

A
Project
Report
on
**Predicting Life Expectancy using
Machine Learning.**

Internship under:

The SMARTBRIDGE

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PROJECT ID : SPS_PRO_215

INTERNSHIP TITLE : Predicting Life Expectancy using Machine
Learning - **SB43733**

Category: Machine Learning

Table Of Content

1. INTRODUCTION

Overview

Purpose

2. LITERATURE SURVEY

Existing problem

Proposed solution

3. THEORITICAL ANALYSIS

4. EXPERIMENTAL INVESTIGATIONS

5. PREDICTION

6. RESULT

7. ADVANTAGES &DISADVANTAGES

8. APPLICATIONS

9. CONCLUSION

10. FUTURE SCOPE

11. BIBLIOGRAPHY

APPENDIX

A. Source Code

1. INTRODUCTION

OVERVIEW :-

This project “Predicting Life Expectancy using Machine Learning” is an web application that predict the expected average life span of people of a given country based on various features. This project is built using IBM services(Watson studio, Node Red, Watson machine learning).

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. 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.

Requirements:-

- Project Requirements: IBM Cloud, IBM Watson, Node-RED
- Functional Requirements: IBMcloud
- Technical Requirements: WATSON MachineLearning
- Software Requirements: Python, Watson Studio, Node-Red

PURPOSE:-

The average life Expectancy of a certain country says many things about that particular country. It ultimately helps in predicting the health conditions and the development of the health sector in that particular country. This ultimately helps the nation to find the area which needs attention in an urge to improve its contribution in average lifespan of a human being. The expectancy obviously depends upon the country’s population, GDP, the economy of the country and many more factors. It is not enough to have a long life ,Instead with having a long life one should have a fit life as well

2. LITERATURE SURVEY

EXISTING PROBLEM:- In our regular prediction system, there are many problems exist such as :

- Health related disease.
- occupational or social class, area level deprivation, geographical area of residence (urban and rural), housing tenure.
- Race-based inequalities.
- whole concept of life expectancy depends on the interpretation given to “full health”.
- Or the factors used to predict the life expectancy of people are based on some associated specific features of particular fields like : morbidity and mortality (smoking, alcohol consumption, overweight and obesity, and physical activity).

PROPOSED SOLUTION:-

- 👉 For the above problem to get solved we have a dataset consist of various factors. In this system we have taken all the correlated features into consideration. So the target output variable i.e expected life span of the people depends upon variety of factors and not factors of particular fields.
- 👉 Important immunization like Hepatitis B, Polio and Diphtheria are also considered.
- 👉 The project uses immunization factors, mortality factors, economic factors, social factors and other health related factors to predict life expectancy of a country for a given year using a machine learning model.
- 👉 Since the observations in 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.

3.THEOROTICAL ANALYSIS

HARDWARE / SOFTWARE

DESIGNING:-

1. Create necessary IBM Cloudservices
2. Create Watson studioproject
3. Configure WatsonStudio
4. Create IBM Machine Learninginstance
5. Create machine learning model in Jupyternotebook
6. Deploy the machine learningmodel
7. Create flow and configurenode
8. Integrate node red with machine learningmodel
9. Deploy and run Node Redapp.

Input is taken from the user using a “Form” element in Node-Red. Then, an HTTP request is made to the IBM cloud that further makes an HTTP request to the deployed model using model’s instance id. After verification of id, the model sends an HTTP response which is finally parsed by the Node-Red application and the result is displayed on the user screen.

4. EXPERIMENTAL INVESTIGATIONS

Following factors are taken into account for predicting the life expectancy of a country.

1. Country
2. Status: Developed or Developing status of the country.
3. Year
4. Adult mortality: Adult Mortality Rates of both sexes (probability of dying between 15 and 60 years per 1000 population).
5. Infant deaths: Number of Infant Deaths per 1000 population.
6. Alcohol: Alcohol, recorded per capita (15+) consumption.
7. Percentage Expenditure: Expenditure on health as a percentage of Gross Domestic Product per capita (%).
8. Hepatitis B: Hepatitis B = immunization coverage among 1-year-olds (%).
9. Measles: Measles - number of reported cases per 1000 population.
10. BMI: Average Body Mass Index of entire population.
11. Under-five deaths: Number of under-five deaths per 1000 population.
12. Polio: Polio (Pol3) immunization coverage among 1-year-olds (%).
13. Total expenditure: General government expenditure on health as a percentage of total government expenditure (%).
14. Diphtheria: Diphtheria tetanus toxoid and pertussis (DTP3) immunization coverage among 1-year-olds (%).
15. HIV/AIDS: Deaths per 1 000 live births HIV/AIDS (0-4 years).
16. GDP: Gross Domestic Product per capita (in USD).
17. Population: Population of the country.
18. Thinness 10-19 years: Prevalence of thinness among children and adolescents for Age 10 to 19 (%).
19. Thinness 5-9 years: Prevalence of thinness among children for Age 5 to 9 (%).
20. Income composition of resources: Human Development Index in terms of income composition of resources (index ranging from 0 to 1).

