Summer Internship Project Report

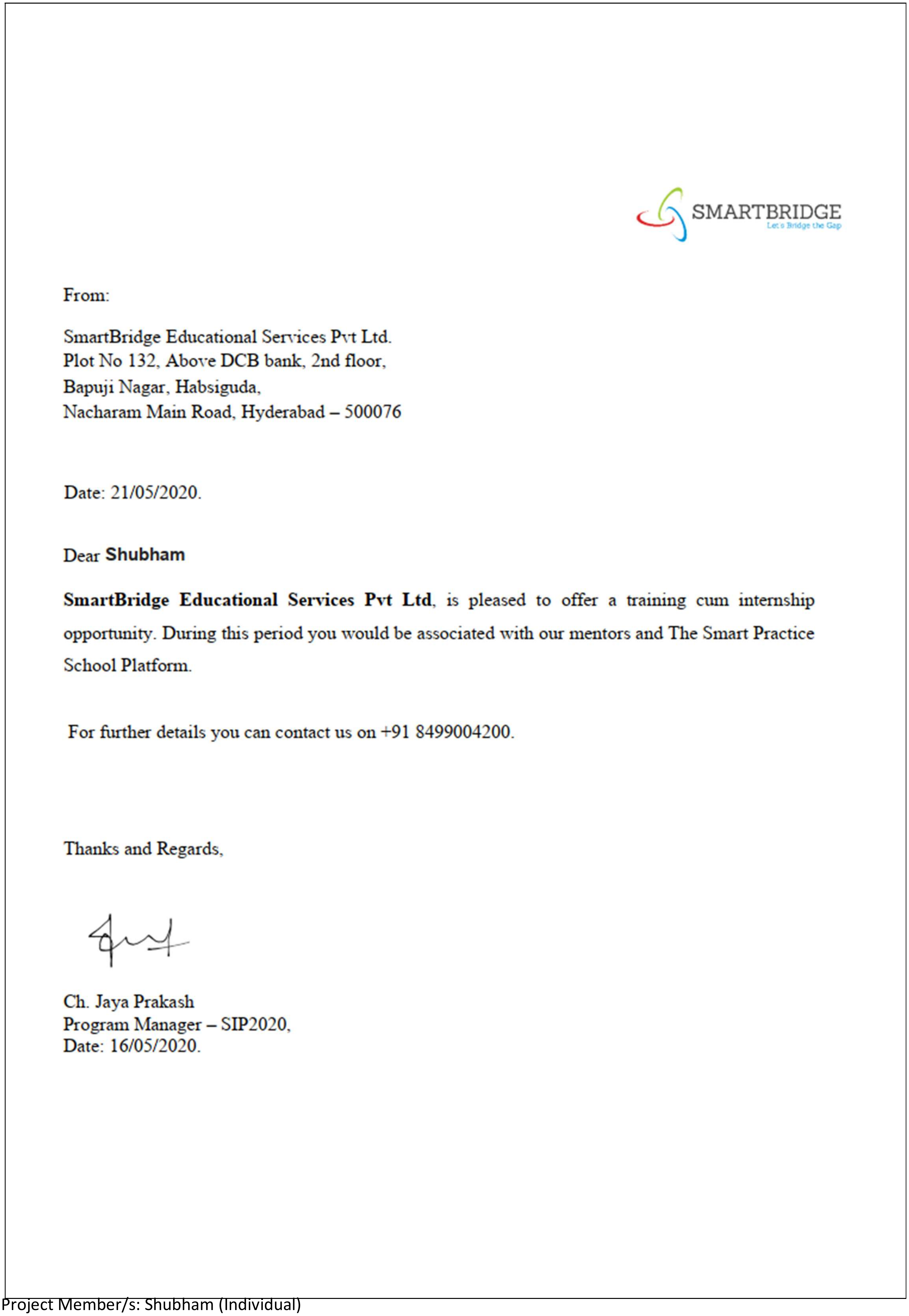
Internship Title: Predicting Life Expectancy using Machine Learning – SB51612

Project Title: Predicting Life Expectancy using Machine Learning

Project Duration: 21/05/2020-18/06/2020

Submitted by: Shubham

Email: **mohitbit22@gmail.com**



SMARTBRIDGE
Let's Bridge the Gap

From:

SmartBridge Educational Services Pvt Ltd.
Plot No 132, Above DCB bank, 2nd floor,
Bapuji Nagar, Habsiguda,
Nacharam Main Road, Hyderabad – 500076

Date: 21/05/2020.

Dear **Shubham**

SmartBridge Educational Services Pvt Ltd, is pleased to offer a training cum internship opportunity. During this period you would be associated with our mentors and The Smart Practice School Platform.

For further details you can contact us on +91 8499004200.

Thanks and Regards,

Ch. Jaya Prakash
Program Manager – SIP2020,
Date: 16/05/2020.

Preface

This report documents is the work done during the summer internship at **SmartBridge Educational Services PVT Ltd**, for the prediction of life- expectancy under the supervision of **mentors of SmartBridge and smart practice school platform**. The report will give an overview of the tasks completed during the period of internship with technical details. Then the results obtained are discussed and analyzed. I have tried my best to keep report simple yet technically correct. I hope I succeed in my attempt.

Shubham

Index

1 INTRODUCTION

1.1 Overview

1.2 Purpose

2 LITERATURE SURVEY

2.1 Existing problem

2.2 Proposed solution

3 THEORITICAL ANALYSIS

3.1 Block diagram

3.2 Hardware / Software designing

4 EXPERIMENTAL INVESTIGATIONS

5 FLOWCHART

6 RESULT

7 ADVANTAGES AND DISADVANTAGES

8 APPLICATIONS

9 CONCLUSION `

10 FUTURE SCOPE

11 BIBILOGRAPHY

APPENDIX

A. Source code

1. INTRODUCTION

1.1. Overview

Life Expectancy is one of the most important factor in end-of-life decision making. 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 Illnesses, Physical Illnesses, Education, Year of their birth and other demographic factors. It is very important to predict average life expectancy of a country to analyse further requirements to increase its rate of growth or stabilise the rate of growth in that country. So this is a typical Regression Machine Learning project that leverages historical data to predict insights into the future.

The end product will be a webpage where you need to give all the required inputs and then submit it . Afterwards it will predict the life expectancy value based on your regression technique.

Project Requirements: Python, IBM Cloud, IBM Watson

Functional Requirements: IBM cloud

Technical Requirements: ML, WATSON Studio, Python, Node-Red

Software Requirements: Watson Studio, Node-Red

Project Deliverables: Smartinternz Internship

Project Team: Shubham

Project Duration: 23.5 Days

1.2. Purpose

Predicting Life Expectancy using Machine Learning 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. The purpose of project is help to country to know their rate of life expectancy, which factors affects more to decrease life expectancy so that they can take appropriate decision to increase life expectancy of human being in their country.

