PREDICTING LIFE EXPECTANCY USING MACHINE LEARNING

BY

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INTRODUCTION

Since ancient times, there are a lot of change in the behavior and cultures of people in different places. According to their way of living, the health care and life expectancy of people varies among each other. These differences are may be based on various factors such as Regional variations, Economic Circumstances, Sex Differences, Mental Illnesses, Physical Illnesses, Education, Year of their birth and other demographic factors.

1.1. Overview

Life expectancy is a statistical measure of the average time a human being is expected to live. 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.

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 health care system and some specific disease related deaths that happened in the country are given in a data set.

In order to predict life expectancy rate of a given country, we will be using Machine Learning algorithms to draw inferences from the given dataset and give an output. For better usability by the customer, we are also going to be creating a UI for the user to interact with using Node-Red.

1.2. Purpose

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 capital. 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 skill set 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

There are so many organizations that are making research in the prediction of life expectancy. Many research papers dealing with the creation of this model under many algorithms such as Machine Learning, Deep learning and programming languages such as Python and Java script.

2.1. Existing Problem

The World Health Organization (WHO) began producing annual life tables for all Member States in 1999. These life tables are a basic input to all WHO estimates of global, regional and country-level patterns and trends in allcause and cause-specific mortality. After the publication of life tables for years to 2009 in the 2011 edition of World Health Statistics, WHO has shifted to a two year cycle for the updating of life tables for all Member States. Even still the model is not really updated in every fields. WHO applies standard methods to the analysis of Member State data to ensure comparability of estimates across countries. This will inevitably result in differences for some Member States with official estimates for quantities such as life expectancy, where a variety of different projection methods and other methods are used.

2.2. Proposed Solution

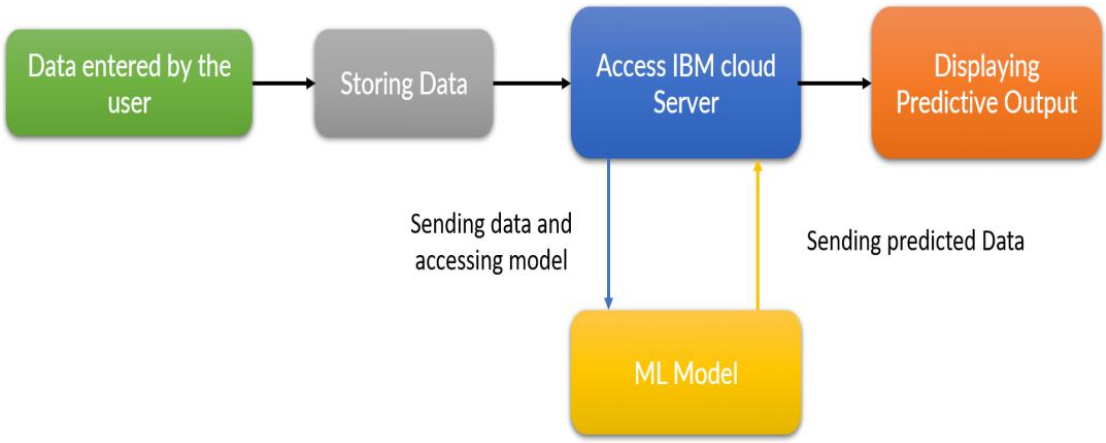
So many people were expecting to use a model of life expectancy prediction. In order to that, many institutions and companies are leading their team to build that model. In my project, I have proposed a solution to predict the life expectancy using machine learning. Machine Learning is the process of

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 health care system and some specific disease related deaths that happened in the country.

3. Theoretical Analysis

3.1. Block Diagram



3.2. Hardware / Software Designing

1. PROJECT PLANNING AND KICKOFF:

    a. Understanding the project description and analyze the data and attributes in the given data set.

    b. Creating Git hub account

    c. Installing Slack and create account with the mail id

    d. Learning to use Zoho writer.

2. EXPLORE IBM CLOUD PLATFORM:

    a. Creating IBM cloud account with the mail id

    b. Creating IBM academic initiative account with the mail id

    c. Create a Node-Red starter application.

3. EXPLORE IBM WATSON SERVICES:

    a. Exploring IBM Watson use cases.

    b. Learning about IBM Watson Machine Learning.

4. INTRODUCTION TO WATSON STUDIO:

    a. Learning to build own Machine Learning model using IBM Watson.

    b. Automate the Machine Learning Model

5. PREDICTING LIFE EXPECTANCY WITH PYTHON:

a. Collecting Data set from www.kaggle.com

b. Creating IBM Watson services

c. Create a jupyter notebook and import data from Object storage.