Steps to Create IBM Cloud services

- Watson Studio
- Watson Machine Learning
- NodeRed

1. Create **Watson Studio** service instance.

- Select **Catalog** found at the top right of the page.
- Click on **Watson** from the menu on the left, which you can find under **Platform services**.
- Select **Watson Studio**.
- Enter the **Service name** or keep the default value and make sure to select the **US South** as the **region/location** and your desired **organization**, and **space**.
- Select **Lite** for the **Plan**, which you can find under **Pricing Plans** and is already selected. Please note you are only allowed one instance of a Lite plan per service.
- Click on **Create**.
- You will be taken to the main page of the service. Click on **Get Started**.
- Create a New Project

2. Create Notebook.

- Click **Add to project => Notebook**
- And create your Model here.

3. Deploy Model as WebService

4. Build Node-RED Flow To Integrate ML Services

SCREENSHOTS :-

IBM CLOUD DASHBOARD

The screenshot shows the IBM Cloud Dashboard interface. At the top, there's a navigation bar with 'IBM Cloud' and a search bar. The main content area is divided into several sections:

- Resource summary:** Shows 16 resources with a breakdown: Cloud Foundry apps (2), Cloud Foundry services (1), Services (8), Storage (1), Apps (2), and Developer tools (2).
- Planned maintenance:** A section for viewing scheduled maintenance events.
- For you:** Personalized recommendations like 'Get started with using AI and Cloud Object Storage in 15 minutes' and 'Get Started with Watson Studio'.
- News:** A list of recent news articles related to IBM.
- Recent support cases:** A section for viewing support cases.
- User access:** A section for managing user access, including an 'Invite' button.
- IBM Cloud status:** A world map showing the status of IBM Cloud services across different regions.

RESOURCES LIST :-

The screenshot shows the IBM Cloud Resources List interface. It features a table with the following columns: Name, Group, Location, Offering, Status, and Tags. The table is filtered to show resources under the 'Cloud Foundry apps' group.

Name	Group	Location	Offering	Status	Tags
Node RED MARS	si05202000803@smartinternz.com / dev	London	SDK for Node.js™	Started	—
Node-red_app	si05202000803@smartinternz.com / dev	London	SDK for Node.js™	Started	—
Cloud Foundry services (1)					
Services (8)					
Continuous Delivery	Default	London	Continuous Delivery	Active	—
Db2-q2	Default	London	Db2	Active	—
Internet of Things Platform-ri	Default	London	Internet of Things Platform	Active	—
Watson Assistant-ba	Default	London	Watson Assistant	Active	—
Watson Studio-ua	Default	London	Watson Studio	Active	—
node-red-mars-cloudant-1590946785413	Default	Chennai 01	Cloudant	Active	—
pm-20-dv	Default	London	Machine Learning	Active	cpda...
watson-vision-combined-bo	Default	Dallas	Visual Recognition	Active	cpda...
Storage (1)					
Network (0)					

WATSON STUDIO :-

The screenshot shows the IBM Cloud Pak for Data Watson Studio interface. The top navigation bar includes 'Upgrade', 'Ankit Sharma's Account', and a 'Launch IDE' button. The main content area is divided into several sections:

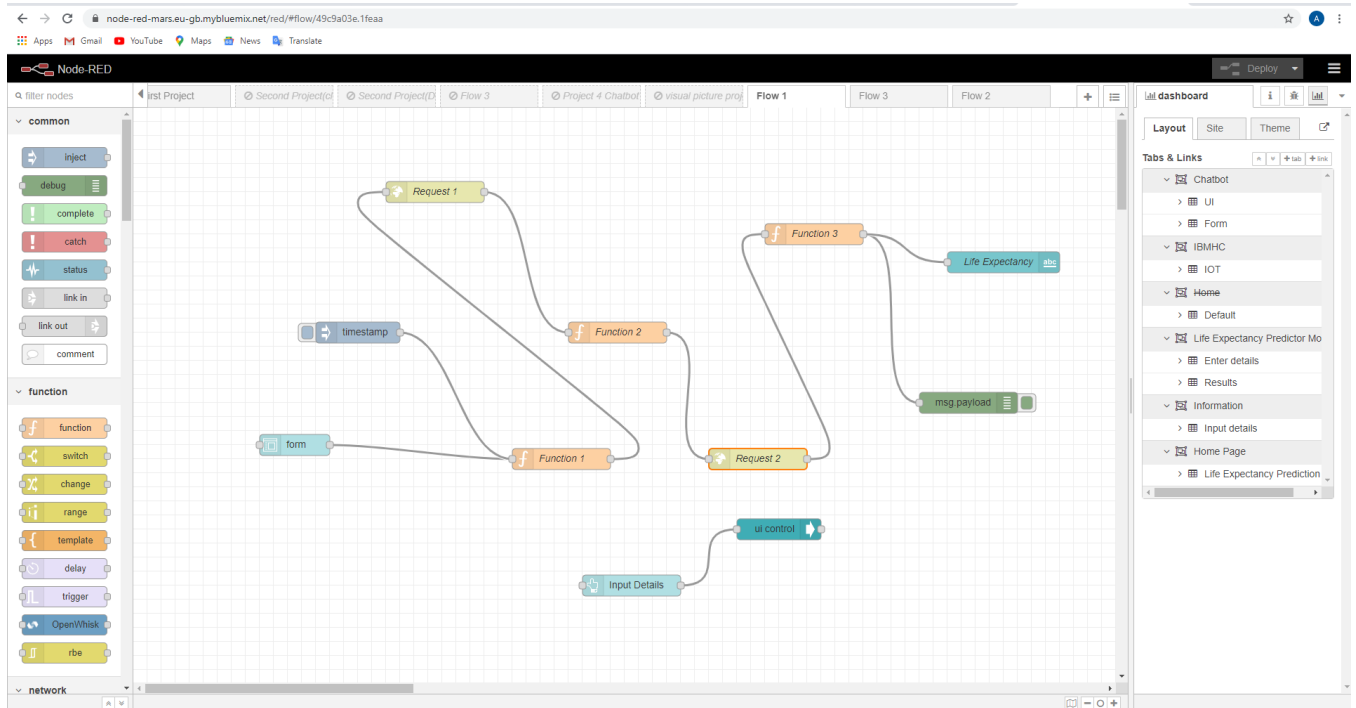
- Data assets:** A table showing 0 assets selected. The table has columns: Name, Type, Created by, and Last modified. One asset is listed: 'Life Expectancy Data.csv' (Data Asset, Created by Ankit Sharma, Last modified Jul 22, 2020, 10:52 PM).
- AutoAI experiments:** A section indicating 'You don't have any AutoAI experiments yet.'
- Notebooks:** A table listing notebooks with columns: Name, Shared, Scheduled, Status, Language, Last editor, and Last modified. Four notebooks are listed: 'Linear Regression', 'Life Expectancy ml model', and 'Life Expectancy Notebook'.
- Deep learning experiments:** A section with a 'New deep learning experiment' button.

API'S OF MACHINE LEARNING SERVICE :-

The screenshot shows the IBM Cloud console interface for the 'pm-20-dv' resource. The 'Service credentials' section is active, displaying a table of credentials. The table has columns: Key name and Date created. One credential is listed: 'Service credentials-1' (JUL 28, 2020 - 10:20:23 PM). The details of this credential are shown in a JSON format:

```
{
  "apikey": "NSEPGeeV002qJ2iaDG0YwI1i_BbEeBP9MsY18n09AvMz",
  "iam_apikey_description": "Auto-generated for key 9becc9a1-61e0-467c-94ba-e0207c7b44ea",
  "iam_apikey_name": "Service credentials-1",
  "iam_role_crn": "crn:vl:bluemix:public:iam:::serviceRole:Writer",
  "iam_serviceid_crn": "crn:vl:bluemix:public:iam-identity:a/6bf34a501a4942749602fefa0414c819:::serviceid:ServiceId-2d0c990c-1eab-4a69-a342-b6329c4c3ddc",
  "instance_id": "408392cf-ac7d-416f-b07c-b9ef85304b96",
  "url": "https://eu-gb.ml.cloud.ibm.com"
}
```

NODERED FLOW :-



OUTPUT :-

The screenshot shows the output of the Life Expectancy Predictor Model. The interface is divided into two main sections: **Enter details** and **Results**.

Enter details section:

- Country: India
- Year: 2020
- Status: unmarried
- Adult Mortality: 60
- Under-five Deaths: 50
- Infant Deaths: 34
- Hepatitis B: 6
- Measles: 3
- Diphtheria: 6
- HIV/AIDS: 8
- Polio: 2
- Population: 12567
- BMI: 12
- Thinness 5-9 years: 6
- Thinness 10-19 years: 16
- Schooling: 12
- Alcohol: 1

Results section:

- Life Expectancy: **75.60 years**

A blue button labeled **INPUT DETAILS** is visible below the results.