2. LITERATURE SURVEY

2.1. Existing Problem :

Country must know about Life Expectancy of their country. If country know about their life expectancy they can understand which factors affects more to decrease life expectancy of their country, so that they can take appropriate decision to increase life expectancy of human being in their country.

2.2. Proposed Solution

Predicting life expectancy is not a new concept. Experts do this at a population level by classifying people into groups, often based on region or ethnicity. Also, tools such as deep learning and artificial intelligence can be used to consider complex variables, such as biomedical data, to predict someone's biological age. Biological age refers to how "old" their body is, rather than when they were born. A 30-year-old who smokes heavily may have a biological age closer to 40. Calculating a life expectancy reliably would require a sophisticated system that considers a breadth of environmental, geographic, genetic and lifestyle factors – all of which have influence.

Predicting life Expectancy using Machine Learning project will help country to know their life expectancy.so that they can understand which factors affects more to decrease life expectancy of their country, so that they can take appropriate decision to increase life expectancy of human being in their country.

With machine learning and artificial intelligence, it's becoming feasible to analyse larger quantities of data. The use of deep learning and cognitive computing, such as with IBM Watson, helps doctors make more accurate diagnoses than using human judgement alone.

This project take following aspects (features) as input:

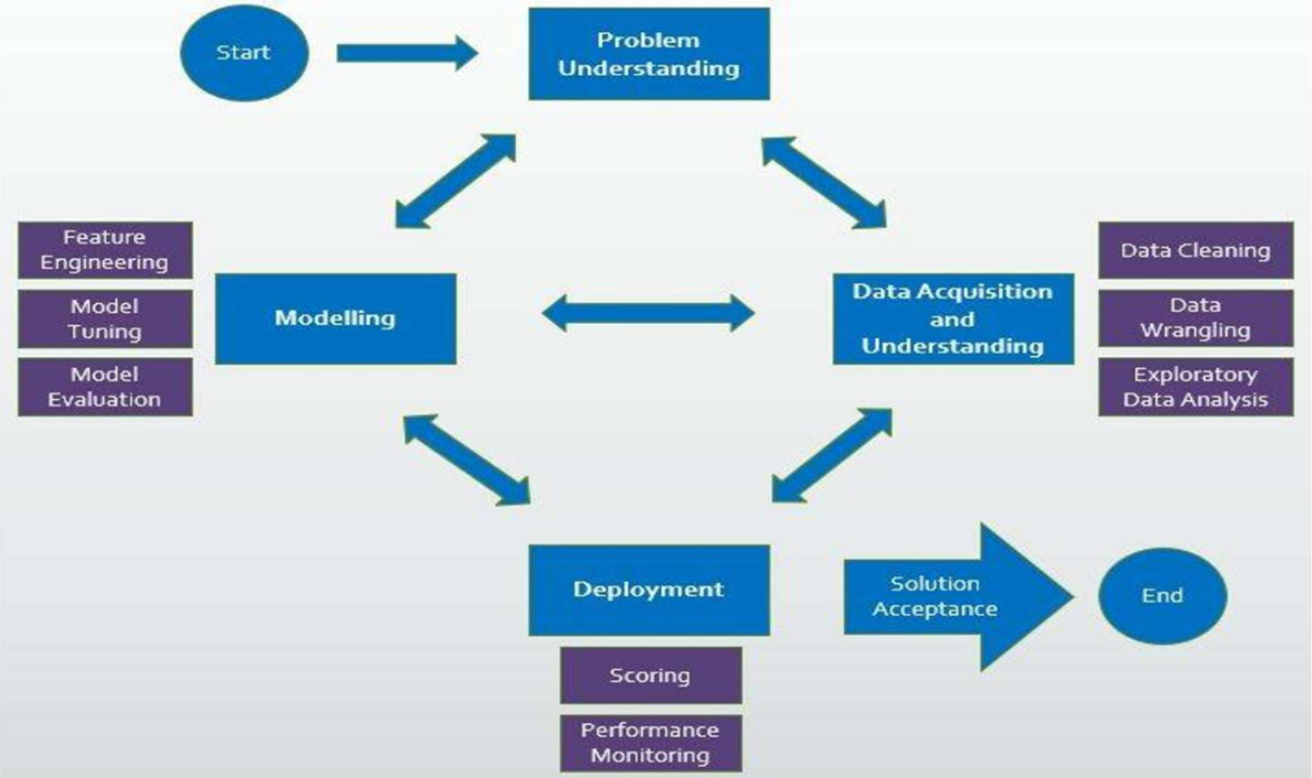
1. Country
2. Status
3. Life Expectancy
4. Adult Mortality
5. Alcohol
6. percentage expenditure
7. Hepatitis B
8. Measles
9. BMI
10. under-five deaths
11. Polio
12. Total expenditure
13. Diphtheria
14. HIV/AIDS
15. GDP
16. Population
17. thinness 1-19 years
18. thinness 5-9 years
19. Income composition of resources
20. Schooling

Target is Life Expectancy, measured in number of years.
The assumptions are:

1.These are country level average
2.There is no distinction between male and female.

3. THEORITICAL ANALYSIS

3.1. Block diagram



3.2. Hardware / Software designing

Hardware :

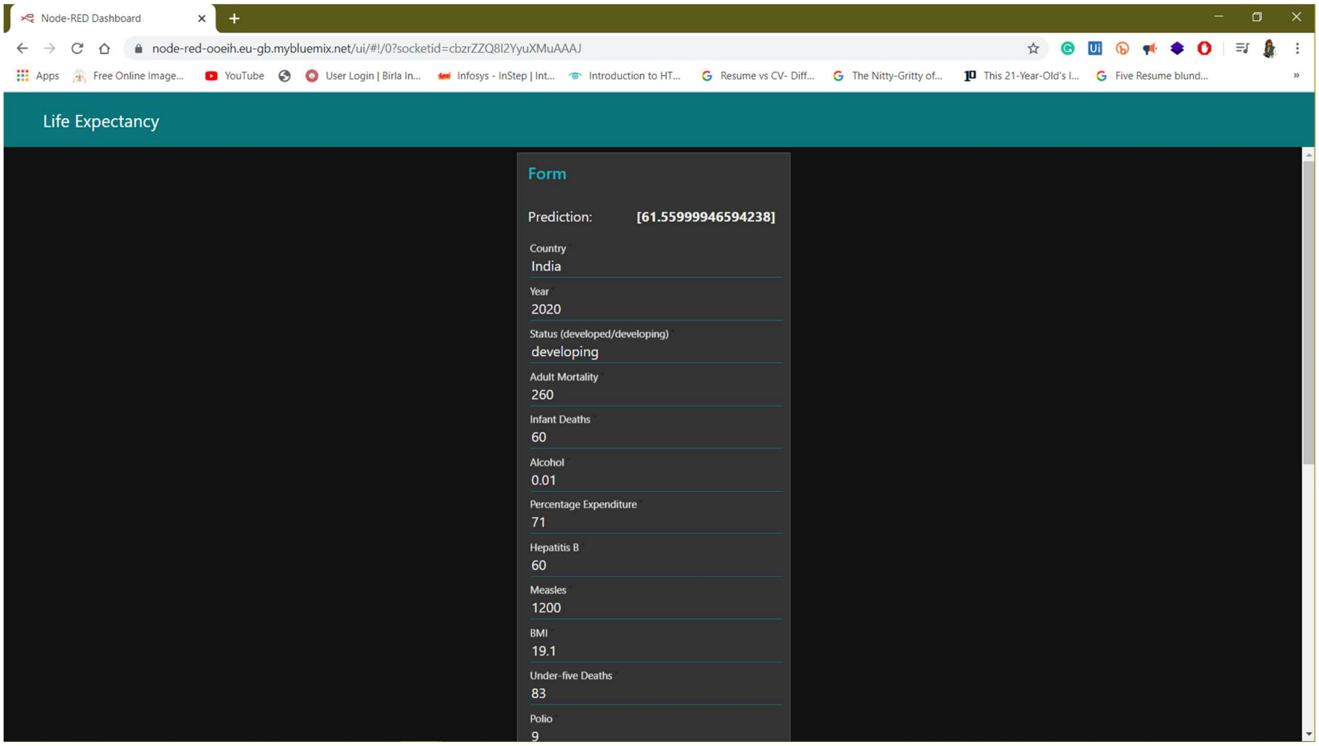
- Internal hardware devices include Motherboard,Hard-Drives,RAM.
- External hardware devices include Monitor,keyboard, mouse.

