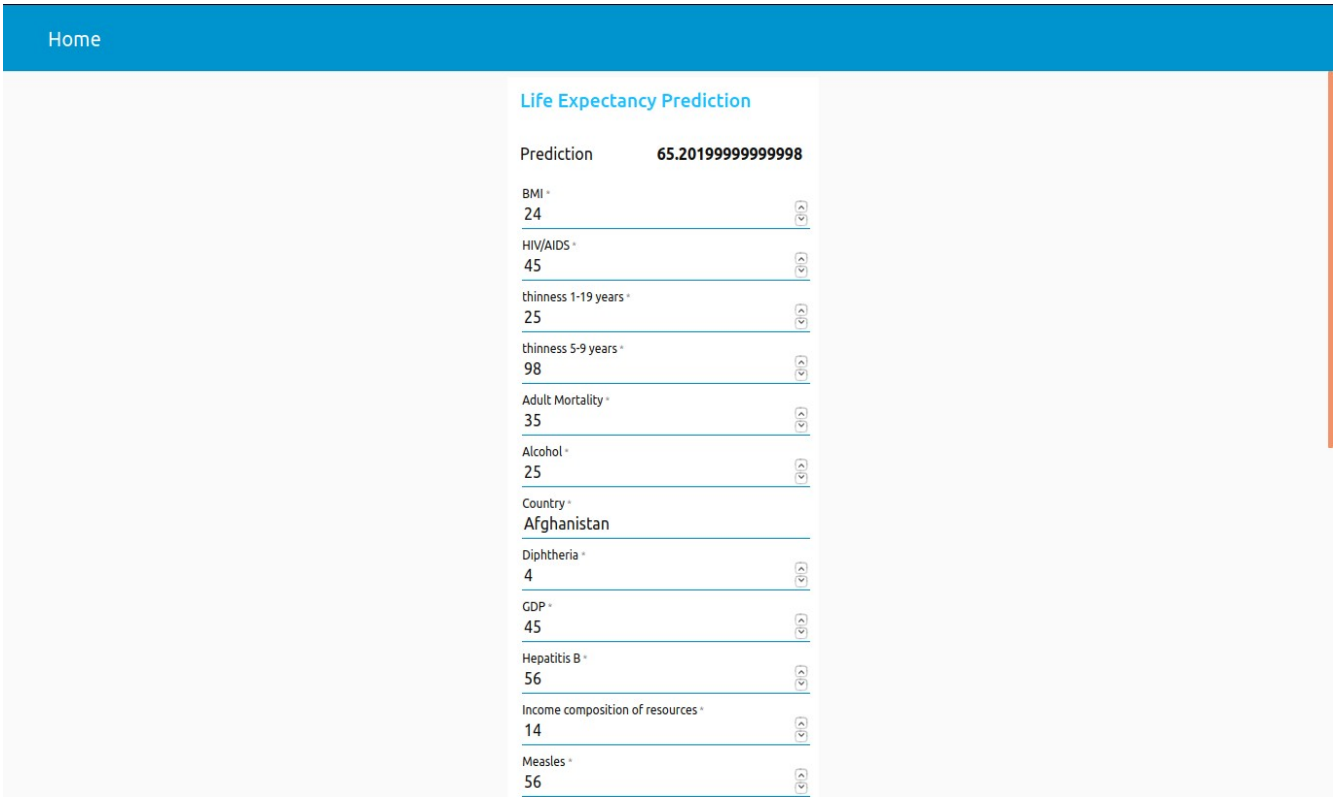
NodeRed flow of the project

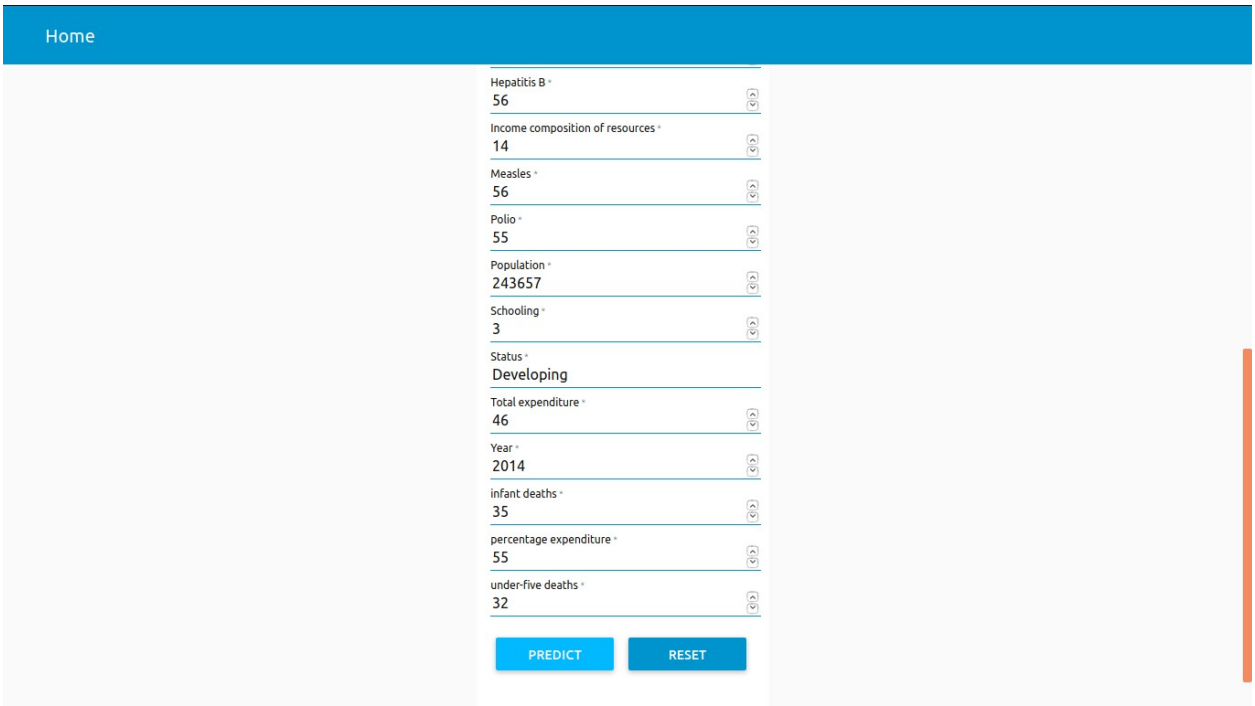
5. FLOWCHART


Model Building Process
Business Problem
ML Problem Framing
ML Problem + Metrics
Data Collection & Integration
Dataset
Data Preparation & Cleaning
High Quality Dataset
Data Visualization & Analysis
Data Summary reports
Feature Engineering
Feature Vectors + Target
Model Training + Parameter Tuning
Predictive Model
Model Evaluation
Performance Metrics
Meet Business Goals?
No
Yes
Model Deployment
Predictions
Data Augment
Feature Augment

6. RESULT

The final UI of the project with input and output





7. ADVANTAGES & DISADVANTAGES

Every coin has two faces, each face has its own property and features. It’s time to uncover the faces of ML. A very powerful tool that holds the potential to revolutionize the way things work**.**

Advantages

1.Advantages of using IBM Watson:

- Processes unstructured data
- Fills human limitations
- Acts as a decision support system, doesn’t replace humans
- Improves performance + abilities by giving best available data
- Improve and transform customer service
- Handle enormous quantities of data
- Sustainable Competitive Advantage

2. Easy for user to interact with the model via the UI.

3. User-friendly

4. Easy to build and deploy.

5. Doesn’t require much storage space.

Disadvantages

1.Disadvantages of using IBM Watson

- Seen as disruptive technology
- Maintenance
- Doesn't process structured data directly
- Increasing rate of data, with limited

2. Not connected to database, hence no record of input.

3. Requires internet connect

8. APPLICATIONS

Personalized Life Expectancy

Individuals can predict their own life expectancy by inputting values in the corresponding fields. This could help make people more aware of their general health, and its improvement or deterioration over time. This may motivate them to make healthier lifestyle choices

Government

It could help the government bodies take appropriate measures to control the population growth and also direct the utilization of the increase in human resources and skillset acquired by people over many years. Across countries, high life expectancy is associated with high income per capita. Increase in life expectancy also leads to an increase in the “manpower” of a country. The knowledge asset of a country increases with the number of individuals in a country.