6. PREDICTING LIFE EXPECTANCY WITHOUT PYTHON:

a. Created Node-Red model and integrated with Machine Learning model.

4. Experimental Investigation

Life Expectancy Data set:

The data set used is a life expectancy data set released by the World Health Organization.

The data set has the following features:

The data is saved as a csv file as LifeExpectancy.csv and it is read and stored in the life data variable. The Year column is dropped as it will not be used in the analysis. The first 5 rows are shown below. The data contains 21 columns and 2938 rows with the header row. The table contains data about:

- Countries
- Status
- Life Expectancy
- Adult Mortality
- 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

Dataset preparation and preprocessing

Data is the foundation for any machine learning project. The second stage of project implementation is complex and involves data collection, selection, preprocessing, and transformation. Each of these phases can be split into several steps.

Data collection

This is the first step in a machine learning project.We have to find ways collecting relevant and comprehensive data, interpreting it, and analyzing results with the help of statistical techniques.

The type of data depends on what you want to predict. There is no exact answer to the question “How much data is needed?” because each machine learning problem is unique. In turn, the number of attributes data scientists will use when building a predictive model depends on the attributes’ predictive value.

Data visualization

A large amount of information represented in graphic form is easier to understand and analyze. Some companies specify that a data analyst must know how to create slides, diagrams, charts, and templates.

Most of the times visualization helps us in finding correlations and outliers which are not visible when we look at the raw data.

Labeling

Supervised machine learning, entails training a predictive model on historical data wit h predefined target answers. An algorithm must be shown which target answers or attributes to look for. Mapping these target attributes in a dataset is called labeling.

Data selection

After having collected all information, we choose a subgroup of data to solve the defined problem.

Data preprocessing

The purpose of preprocessing is to convert raw data into a form that fits the required model . Structured and clean data helps in getting more precise results from an applie d machine learning model. The technique includes data formatting, cleaning, and sampling

Data transformation

In this final preprocessing phase, we transform or consolidate data into a form appropriate for machine learning. Data can be transformed through scaling, normalization, attribute decompositions, and attribute aggregations. This phase is als o called feature engineering.

Dataset splitting

Any dataset for predictive analysis should be partitioned into three subsets — training, validation and test sets

Training set:

We create a training set to train a model and define its optimal parameters known as hyperparameters which helps in increasing the accuracy of the model in case of classification or decreasing the loss in case of regression task.

Validation set:

The validation set is used to evaluate a given model, but this is for frequent evaluation. We use this data to fine-tune the model hyperparameters. Hence the model occasionally sees this data, but never does it “Learn” from this. We use the validation set results and update higher level hyperparameters. So the validation set in a way affects a model, but indirectly. A small portion of data is separated from training set and used as validation dataset.

Test set:

The Test dataset provides the gold standard used to evaluate the model. It is only used once a model is completely trained(using the train and validation sets). The test set is generally what is used to evaluate competing models . Many a times the validation set is used as the test set, but it is not good practice. The test set is generally well curated.

It contains carefully sampled data that spans the various classes that the model would face, when used in the real world.

Model training

After we have preprocessed the collected data and split it into three subsets,we can proceed with a model training. This process entails “feeding” the algorithm with traini ng data.

Modeling

During this stage, we train numerous models to see which one of them provides the most accurate predictions. We can use cross validation to find the most suitable hyperparameters. In this stage we observe the loss from our model and introduce new parameters like l1,l2 regularization ,weight decay to avoid overfitting.