Courseva | Online Cour... x Data Science - Univers... x Student Dashboard x Editing ISPS-INT-3373 x ISPS_INT_3373_Predic... x Service Details - IBM C... x IBM Cloud Pak for Data x Node-RED : node-red- x Node-RED Dashboard x

node-red-mars.eu-gb.mybluemix.net/ui/#/0?socketid=vqtOBHuwGcgEKKPcAAAJ

Life Expectancy Predictor Model 1

6
Measles *
3
Diphtheria *
6
HIV/AIDS *
8
Polio *
2
Population *
12567
BMI *
12
Thinness 5-9 years *
6
Thinness 10-19 years *
16
Schooling *
12
Alcohol *
1
GDP *
12
Percentage Expenditure *
23
Total Expenditure *
12
Income Composition of Resources *
12

SUBMIT CANCEL

Type here to search

16:34
10-07-2020

7. ADVANTAGES AND DISADVANTAGES :-

ADVANTAGES :-

- ✓ 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.
- ✓ The data-sets are made available to public for the purpose of health data analysis.
- ✓ Can be used in any organization to analyze the data.
- ✓ Random Forest algorithm is very stable. Even if a new data point is introduced in the dataset, the overall algorithm is not affected much since the new data may impact one tree, but it is very hard for it to impact all the trees.
- ✓ Some of the past research was done considering multiple linear regression based on data set of one year for all the countries. But the dataset used for training the model contained data of past 15 years to give a fairly better prediction.
- ✓ Random Forest is comparatively less impacted by noise.

DISADVANTAGES :-

1. Can be only used by the people having the knowledge of data analysis.
2. As the model is deployed on cloud, so one requires good internet connection to use the application.
3. The model used is Random Forest regression and Random Forest creates a lot of trees (unlike only one tree in case of decision tree) and combines

their outputs. By default, it creates 100 trees in Python sklearn library. To do so, this algorithm requires much more computational power and resources.

4. Random Forest require much more time to train as compared to decision trees as it generates a lot of trees (instead of one tree in case of decision tree) and makes decision on the majority of votes.
5. The Node-Red application needs to make HTTP request to IBM cloud and then another HTTP request to the model before providing the prediction. That makes the application a bit slow.

8. APPLICATIONS

- a. This will help in suggesting a country which area should be given importance in order to efficiently improve the life expectancy of its population.
- b. It will be easier for a country to determine the predicting factor which is contributing to lower value of life expectancy and can be used in various organization to improve the quality of service.
- c. The project can be used as a basis to develop personalized health applications.
- d. The governments can plan and develop their health infrastructures by keeping the most correlated factors in mind.
- e.** The project can help governments to keep track of their country's health status so they can plan for the future accordingly

9. CONCLUSION

By doing the above procedure and all we successfully created Life expectancy prediction system using IBM Watson studio, Watson machine learning and Node-RED service. The potential use of project is not limited to health care in practice, but could also be useful in other clinical applications such as clinical trials. The project makes a good use of machine learning in predicting life expectancy of a country that can help respective government in making policies that will serve for the benefit of the nation and entire human kind.

10. FUTURE SCOPE

- Look at class within a particular country and see if these same factors are same in determining life expectancy for an individual.
- Use the Twitter API to incorporate NLP analysis for a country to see how it relates to Life Expectancy.
- Increase the dataset size with continuing UN and Global Data to incorporate new added features like population, GDP, environmental, and etc in order to test and clarify country groupings.

- Mental Health versus LifeExpectancy
- As more data comes, that can be fed to the model for more accuratepredictions.
- Currently, the project is just a web application. It can be developed to support other platforms like Android, IOS and Windows Mobile.
- Other regression models can also be used for prediction and later the best among them should bechosen

11. BIBLIOGRAPHY :-

Appendix :-

Source Code (json file)

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[{"id":"49c9a03e.1feaa","type":"tab","label":"Flow
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},{ "label":"Status","value":"stat","type":"text","required":false,"row
s":null},{ "label":"Adult
Mortality","value":"am","type":"number","required":true,"rows":nul
```

```

l},{ "label": "Under-five
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```



```

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```

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dipt=global.get('dipt');\nvar          hiv=global.get('hiv');\nvar
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thin5=global.get('thin5');\nvar      thin10=global.get('thin10');\nvar
scl=global.get('scl');\nvar          alc=global.get('alc');\nvar
gdp=global.get('gdp');\nvar        perexp=global.get('perexp');\nvar
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\"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\"], \n  \"values\":
[[country, year, stat, am, idr, alc, perexp, hepb, mesls, bmi, ufd,

```

```

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```

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=
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```

```

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```

Nodered flow :-

<https://node-red-mars.eu-gb.mybluemix.net/red/#flow/49c9a03e.1feaa>

Github link :-

<https://github.com/SmartPracticeschool/IISPS-INT-3373-Predicting-Life-Expectancy-using-Machine-Learning>

Youtube video link :-

<https://youtu.be/8A3zkhWLcX0>