Health Sector

on the factors used to calculate life expectancy of an individual and the outcome, health care will be able to fund and provide better services to those with greater need.

Insurance Companies

Insurance sector will be able to provide individualized services to people based on the life expectancy outcomes and factors.

9. CONCLUSION

I have developed a model that will predict the life expectancy of a specific demographic region based on the inputs provided from the user. Various factors have a significant impact on the life span such as Adult Mortality, Population, Under 5 Deaths, Thinness 1-5 Years, and Alcohol, HIV, Hepatitis B, GDP, Percentage Expenditure and many more. Here my dataset contains 22 columns as factors affecting this project. User can interact with the system via a simple user interface which is like a with the required fields to fill for getting output.

10. FUTURE SCOPE

This project ‘Predicting Life Expectancy using Machine Learning’ will be developed into predicting life expectancy of a person with more factors including in the data-set as well as geographical factors along with the health related data of a person. Then there will be no limitations for this project. I used Extra Tree Regressor for this project and I got 97.14% accuracy, so we can apply many other new regression techniques to increase the accuracy along with decreasing error.

11. BIBLIOGRAPHY

Node-RED Starter Application

https://developer.ibm.com/tutorials/how-to-create-a-node-red-starter-application/

Watson studio cloud

https://bookdown.org/caoying4work

Dataset Reference

https://www.kaggle.com/kumaraja rshi/life-expectancy-who

IBM cloud services

https://www.youtube.com/watch?v=DBRGlAHdj48&list=PLzpeuWUENMK2PYtasCaKK4bZjaYzhW23L

Import the data set into the jupyter notebook

https://www.youtube.com/watch?v=Jtej3Y6uUng

APPENDIX

Source code : Predicting Life Expectancy using Machine Learning

Installing watson studio client for model building

!pip install watson_machine_learning_client

#import basic libraries for preprocessing and EDA

```
import pandas as pd
import numpy as np
import os
import matplotlib.pyplot as plt
import seaborn as sns
pd.options.display.float_format='{:.5f}'.format
import warnings
import math

#import libraries for pipelining
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import OneHotEncoder
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import StandardScaler
from sklearn.compose import ColumnTransformer

#import libraries for train and test
from sklearn.model_selection import train_test_split

#import ExtraTreesRegressor for model fit and prediction
from sklearn.ensemble import ExtraTreesRegressor

#import libraries for accuracy and error calculation
```

```
from sklearn.metrics import mean_squared_error, r2_score

#import libraries for model building and deployment
from watson_machine_learning_client import WatsonMachineLearningAPIClient
```

Importing Dataset

import types

```
import types
import pandas as pd
from botocore.client import Config
import ibm_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_e4707596b92a4ff98466fe0798510979 = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='xpn5iNqiLFxhBI9AHbGcB0kzDNAaljjSPwOQNTx7-xzi',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.eu-geo.objectstorage.service.networklayer.com')

body =
client_e4707596b92a4ff98466fe0798510979.get_object(Bucket='mlpredictinglifeacc
uracy-donotdelete-pr-wy1nywsmz65trf',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()
```

Data Preprocessing

df.columns

df=df.rename(columns={'Life expectancy ':'Life expectancy','Measles ':'Measles',' BMI ':'BMI','Diphtheria ':'Diphtheria',' HIV/AIDS':'HIV/AIDS',' thinness 1-19 years':'thinness 1-19 years',' thinness 5-9 years':'thinness 5-9 years'})

df.isnull().sum()

#fill the null values with mean to avoid test and train error

```
df=df.fillna(df.mean())
```

#checking for null values

```
df.isnull().sum()
```

Exploratory data analysis

```
#Ploting heat map to find similar values

df_kor=df.corr()
plt.figure(figsize=(10,10))
sns.heatmap(df_kor,vmin=-1,vmax=1,annot=True,linewidth=0.1)
```