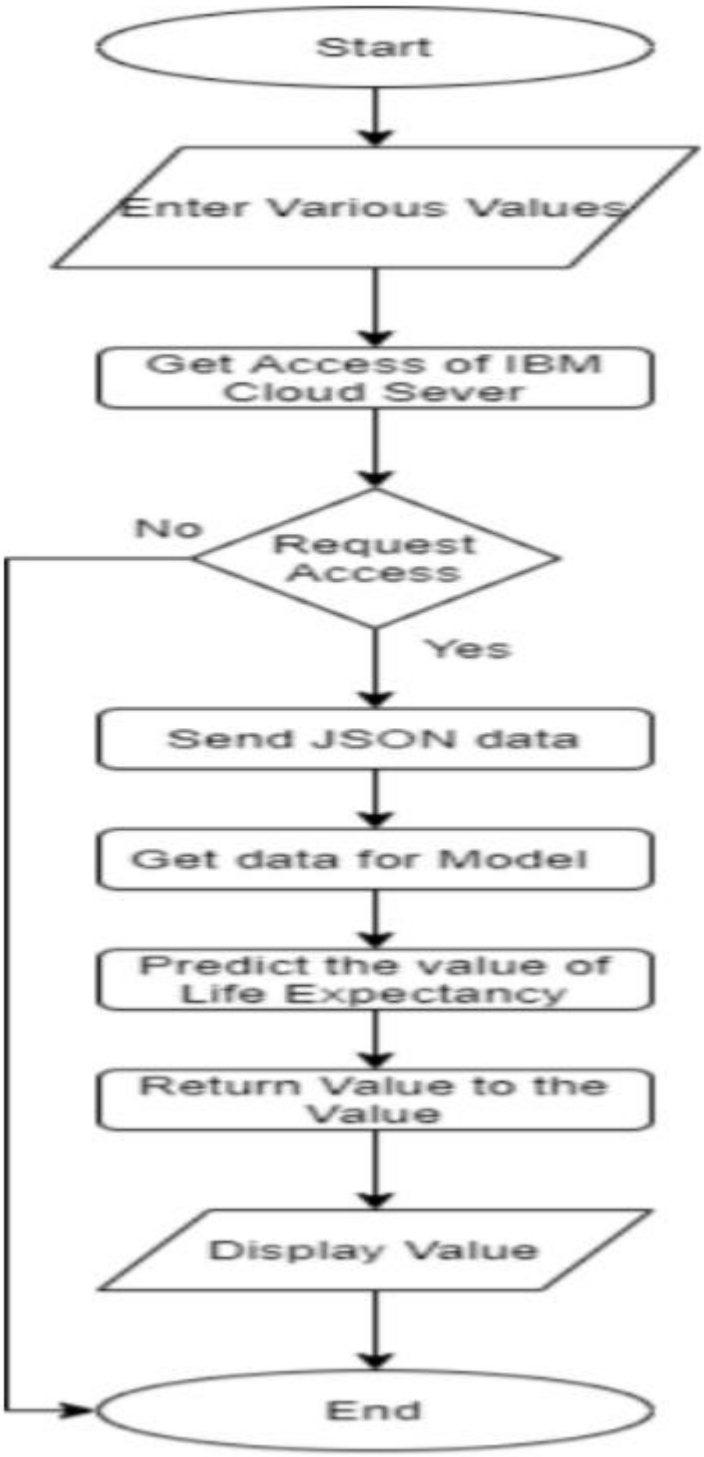
Deployment

The wml_credentials (created during watson studio instantiation phase) are used to save the model and create a scoring endpoint for our model which will be used in nod e red application.

A flow is constructed using different components of nod red like forms, https requests, text fields, functions.

Input is given to the application through a form and the functions are supplied with APIkeys, Instance IDs and scoring endpoint to connect to the model and create an out put.The output is displayed through a text field.

5. FLOWCHART


Start
Enter Various Values
Get Access of IBM Cloud Sever
No
Request Access
Yes
Send JSON data
Get data for Model
Predict the value of Life Expectancy
Return Value to the Value
Display Value
End