Software:

- IBM cloud Software :
  -Node-Red App[Webpage].
- Programming Environment :
  -Default Python 3.6 XS

A node red flow is made for the prediction of life expectancy. Which is given below.

https://node-red-ooeih.eu-gb.mybluemix.net/ui/#!/0?socketid=cbzrZZQ8I2YyuXMuAAAJ



Life Expectancy

Form

Prediction: [61.55999946594238]

Country
India

Year
2020

Status (developed/developing)
developing

Adult Mortality
260

Infant Deaths
60

Alcohol
0.01

Percentage Expenditure
71

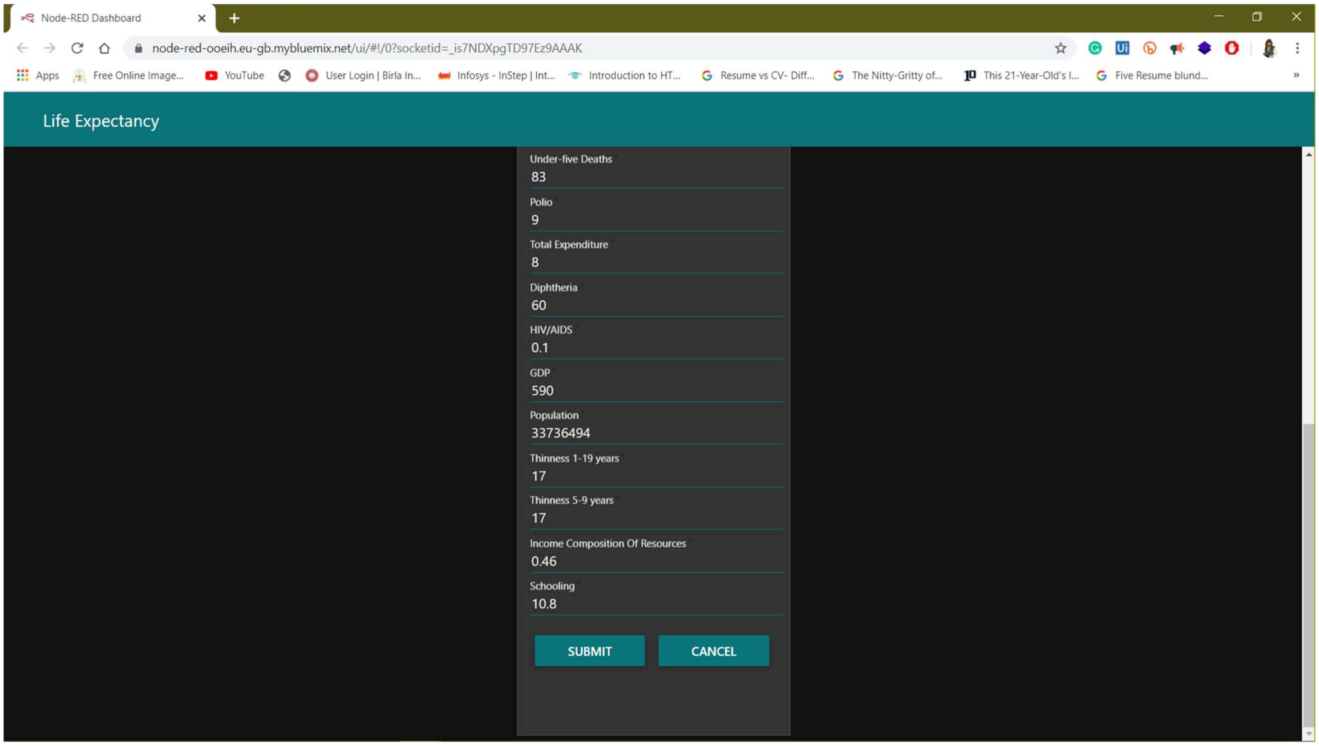
Hepatitis B
60

Measles
1200

BMI
19.1

Under-five Deaths
83

Polio
9



Life Expectancy

Under-five Deaths
83

Polio
9

Total Expenditure
8

Diphtheria
60

HIV/AIDS
0.1

GDP
590

Population
33736494

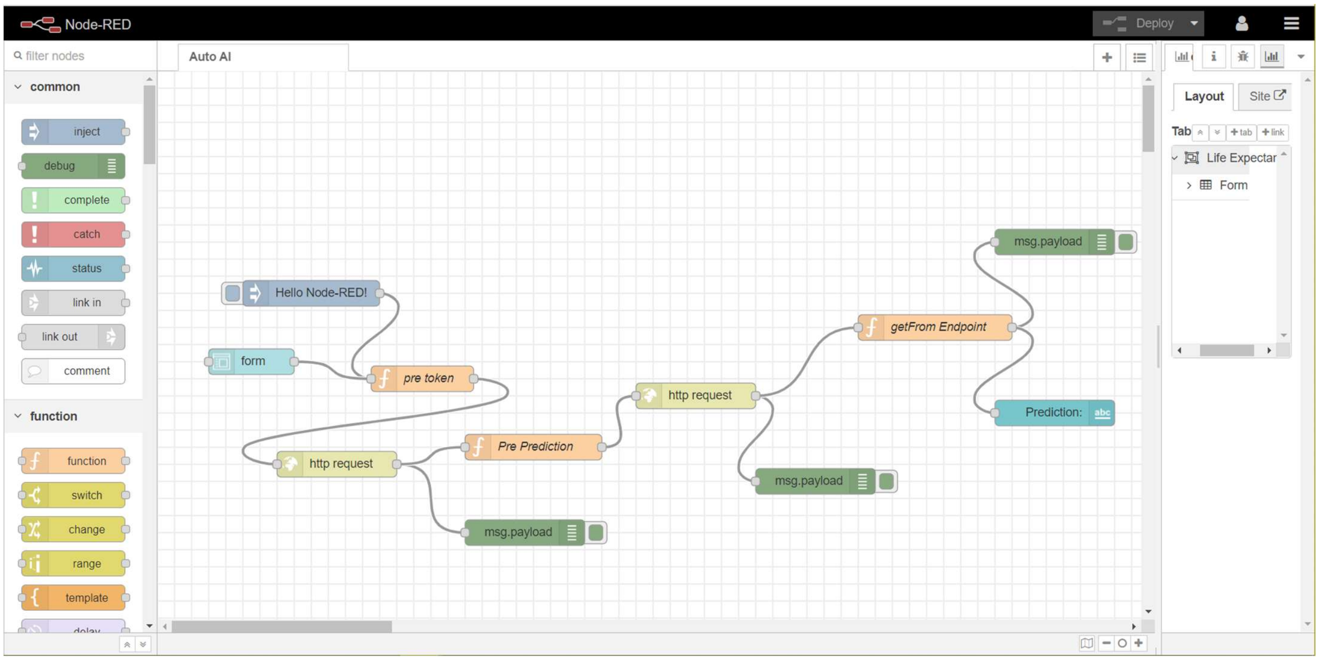
Thinness 1-19 years
17