Train and Test

```
#splitting the dataset
Y=df['Life expectancy']
X=df[df.columns.difference(['Life expectancy'])]

#check for numerical columns
df.select_dtypes(include=['int64', 'float64']).columns

df.select_dtypes(include=['object', 'bool']).columns

#identify the categorical values for column transform

categorical_features = ['Country', 'Status']
categorical_feature_mask = X.dtypes==object
categorical_features = X.columns[categorical_feature_mask].tolist()
#defne categorical pipeline
categorical_transformer = Pipeline(steps=[
    ('onehot', OneHotEncoder(handle_unknown='ignore')),])

#identify the numerical values for column transform

numeric_features = ['Year','Adult Mortality','infant
deaths','Alcohol','percentage expenditure', 'Hepatitis B',
       'Measles', 'BMI', 'under-five deaths ', 'Polio', 'Total
expenditure','Diphtheria', 'HIV/AIDS', 'GDP', 'Population',
       'thinness  1-19 years', 'thinness 5-9 years','Income composition of
resources', 'Schooling']
numeric_feature_mask = X.dtypes!=object
numeric_features = X.columns[numeric_feature_mask].tolist()
#define numeric pipeline
numeric_transformer = Pipeline(steps=[
    ('imputer', SimpleImputer(strategy='median')),
    ('scaler', StandardScaler()),
])

#pipelining using columntransform
preprocessor = ColumnTransformer(
    transformers=[
        ('num', numeric_transformer, numeric_features),
        ('cat', categorical_transformer, categorical_features)
    ]
)
```

```
#define a regressor model using pipeline function
ExtraTreeRegressor = Pipeline([
     ('preprocessor', preprocessor),
     ('ExtraTreeRegressor', ExtraTreesRegressor(n_estimators=100,
random_state=0))
])

#train-test split
X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=0.2)

#fit the training model
reg = ExtraTreeRegressor.fit(X_train, Y_train)

#predict the test data value
test_pred=reg.predict(X_test)
print(test_pred)

#error estimation and accuracy

print('Mean squared error: ',mean_squared_error(Y_test, test_pred))
print('R2 score: ',r2_score(Y_test, test_pred)*100)
```

Model Building and Deployment

```
wml_credentials={                     #see below instruction for credentials

 "apikey": "*****************",
 "instance_id": "****************",
  "url": "****************"
}
client = WatsonMachineLearningAPIClient(wml_credentials)
print(client.service_instance.get_url())

model_props = {client.repository.ModelMetaNames.AUTHOR_NAME: "Peyala
Samarasimha Reddy",

               client.repository.ModelMetaNames.AUTHOR_EMAIL:
"samarasimhareddy369@gmail.com",
               client.repository.ModelMetaNames.NAME:
"LifeExpectancyPrediction"}
#STORE THE MACHINE LEARNING MODEL
model_artifact=client.repository.store_model(ExtraTreeRegressor,
meta_props=model_props)

#GET MODEL UID
model_uid = client.repository.get_model_uid(model_artifact)
#DEPLOY THE MODEL
create_deployment = client.deployments.create(model_uid, name="Predicting Life
Expectancy using Machine Learning")

#GET SCORING END-POINT URL
scoring_endpoint = client.deployments.get_scoring_url(create_deployment)
```

```
print(scoring_endpoint)
```

Instruction:

For service credentials, open ibm cloud account and get in credentials tabs of machine learning instance.
Path to get that:- Go To dashboard->Resource list->cloud Foundry services->machine learning ** ->service credentials->copy and paste
wml_credentials={
  "apikey": "**********",
  "instance_id": "**********",
  "url": "**********"
}

Node-Red code:


```
[
    {
        "id": "a733e1fa.bd6678",
        "type": "tab",
        "label": "Flow 1",
        "disabled": false,
        "info": ""
    },
    {
        "id": "f945e4a0.31da68",
        "type": "ui_form",
        "z": "a733e1fa.bd6678",
        "name": "",
        "label": "",
        "group": "f60ef5b9.5856a",
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        "width": 0,
        "height": 0,
        "options": [
            {
```

```
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    "rows": null
},
{
    "label": "HIV/AIDS",
    "value": "b",
    "type": "number",
    "required": true,
    "rows": null
},
{
    "label": "thinness  1-19 years",
    "value": "c",
    "type": "number",
    "required": true,
    "rows": null
},
{
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    "rows": null
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    "label": "Adult Mortality",
    "value": "e",
    "type": "number",
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{
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    "value": "f",
```