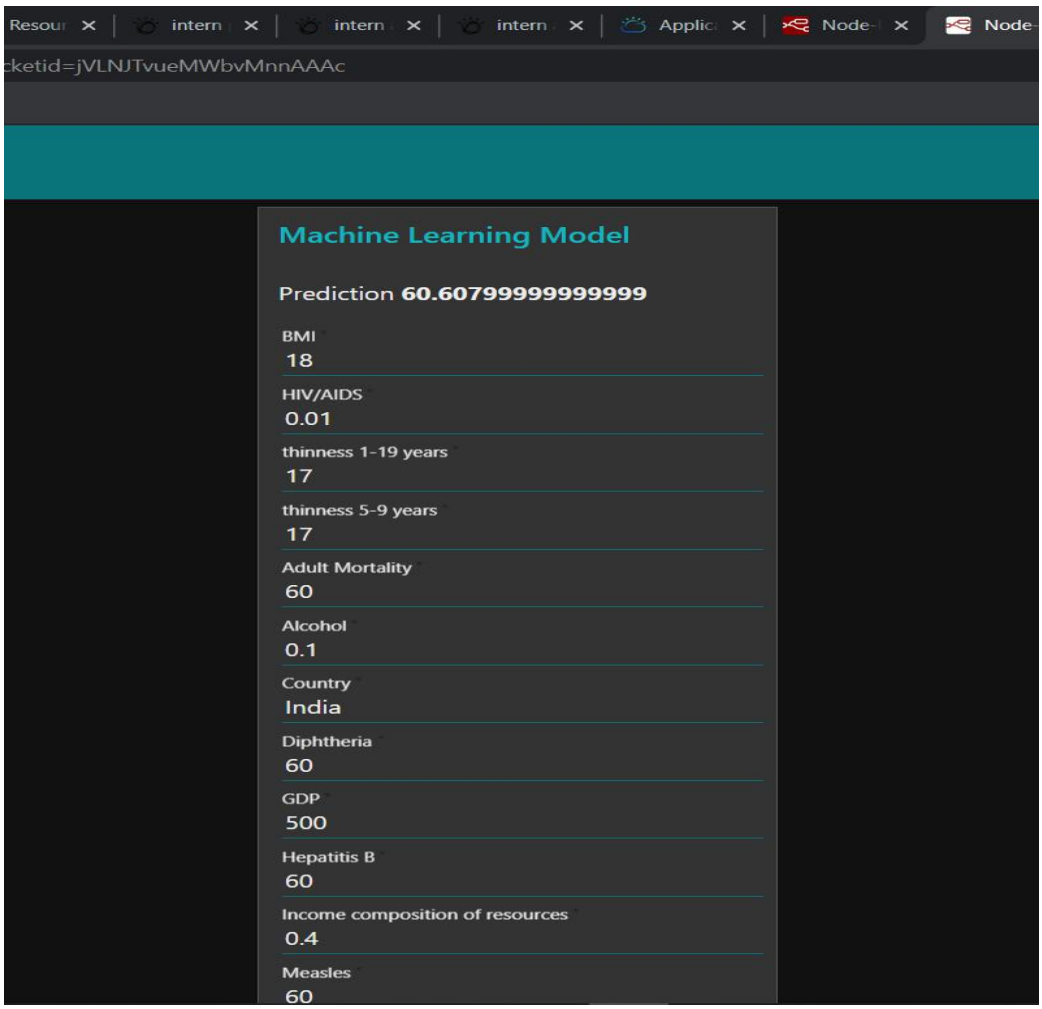
6. Result

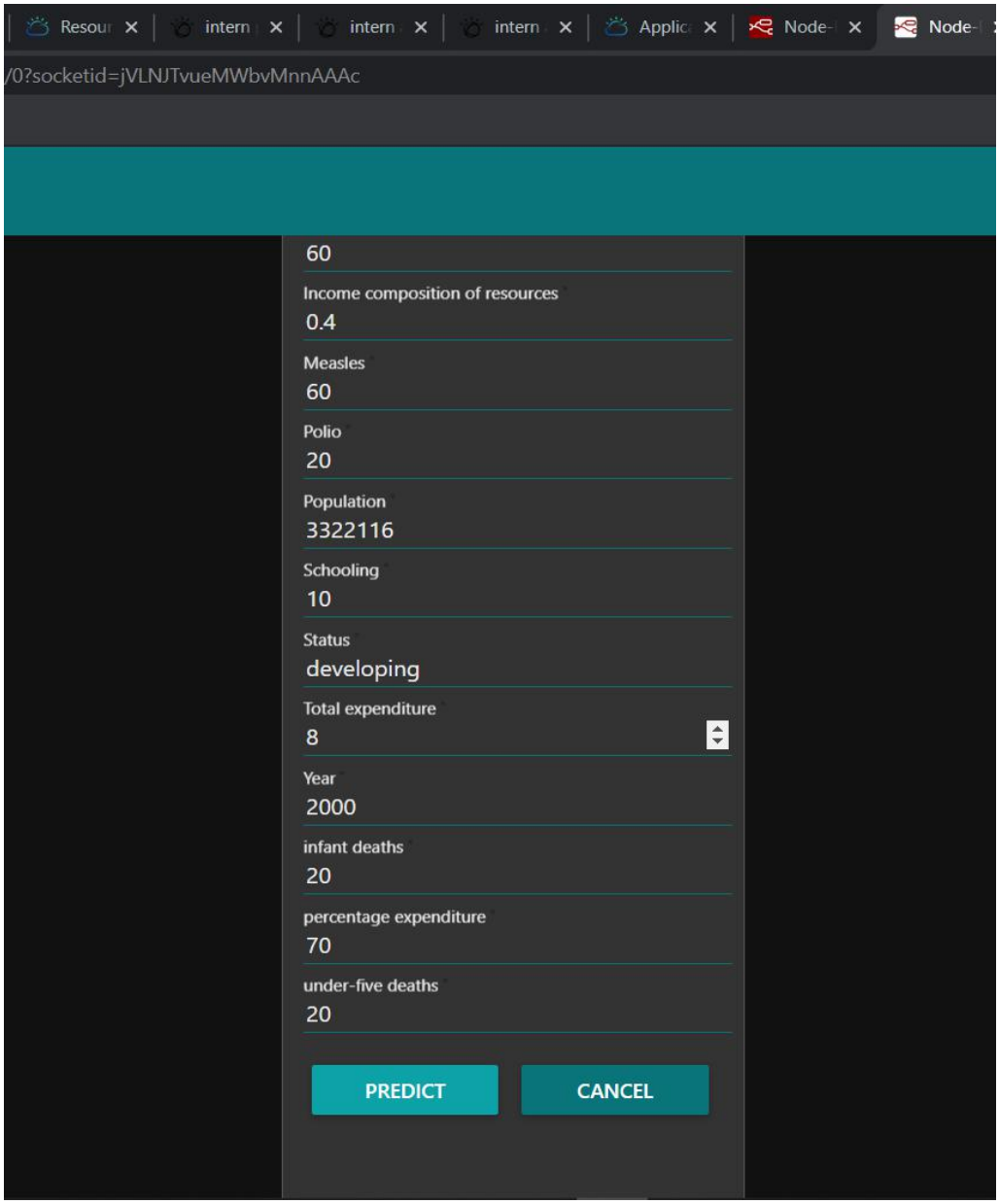
Web based UI was developed by integrating all the services using NODERED.
URL for UI Dashboard:
https://node-red-cexgy.eu-gb.mybluemix.net/ui/#!/0?socketid=jVLNJTvueMWbvMnnAAAc