Thinness 5-9 years
17

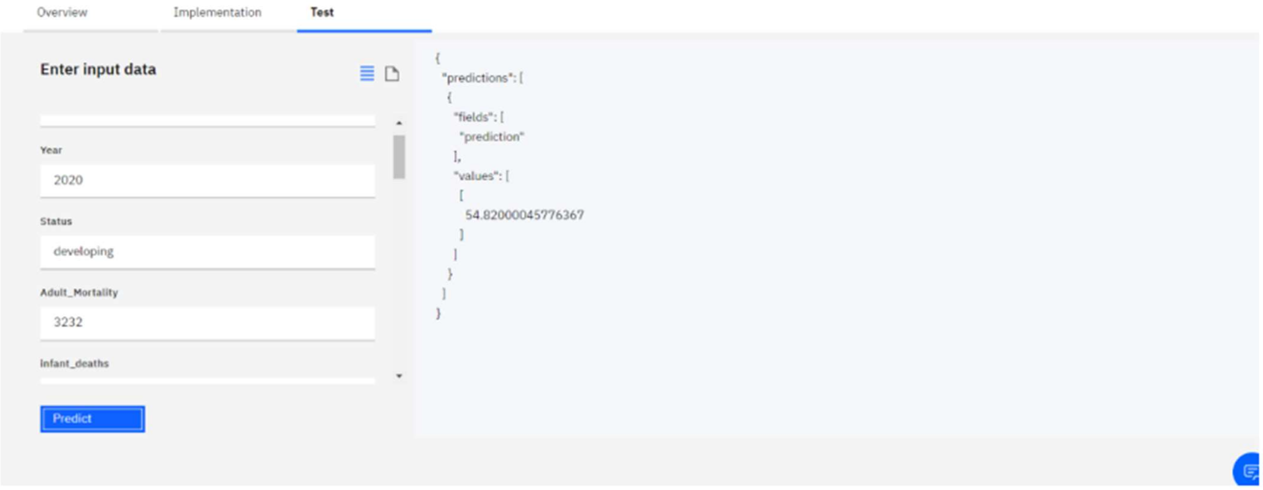
Income Composition Of Resources
0.46

Schooling
10.8

Demonstration of node red flow



Auto AI model



Enter input data

Year: 2020

Status: developing

Adult_Mortality: 3232

infant_deaths

```
{
 "predictions": [
  {
   "fields": [
    "prediction"
   ],
   "values": [
    [
     54.82000045776367
    ]
   ]
  }
 ]
}
```

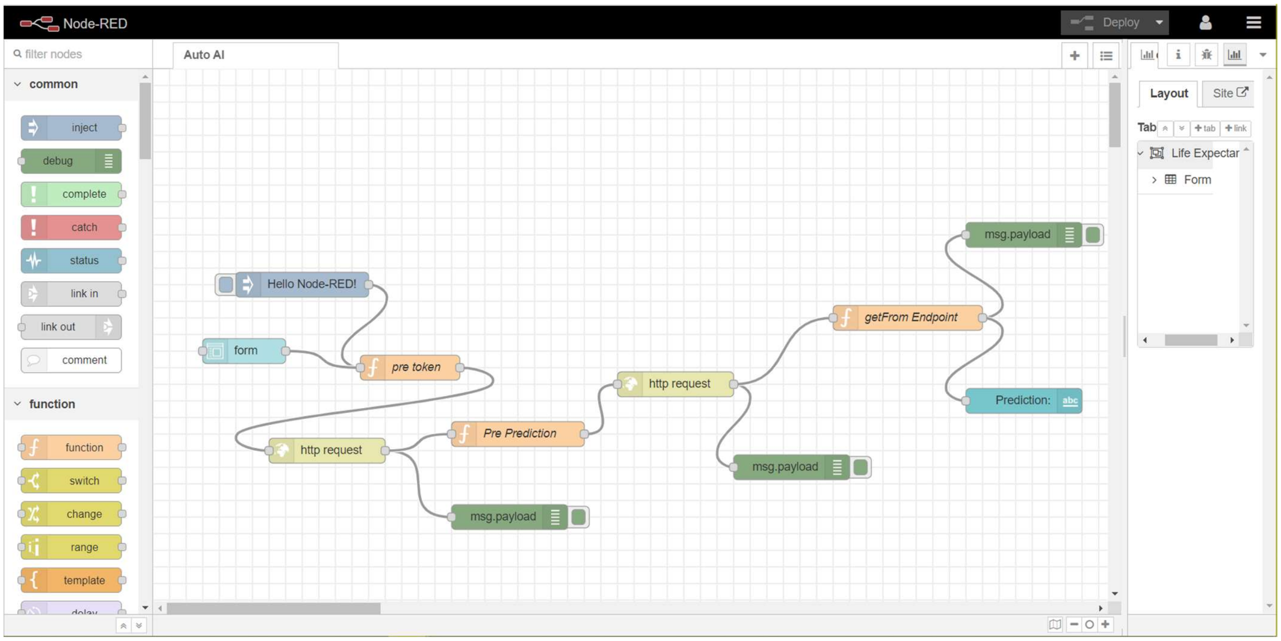
4. EXPERIMENTAL INVESTIGATIONS

- Collection of data set from Kaggle.
https://www.kaggle.com/c/predicting-life-expectancy/data
- On IBM Watson studio machine learning using auto ai build a model to predict life expectancy.
  - To do so first create account on IBM Watson studio.
  - Using Add to project choose auto ai.
  - Then upload data set
  - Choose best way to predict.