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    "rows": null
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    "required": true,
    "rows": null
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    "label": "Diphtheria ",
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    "required": true,
    "rows": null
  },
  {
    "label": "GDP",
    "value": "i",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Hepatitis B",
    "value": "j",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Income composition of resources",
    "value": "k",
    "type": "number",
    "required": true,
```

```
    "rows": null
  },
  {
    "label": "Measles ",
    "value": "l",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Polio",
    "value": "m",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Population",
    "value": "n",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Schooling",
    "value": "o",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Status",
    "value": "p",
    "type": "text",
    "required": true,
    "rows": null
  },
```

```
    {
      "label": "Total expenditure",
      "value": "q",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "Year",
      "value": "r",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "infant deaths",
      "value": "s",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "percentage expenditure",
      "value": "t",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "under-five deaths ",
      "value": "u",
      "type": "number",
      "required": true,
      "rows": null
    }
  ],
  "formValue": {
```

```
        "a": "",
        "b": "",
        "c": "",
        "d": "",
        "e": "",
        "f": "",
        "g": "",
        "h": "",
        "i": "",
        "j": "",
        "k": "",
        "l": "",
        "m": "",
        "n": "",
        "o": "",
        "p": "",
        "q": "",
        "r": "",
        "s": "",
        "t": "",
        "u": ""
    },
    "payload": "",
    "submit": "predict",
    "cancel": "reset",
    "topic": "",
    "x": 70,
    "y": 100,
    "wires": [
        [
            "bc831c8e.528f2"
        ]
    ]
},
{
    "id": "fb0f6014.c5295",
    "type": "http request",
```

```
    "z": "a733e1fa.bd6678",
    "name": "",
    "method": "POST",
    "ret": "obj",
    "paytoqs": false,
    "url": "**********insert your url",
    "tls": "",
    "persist": false,
    "proxy": "",
    "authType": "",
    "x": 470,
    "y": 180,
    "wires": [
      [
        "894080cd.5e3c6",
        "f6aefa26.d13bf8"
      ]
    ]
  },
  {
    "id": "d47886b0.52eee8",
    "type": "debug",
    "z": "a733e1fa.bd6678",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "x": 750,
    "y": 280,
    "wires": []
  },
  {
    "id": "f6aefa26.d13bf8",
    "type": "function",
    "z": "a733e1fa.bd6678",
```

```
        "name": "getFrom Endpoint",
        "func":
"msg.payload=msg.payload.values[0][0];\n//msg.payload=msg.payload.predictions
[0].values[0][0];\nreturn msg;",
        "outputs": 1,
        "noerr": 0,
        "x": 470,
        "y": 280,
        "wires": [
          [
            "d47886b0.52eee8",
            "d0ea74a.02cda88"
          ]
        ]
    },
    {
        "id": "894080cd.5e3c6",
        "type": "debug",
        "z": "a733e1fa.bd6678",
        "name": "",
        "active": true,
        "tosidebar": true,
        "console": false,
        "tostatus": false,
        "complete": "payload",
        "targetType": "msg",
        "x": 710,
        "y": 180,
        "wires": []
    },
    {
        "id": "71d21e66.f83b08",
        "type": "function",
        "z": "a733e1fa.bd6678",
        "name": "sendTo Endpoint",
        "func": "//get token and make headers\nvar
token=msg.payload.access_token;\nvar instance_id=\"**********\"\
```