URL for Notebook:

https://eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/a5364361-70d7-456f-9e74-21e662f72607/view?access_token=08a15e8a9edfac6a697b955dc009a76269427cfdbc436b1adfce97d9479e1ba6

ITS OUTPUT IS SHOWN IN BELOW FIGURE




Resour
intern
intern
intern
Applic
Node-
Node-
/0?socketid=jVLNJTvueMWbvMnnAAAc
60
Income composition of resources
0.4
Measles
60
Polio
20
Population
3322116
Schooling
10
Status
developing
Total expenditure
8
Year
2000
infant deaths
20
percentage expenditure
70
under-five deaths
20
PREDICT
CANCEL

7. Advantages & Disadvantages

Advantages:

One of the biggest advantages of embedding machine learning
algorithms is their ability to improve over time. Machine learning technology typically improves efficiency and accuracy thanks to the ever-increasing amounts of data that are processed.

The application learns the patterns and trends hidden within the data without human intervention which makes predicting much simpler and easier. The more data is fed to the algorithm, the higher the accuracy of the algorithm is. It is also the key component in technologies for automation.

Using Node-Red also simplifies the effort put into a creating the frontend. The programmer doesn't need extensive knowledge on HTML and JavaScript. It also makes the integration between Machine learning model and the UI much easier.

Disadvantages:

Using machine learning interface comes with its own problems. Since the whole point of it is minimize human involvement, it also makes error detection and fixing much more problematic. It takes a lot of time to identify the root cause for the problem.

Machine learning can also be very time-consuming. When the size of the data fed to the machine learning is very large, the computational cost and the time taken to train the model on the data increases drastically. This can increase the cost of resources required to implement the application on a large scale. At the same time, Node-Red does not give many features to customize
our UI.

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: 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.

9. Conclusion

• The end product is a webpage created and deployed on node-red app of IBM cloud. The backend of webpage is a linear regression model created and deployed on Watson Studio using machine learning service.

• This model can be used to predict the life expectancy of people in different places.

• This model contains various factors such as Country, Year, Status, Life Expectancy, 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.

• With the help of all these input values, the model will predict the life expectancy of such people.

• The accuracy level of prediction in my model is more than 95%.

• From the help of this model, the life expectancies of more than 190 countries can be detected.

10. Future Scope

For future use, one can integrate the life expectancy prediction with providing suggestions and medications to the individual using the application. This will help predict as well as increase the individual's life expectancy.

The scalability and flexibility of the application can also be improved with advancement in technology and availability of new and improved resources. Also, with the growth in Artificial Neural networks and Deep learning, one can integrate that with our existing application. With the help of Convolutional Neural networks and Computer vision, we can also try to take into account the physical health and appearance of a person.

Mental health can also be taken into account while predicting life expectancy with the help of sentiment analysis systems as well.