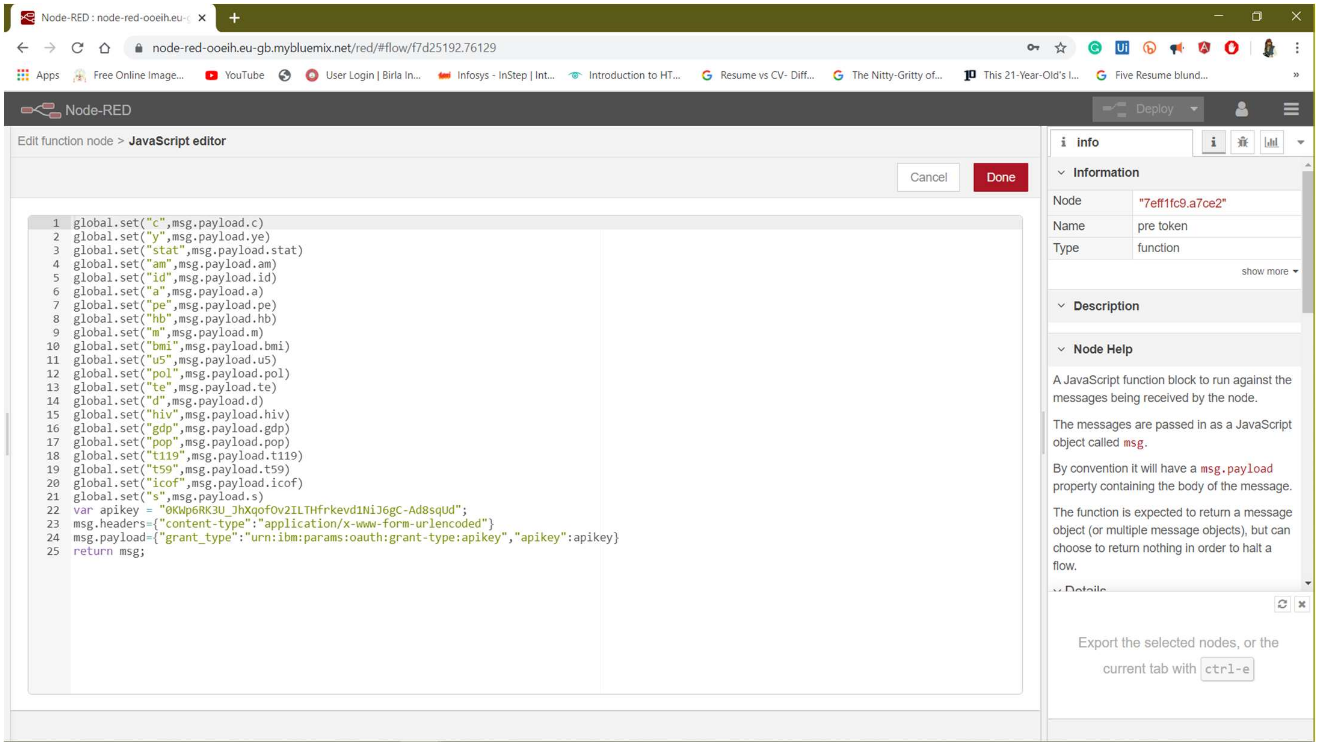
- Save as a model which is on the top
- Deploy the model.
- Test the model.
- Create service credential

- Create cloud foundry app
https://node-red-ooeih.eu-gb.mybluemix.net/red/#flow/f7d25192.76129

- Make node red flow



- Then add API key, instance Id and url.



```
global.set("c",msg.payload.c)
global.set("y",msg.payload.ye)
global.set("stat",msg.payload.stat)
global.set("am",msg.payload.am)
global.set("id",msg.payload.id)
global.set("a",msg.payload.a)
global.set("pe",msg.payload.pe)
global.set("hb",msg.payload.hb)
global.set("m",msg.payload.m)
global.set("bmi",msg.payload.bmi)
global.set("u5",msg.payload.u5)
global.set("pol",msg.payload.pol)
global.set("te",msg.payload.te)
global.set("d",msg.payload.d)
global.set("hiv",msg.payload.hiv)
global.set("gdp",msg.payload.gdp)
global.set("pop",msg.payload.pop)
global.set("t119",msg.payload.t119)
global.set("t59",msg.payload.t59)
global.set("icof",msg.payload.icof)
global.set("s",msg.payload.s)
var apikey = "0KWp6RK3U_JhXqofOv2ILTHfrkevd1NiJ6gC-Ad8sqUd";
msg.headers={"content-type":"application/x-www-form-urlencoded"}
msg.payload={"grant_type":"urn:ibm:params:oauth:grant-type:apikey","apikey":apikey}
return msg;
```

Information

Node	"7eff1fc9.a7ce2"
Name	pre token
Type	function

show more

Description

Node Help

A JavaScript function block to run against the messages being received by the node.

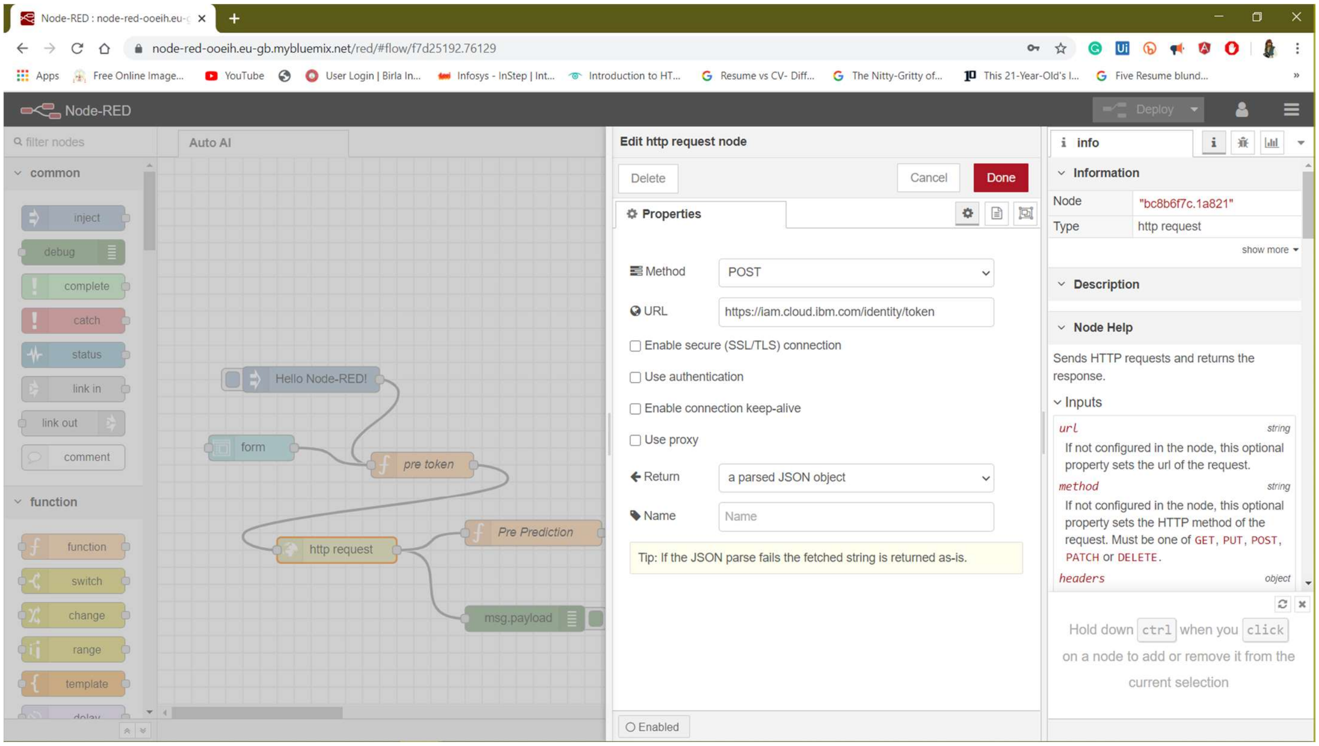
The messages are passed in as a JavaScript object called msg.