```
nmsg.headers={'Content-Type':
'application/json',\"Authorization\":\"Bearer \"+token,\"ML-Instance-
ID\":instance_id}\n\n//get variables that are set earlier\nvar a = global.get(\"a\");\
nvar b = global.get(\"b\");\nvar c = global.get(\"c\");\nvar d = global.get(\"d\");\
nvar e = global.get(\"e\");\nvar f = global.get(\"f\");\nvar g = global.get(\"g\");\nvar
h = global.get(\"h\");\nvar i = global.get(\"i\");\nvar j = global.get(\"j\");\nvar k =
global.get(\"k\");\nvar l = global.get(\"l\");\nvar m = global.get(\"m\");\nvar n =
global.get(\"n\");\nvar o = global.get(\"o\");\nvar p = global.get(\"p\");\nvar q =
global.get(\"q\");\nvar r = global.get(\"r\");\nvar s = global.get(\"s\");\nvar t =
global.get(\"t\");\nvar u = global.get(\"u\");\n\n//send the user values to service
endpoint\nmsg.payload = \n{\"fields\":[\"BMI\", \"HIV/AIDS\", \"thinness  1-19
years\", \"thinness 5-9 years\",\n       \"Adult
Mortality\", \"Alcohol\", \"Country\", \"Diphtheria \", \"GDP\",\n       \"Hepatitis
B\", \"Income composition of resources\", \"Measles \", \"Polio\",\
n       \"Population\", \"Schooling\", \"Status\", \"Total expenditure\", \"Year\",\n
\"infant deaths\", \"percentage expenditure\", \"under-five deaths \"],\n\"values\":
[[a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u]]};\n\nreturn msg;\n",
        "outputs": 1,
        "noerr": 0,
        "x": 210,
        "y": 180,
        "wires": [
            [
                "fb0f6014.c5295"
            ]
        ]
    },
    {
        "id": "a3042c1b.71c68",
        "type": "http request",
        "z": "a733e1fa.bd6678",
        "name": "",
        "method": "POST",
        "ret": "obj",
        "paytoqs": false,
        "url": "https://iam.cloud.ibm.com/identity/token",
        "tls": "",
```

```
        "persist": false,
        "proxy": "",
        "authType": "basic",
        "x": 370,
        "y": 100,
        "wires": [
            [
                "71d21e66.f83b08"
            ]
        ]
    },
    {
        "id": "bc831c8e.528f2",
        "type": "function",
        "z": "a733e1fa.bd6678",
        "name": "pre token",
        "func": "//make user given values as global variables\
nglobal.set(\"a\",msg.payload.a);\nglobal.set(\"b\",msg.payload.b);\
nglobal.set(\"c\",msg.payload.c);\nglobal.set(\"d\",msg.payload.d);\
nglobal.set(\"e\",msg.payload.e);\nglobal.set(\"f\",msg.payload.f);\
nglobal.set(\"g\",msg.payload.g);\nglobal.set(\"h\",msg.payload.h);\
nglobal.set(\"i\",msg.payload.i);\nglobal.set(\"j\",msg.payload.j);\
nglobal.set(\"k\",msg.payload.k);\nglobal.set(\"l\",msg.payload.l);\
nglobal.set(\"m\",msg.payload.m);\nglobal.set(\"n\",msg.payload.n);\
nglobal.set(\"o\",msg.payload.o);\nglobal.set(\"p\",msg.payload.p);\
nglobal.set(\"q\",msg.payload.q);\nglobal.set(\"r\",msg.payload.r);\
nglobal.set(\"s\",msg.payload.s);\nglobal.set(\"t\",msg.payload.t);\
nglobal.set(\"u\",msg.payload.u);\n\n//following are required to receive a token\
nvar apikey=\"u-5c5jmIdfyPIPAb4R8puYY2gmYOUln0gck_G0eStcJE\";\
nmsg.headers={\"content-type\":\"application/x-www-form-urlencoded\"};\
nmsg.payload={\"grant_type\":\"urn:ibm:params:oauth:grant-
type:apikey\",\"apikey\":apikey};\n\nreturn msg;",
        "outputs": 1,
        "noerr": 0,
        "x": 210,
        "y": 120,
        "wires": [
```

```
      [
        "a3042c1b.71c68"
      ]
    ]
},
{
    "id": "d0ea74a.02cda88",
    "type": "ui_text",
    "z": "a733e1fa.bd6678",
    "group": "f60ef5b9.5856a",
    "order": 2,
    "width": 0,
    "height": 0,
    "name": "",
    "label": "Prediction",
    "format": "{{msg.payload}}",
    "layout": "row-spread",
    "x": 680,
    "y": 420,
    "wires": []
},
{
    "id": "f60ef5b9.5856a",
    "type": "ui_group",
    "z": "",
    "name": "Life Expectancy Prediction",
    "tab": "4ab20b87.404294",
    "order": 1,
    "disp": true,
    "width": "6",
    "collapse": false
},
{
    "id": "4ab20b87.404294",
    "type": "ui_tab",
    "z": "",
    "name": "Home",
```

```
        "icon": "dashboard",
        "disabled": false,
        "hidden": false
    }
]
```


Thank you,

The End