11. Bibliography

1. Node-RED Starter Application :

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

red-starter-applicat ion/

2. Watson Studio Cloud :

https://bookdown.org/caoying4work

/watsonstudio-workshop/jn.html

3. Dataset Reference:

https://www.kaggle.com/kumaraja

rshi/life-expectancy-who

4. IBM Cloud Services :

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

ist=PLzpeuWUENMK2PYtasCaKK4bZjaYzhW23L

5. Import the Dataset into Jupyter Notebook :

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

APPENDIX

SOURCE CODE

IMPORTING NECESSARY LIBRARIES

In [ ]:

```
#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 mathfrom tqdm
import tqdm
#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 WatsonMachineLearningAPICli
ent
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 Obje
ct Storage. It includes your credentials.# You might want to remove those cr
edentials before you share the notebook
.client_14132c58aa044323b380fb6bbfc18dc4 = ibm_boto3.client(service_name='s
3',
```

```
    ibm_api_key_id='2T40hwCoy0mnfVCFbb3GRUJ3Ei45-SX9pIKM0f5Xu0XO
',
    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_14132c58aa044323b380fb6bbfc18dc4.get_object(Bucket='autoai-do
notdelete-pr-7dgkksiyvpobwr',Key='Life Expectancy Data.csv')['Body']# add mis
sing __iter__ method, so pandas accepts body as file-like objectif not hasattr
(body, "__iter__"): body.__iter__ = types.MethodType( __iter__, body )
df = pd.read_csv(body)df.head()
```

In [ ]:

```
df.columns
```

In [ ]:

```
#THERE IS INCONSISTENCY IN COLUMN NAMES IN THIS DATASET SO
WE HAVE TO CHANGE THEM TO A COMMON FORMATdf=df.rename(colu
mns={'Life expectancy ':'Life expectancy','Measles ':'Measles',' BMI ':'BMI','und
er-five deaths ':'under-five deaths','Diphtheria ':'Diphtheria',' HIV/AIDS':'HIV/AI
DS',' thinness  1-19 years':'thinness  1-19 years',' thinness 5-9 years':'thinness
5-9 years'})
```

In [ ]:

```
#CHECKING NULL VALUESdf.isnull().sum()
```

In [ ]:

```
#FILL NULL VALUES TO AVOID TRAINING AND TESTING ERRORdf=df.fi
llna(df.mean())
```

In [ ]:

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

In [ ]:

```
#PLOTTING A HEATMAP df_cor=df.corr()plt.figure(figsize=(10,10))sns.heatmap
(df_cor,annot=True,linewidth=0.1)
```

In [ ]:

```
#PLOTTING A PAIRPLOTsns.pairplot(df)
```

In [ ]:

```
sns.scatterplot(x=df['Life expectancy'],y=df['Polio'])
```

In [ ]:

```
sns.scatterplot(x=df['Life expectancy'],y=df['Measles'])
```

In [ ]:

```
sns.scatterplot(x=df['Life expectancy'],y=df['HIV/AIDS'])
```

In [ ]:

```
sns.scatterplot(x=df['Life expectancy'],y=df['Hepatitis B'])
```

In [ ]:

```
sns.scatterplot(x=df['Life expectancy'],y=df['BMI'])
```

In [ ]:

```
sns.scatterplot(x=df['Life expectancy'],y=df['GDP'])
```

In [ ]:

```
df.describe(include= 'O')
```

In [ ]:

```
sns.countplot(df['Status'])
```

In [ ]:

```
#SEPARATING THE DATASET INTO DEPENDENT COLUMNS AND PREDICTION COLUMN
Y=df['Life expectancy']
X=df[df.columns.difference(['Life expectancy'])]
```

In [ ]:

```
#SEE NUMERICAL COLUMNS
df.select_dtypes(include=['int64', 'float64']).columns
```

In [ ]:

```
#SEE CATEGORICAL COLUMNS
df.select_dtypes(include=['object', 'bool']).columns
```

In [ ]:

```
#IDENTIFY THE CATEGORICAL VALUES FOR COLUMNTRANSFORM
categorical_features = ['Country', 'Status']categorical_feature_mask = X.dtypes==objectcategorical_features = X.columns[categorical_feature_mask].tolist()
#DEFINE CATEGORICAL PIPELINE
categorical_transformer = Pipeline(steps=[
    ('onehot', OneHotEncoder(handle_unknown='ignore')),])
```