By convention it will have a msg.payload property containing the body of the message.

The function is expected to return a message object (or multiple message objects), but can choose to return nothing in order to halt a flow.

Details

Export the selected nodes, or the current tab with ctrl-e



Edit http request node

Delete Cancel Done

Properties

Method: POST

URL: https://iam.cloud.ibm.com/identity/token

□ Enable secure (SSL/TLS) connection

□ Use authentication

□ Enable connection keep-alive

□ Use proxy

Return: a parsed JSON object

Name: Name

Tip: If the JSON parse fails the fetched string is returned as-is.

○ Enabled

info

Information

Node	"bc8b6f7c.1a821"
Type	http request

show more

Description

Node Help

Sends HTTP requests and returns the response.

Inputs

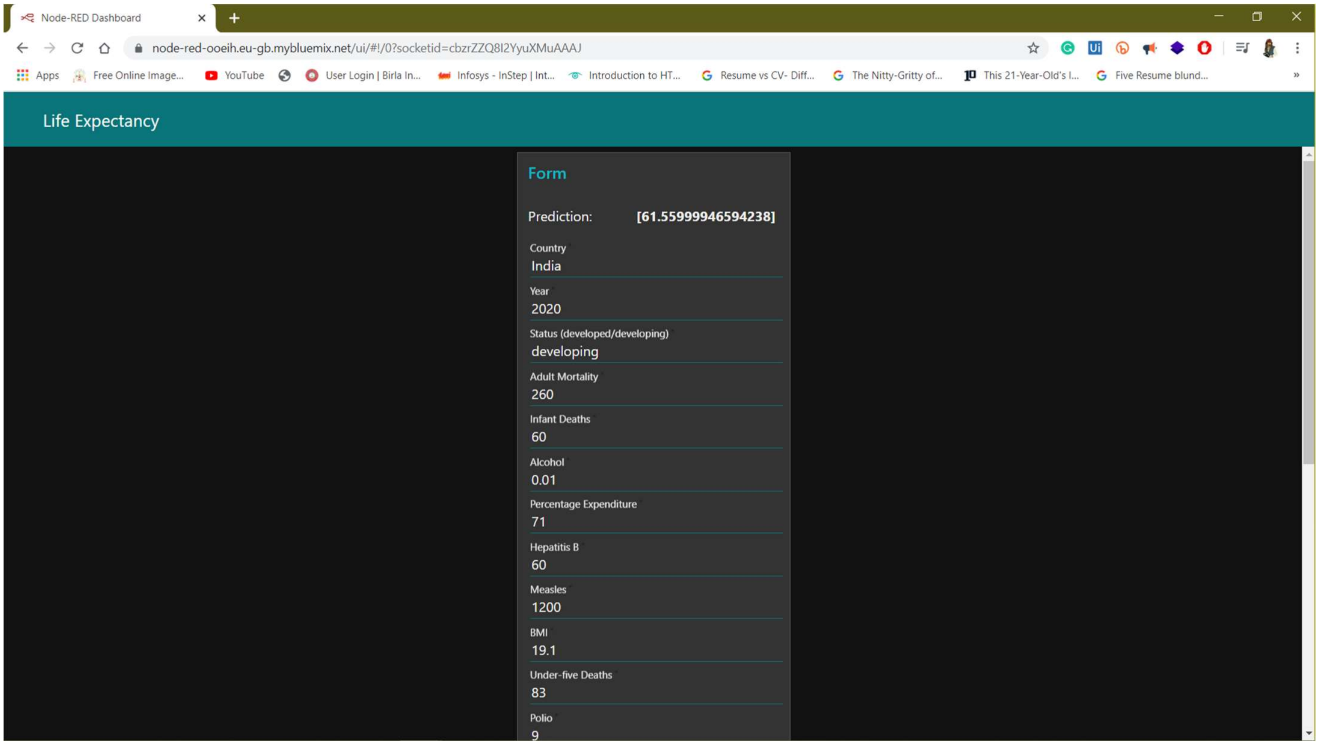
url string
If not configured in the node, this optional property sets the url of the request.

method string
If not configured in the node, this optional property sets the HTTP method of the request. Must be one of GET, PUT, POST, PATCH or DELETE.

headers object

Hold down ctrl when you click on a node to add or remove it from the current selection

- After deploying the model from dashboard UI can be seen.


Node-RED Dashboard
node-red-ooeih.eu-gb.mybluemix.net/ui/#!/0?socketid=cbzrZZQ8I2YyuXMuAAAJ

Life Expectancy

Form

Prediction: [61.55999946594238]

Country
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Year
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Percentage Expenditure
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BMI
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Under-five Deaths
83