In [ ]:

```
#IDENTIFY THE NUMERIC VALUES FOR COLUMNTRANSFORM
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!=objectnumeric_features = X.columns[numeric_feature_mask].tolist()
#DEFINE NUMERIC PIPELINE
numeric_transformer = Pipeline(steps=[
    ('imputer', SimpleImputer(strategy='median')),
    ('scaler', StandardScaler()),])
```

In [ ]:

```
#PIPELINNING USING COLUMNTRANSFORM
preprocessor = ColumnTransformer(
    transformers=[
        ('num', numeric_transformer, numeric_features),
        ('cat', categorical_transformer, categorical_features)
    ])
```

In [ ]:

```
#DEFINE A REGRESSOR MODEL USING PIPELINE FUNCTION
```

```
ExtraTreeRegressor = Pipeline([
        ('preprocessor', preprocessor),
        ('ExtraTreeRegressor', ExtraTreesRegressor(n_estimators=100, random_state=0))])
```

In [ ]:

```
#TRAIN-TEST SPLIT
X_train,X_test,Y_train,Y_test=train_test_split(X,Y,test_size=0.2)
```

In [ ]:

```
#FIT THE TRAINING MODEL
reg = ExtraTreeRegressor.fit(X_train, Y_train)
```

In [ ]:

```
#PREDICT THE TEST DATA VALUE
test_pred=reg.predict(X_test)
```

In [ ]:

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

In [ ]:

```
wml_credentials = {
  "apikey": "QzaIgq2Wwb4DFlFt6uN-5zWBcId77IAc8kkzBMZHDXAY",
  "iam_apikey_description": "Auto-generated for key d03aecee-edf6-4ab8-a065-a552798dabff",
  "iam_apikey_name": "Service credentials-1",
  "iam_role_crn": "crn:v1:bluemix:public:iam::::serviceRole:Writer",
  "iam_serviceid_crn": "crn:v1:bluemix:public:iam-identity::a/30c2736f650e4e35b58a491ba65cd136::serviceid:ServiceId-7ec5cd3a-1870-4a28-8fd9-7f0e8e0adf82",
  "instance_id": "b3b80e76-a164-4688-b914-331f3794b0f4",
  "url": "https://eu-gb.ml.cloud.ibm.com"}
```

In [ ]:

```
client=WatsonMachineLearningAPIClient(wml_credentials)
```

In [ ]:

```
model_props = {
      client.repository.ModelMetaNames.AUTHOR_NAME: "Manikanta",
      client.repository.ModelMetaNames.AUTHOR_EMAIL: "pinnamanikanta169@gmail.com",
      client.repository.ModelMetaNames.NAME: "life expectancy"}
```

In [ ]:

```
#STORE THE MACHINE LEARNING MODEL
model_artifact=client.repository.store_model(ExtraTreeRegressor, meta_props=model_props)
```

In [ ]:

```
#GET MODEL UID
```

```
model_uid = client.repository.get_model_uid(model_artifact)
#DEPLOY THE MODELcreate_deployment = client.deployments.create(model_u
id, name="life expectancy")
```

In [ ]:

```
#GET SCORING END-POINT URLscoring_endpoint = client.deployments.get_s
coring_url(create_deployment)print(scoring_url)
```

In [ ]:

```
#TEST THE DEPLOYMENT
scoring_payload = {"fields": ['BMI', 'HIV/AIDS', 'thinness  1-19 years', 'thinne
ss 5-9 years',
        'Adult Mortality', 'Alcohol', 'Country', 'Diphtheria ', 'GDP',
        'Hepatitis B', 'Income composition of resources', 'Measles ', 'Polio',
        'Population', 'Schooling', 'Status', 'Total expenditure', 'Year',
        'infant deaths', 'percentage expenditure', 'under-five deaths '],"values":
[[19.1,0.1,17.2,17.3,263,0.01,'Afghanistan',65,584.25,65,0.47,1154,6,33736494,10,'
Developing',8.16,2015,62,71.27,83]]}predictions = client.deployments.score(scori
ng_url, scoring_payload)print(predictions)
```