Polio
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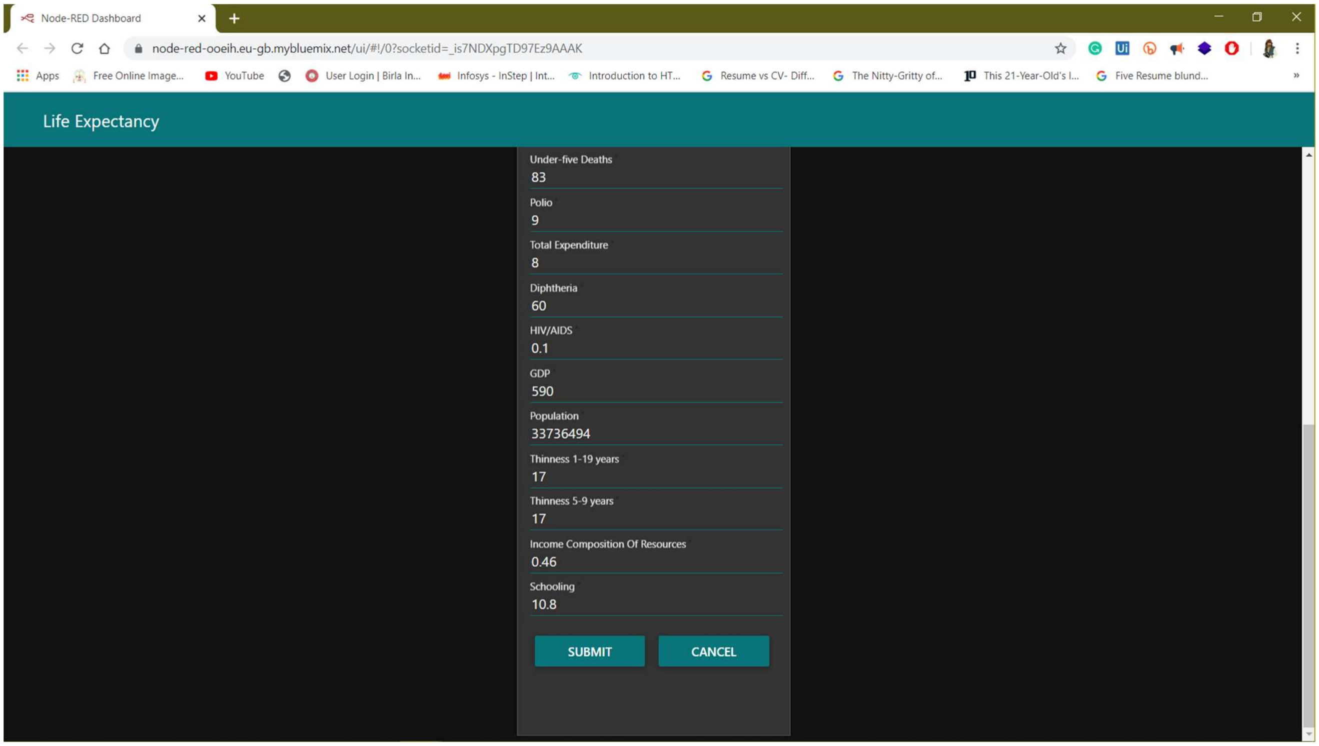

Life Expectancy

Under-five Deaths
83

Polio
9

Total Expenditure
8

Diphtheria
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HIV/AIDS
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GDP
590

Population
33736494

Thinness 1-19 years
17

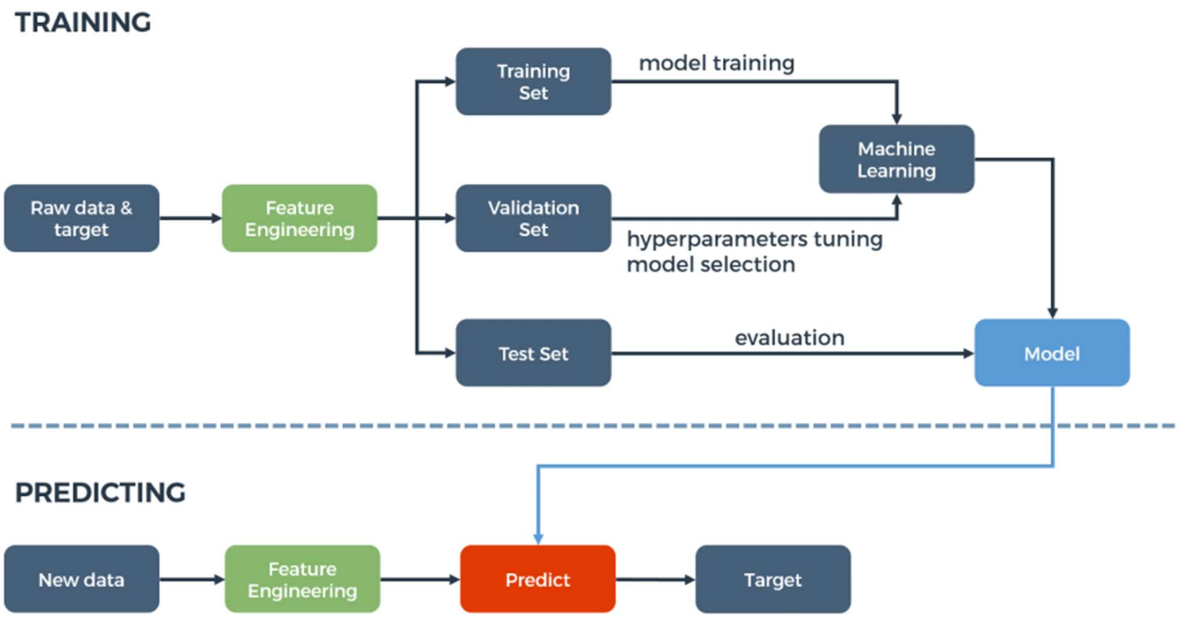
Thinness 5-9 years
17

Income Composition Of Resources
0.46

Schooling
10.8

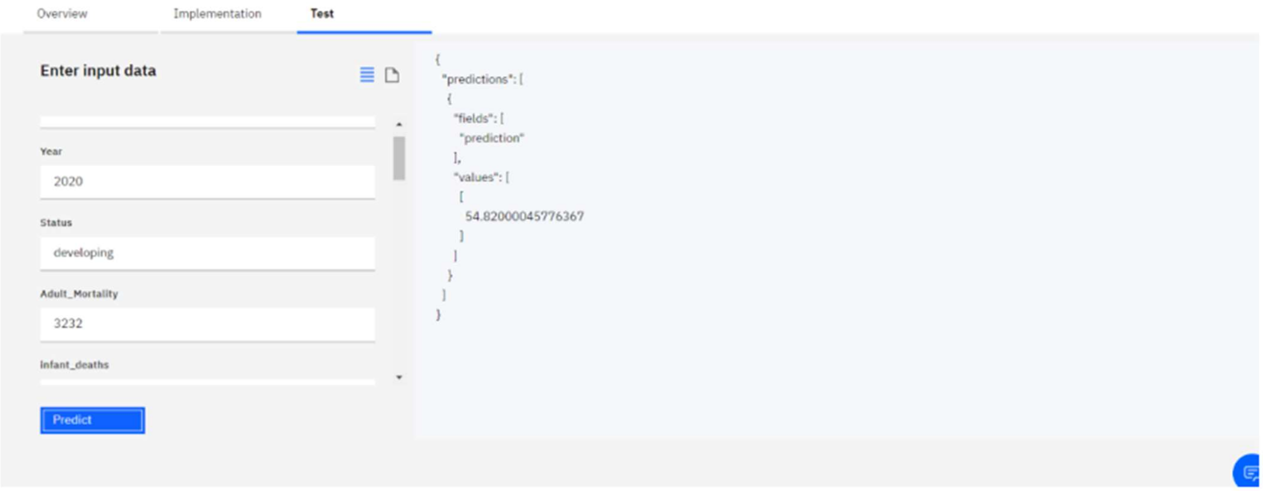
SUBMIT CANCEL

5. FLOWCHART



6. RESULT

Prediction of life expectancy based on country, year, status, adult molarity, GDP and population etc.