NODE RED JSON CODE


```
[{"id":"8f72db06.967288","type":"tab","label":"Flow2","disabled":false,"info":""},{"i
d":"8739c552.c66058","type":"ui_form","z":"8f72db06.967288","name":"","label":"",
"group":"14e23e8.5ea9bc2","order":2,"width":0,"height":0,"options":[{"label":"BMI",
"value":"a","type":"number","required":true,"rows":null},{"label":"HIV/AIDS","valu
e":"b","type":"number","required":true,"rows":null},{"label":"thinness 1-19
years","value":"c","type":"number","required":true,"rows":null},{"label":"thinness
5-9 years","value":"d","type":"number","required":true,"rows":null},{"label":"Adult
Mortality","value":"e","type":"number","required":true,"rows":null},{"label":"Alcoho
l","value":"f","type":"number","required":true,"rows":null},{"label":"Country","value
":"g","type":"text","required":true,"rows":null},{"label":"Diphtheria
","value":"h","type":"number","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":"Measle
s","value":"l","type":"number","required":true,"rows":null},{"label":"Polio","value":"
m","type":"number","required":true,"rows":null},{"label":"Population","value":"n","t
ype":"number","required":true,"rows":null},{"label":"Schooling","value":"o","type":"
```

number","required":true,"rows":null},{"label":"Status","value":"p","type":"text","req
uired":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":"percentag
e
expenditure","value":"t","type":"number","required":true,"rows":null},{"label":"unde
r-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","canc
el":"cancel","topic":"","x":70,"y":160,"wires":[["bca1f62a.7949b8"]]},{"id":"bca1f62
a.7949b8","type":"function","z":"8f72db06.967288","name":"pre
token","func":"//make user given values as global
variables\nglobal.set(\"a\",msg.payload.a);\nglobal.set(\"b\",msg.payload.b);\nglobal.s
et(\"c\",msg.payload.c);\nglobal.set(\"d\",msg.payload.d);\nglobal.set(\"e\",msg.paylo
ad.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);\n
global.set(\"p\",msg.payload.p);\nglobal.set(\"q\",msg.payload.q);\nglobal.set(\"r\",ms
g.payload.r);\nglobal.set(\"s\",msg.payload.s);\nglobal.set(\"t\",msg.payload.t);\ngloba
l.set(\"u\",msg.payload.u);\n\n\n//following are required to receive a token\nvar
apikey=\"QzaIgq2Wwb4DFlFt6uN-5zWBcId77IAc8kkzBMZHDXAY\";\nmsg.heade
rs={\"content-type\":\"application/x-www-form-urlencoded\"};\nmsg.payload={\"gra
nt_type\":\"urn:ibm:params:oauth:grant-type:apikey\",\"apikey\":apikey};\nreturn
msg;\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":160,"y":260,"wires":[["4
f328d21.cc9744"]]},{"id":"1bfe8e41.b14322","type":"http
request","z":"8f72db06.967288","name":"","method":"POST","ret":"obj","paytoqs":"i
gnore","url":"https://eu-gb.ml.cloud.ibm.com/v3/wml_instances/b3b80e76-a164-4688
-b914-331f3794b0f4/deployments/c24eacbd-6bff-4c4f-8a71-70fcb3f44a25/online","tl
s":"","persist":false,"proxy":"","authType":"","x":530,"y":360,"wires":[["cffb3308.cb
93a"]]},{"id":"50485fee.de9ff","type":"debug","z":"8f72db06.967288","name":"","ac
tive":false,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targ

etType":"msg","x":790,"y":200,"wires":[]},{"id":"cffb3308.cb93a","type":"function","z":"8f72db06.967288","name":"","func":"msg.payload=msg.payload.values[0][0];\nreturn msg;","outputs":1,"noerr":0,"initialize":"","finalize":"","x":640,"y":280,"wires":[["50485fee.de9ff","f7701150.159d7"]]},{"id":"10443520.dde7eb","type":"function","z":"8f72db06.967288","name":"pre prediction","func":"//get token and make headers\nvar token=msg.payload.access_token;\nvar instance_id=\"b3b80e76-a164-4688-b914-331f3794b0f4\"\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//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 \"],\"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,"initialize":"","finalize":"","x":400,"y":460,"wires":[["1bfe8e41.b14322"]]},{"id":"4f328d21.cc9744","type":"http request","z":"8f72db06.967288","name":"","method":"POST","ret":"obj","paytoqs":"ignore","url":"https://iam.cloud.ibm.com/identity/token","tls":"","persist":false,"proxy":"","authType":"basic","x":270,"y":360,"wires":[["10443520.dde7eb"]]},{"id":"f7701150.159d7","type":"ui_text","z":"8f72db06.967288","group":"14e23e8.5ea9bc2","order":1,"width":"0","height":"0","name":"","label":"Prediction","format":"{{msg.payload}}","layout":"row-left","x":780,"y":360,"wires":[]},{"id":"14e23e8.5ea9bc2","type":"ui_group","z":"","name":"Machine Learning Model","tab":"9d8d1e.41c832e","order":1,"disp":true,"width":"6","collapse":false},{"

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