Year: 2020

Status: developing

Adult_Mortality: 3232

Infant_deaths

```
{
 "predictions": [
  {
   "fields": [
    "prediction"
   ],
   "values": [
    [
     54.82000045776367
    ]
   ]
  }
 ]
}
```

Based on the given data, the auto ai understands the data and cross reference the data to watch what are the factors that are affecting the results we require i.e life expectancy.

Then when we give any input, it has already run algorithm to get the output based on previously given data. So the results we get are approximations, they are not definitely true, but it works in maximum number of cases, except for some exceptional ones.

7. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

a) Health Inequalities: Life expectancy has been used nationally to monitor health inequalities of a country.

b) Reduced Costs: This is a simple webpage and can be accessed by any citizen of a country to calculate life expectancy of their country and doesnot required any kind of payment neither for designing nor for using.

c) User Friendly Interface: This interface requires no background knowledge of how to use it. It’s a simple interface and only ask for required values and predict the output.

DISADVANTAGES:

a) Wrong Prediction: As it depends completely on user, so if user provides some wrong values then it will predict wrong value.

b) Average Prediction: The model predicts average or approximate value with 97.07% accuracy but not accurate value.

8. APPLICATIONS

● Predicting life expectancy will help to country to know their average rate of life expectancy.
● Country can analyse what factors affects more to increase life expectancy.
● Country can also analyse which factors affects more to decrease life expectancy so that they can take appropriate decision to increase life expectancy of human being in their country.

9. CONCLUSION

Some interesting correlations here:
• There is a strong positive correlation between ‘Schooling’ and ‘Life Expectancy’. This may be because education is more established and prevalent in wealthier countries. This means countries with less corruption, infrastructure, healthcare, welfare, and so forth.
• Similarly to the point above, there is a moderate positive correlation between ‘GDP’ and ‘Life Expectancy’, most likely due to the same reason.
• Surprisingly there’s a moderate positive correlation between ‘Alcohol’ and ‘Life Expectancy’. I’m guessing that this is due to the fact that only wealthier countries can afford alcohol or the consumption of alcohol is more prevalent among wealthier populations.
Similarly more result can be abstract.
Predicting Life Expectancy using Machine Learning project will help country to know their life expectancy.

10. FUTURE SCOPE

The problem of processing datasets such as electronic medical records(EMR) and their integration with genomics, environmental factors, socioeconomic factor and patient behavior variations have posed a problem for researchers the health industry. Due to rapid innovations in machine learning field such as big data, analytics, visualization, deep learning, health workers now have improved way of processing, and developing meaningful information from huge datasets that have been accumulated over many years.
Big data and machine learning can benefit public health researchers with analyzing thousands of variables to obtain data regarding life expectancy. We can use demographics of selected regional areas and multiple behavioral health disorders across regions to find correlation between individual behavior indicators and behavioral health outcomes.

Future Scope of the Model can be:

a) Feature Reduction
It requires much more data about 21 columns to be known prior for predicting life expectancy which can be again difficult for a normal user to gather such datas so I have decided to do

some kind of feature reduction or replacement of some features as individuals or groups to make it more user friendly.

b) Attractive UI
It is a simple webpage only asking inputs and predict output. In future I have decided to make it more user friendly by providing some useful information about the country in the webpage itself so that user does not need to do any kind of prior research for the values.

c) Integrating with services such as speech recognition

11. BIBLIOGRAPHY

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- ✦ https://developer.ibm.com/tutorials/how-to-create-a-node-red-starter-application/
- ✦ https://nodered.org/
- ✦ https://github.com/watson-developer-cloud/node-red-labs
- ✦ https://www.youtube.com/embed/r7E1TJ1HtM0
- ✦ https://bookdown.org/caoying4work/watsonstudio-workshop/jn.html
- ✦ https://www.kaggle.com/kumarajarshi/life-expectancy-who
- ✦ https://www.youtube.com/watch?v=Jtej3Y6uUng
- ✦ https://bookdown.org/caoying4work/watsonstudio-workshop/jn.html#deploy-model-as-webservice
- ✦ https://machinelearningmastery.com/columntransformer-for-numerical-and-categorical-data/

APPENDIX:

Source Code

1)Notebook

```
#import librarires
import pandas as pd
import numpy as np
import os
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
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
from sklearn.model_selection import train_test_split
from sklearn.ensemble import ExtraTreesRegressor
from sklearn.metrics import mean_squared_error, r2_score
from watson_machine_learning_client import WatsonMachineLearningAPIClient
#import dataset
#Data Preprocessing
df=df.rename(columns={‘old name:new name’})
df=df.fillna(df.mean())
#Exploratory data Analysis
df_kor=df.corr()
plt.figure(figsize=(10,10))
#heatmap
sns.heatmap(df_kor,vmin=-1,vmax=1,annot=True,linewidth=0.1)
#pairplot
sns.pairplot(df)
#Train&Test
Y=df['Life expectancy']
X=df[df.columns.difference(['Life expectancy'])]
categorical_features = ['Country', 'Status']
categorical_feature_mask = X.dtypes==object
categorical_features = X.columns[categorical_feature_mask].tolist()
categorical_transformer = Pipeline(steps=[
('onehot', OneHotEncoder(handle_unknown='ignore')),
])
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()
numeric_transformer = Pipeline(steps=[
('imputer', SimpleImputer(strategy='median')),
('scaler', StandardScaler()),
])
preprocessor = ColumnTransformer(
transformers=[
('num', numeric_transformer, numeric_features),
('cat', categorical_transformer, categorical_features)
]
)
ExtraTreeRegressor = Pipeline([
('preprocessor', preprocessor),
('ExtraTreeRegressor', ExtraTreesRegressor(n_estimators=100, random_state=0))
])
reg = ExtraTreeRegressor.fit(X_train, Y_train)
test_pred=reg.predict(X_test)
#Model Building and Deployment
wml_credentials={
"apikey": "********************************",
"instance_id": "********************************",
"url": "************************************"
}
client = WatsonMachineLearningAPIClient(wml_credentials)
          model_props = {client.repository.ModelMetaNames.AUTHOR_NAME: "****",
client.repository.ModelMetaNames.AUTHOR_EMAIL: "**********",
client.repository.ModelMetaNames.NAME: "LifeExpectancy"}
model_artifact=client.repository.store_model(ExtraTreeRegressor, meta_props=model_props)
model_uid = client.repository.get_model_uid(model_artifact)
create_deployment = client.deployments.create(model_uid, name="LifeExpectancyPrediction")
scoring_endpoint = client.deployments.get_scoring_url(create_deployment)
print(scoring_endpoint)
```

2) Flow.json

```
[{"id":" }]
```