

VIT BUILD-A-THON -
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sarada-manaswini

Project Title: Predict heart failure using IBM auto AI service

1. INTRODUCTION

1.1 Overview

Cardiovascular diseases (CVDs) are the number 1 cause of death globally, taking an estimated 17.9 million lives each year, which accounts for 31% of all deaths worldwide. Heart failure is a common event caused by CVDs and this dataset contains 9 features that can be used to predict mortality by heart failure.

In this project, I built a model using Auto AI and built a web application where we can showcase the prediction of heart failure.

Services Used are:

1. IBM Watson Studio
2. IBM Watson Machine Learning
3. Node-RED
4. IBM Cloud Object Storage

1.2 Purpose

As we train the existing dataset using our created Auto AI experiment in Watson Studio we will be able to predict the values if a person has or will have a heart failure or not depending upon the features used and given as input . The webpage developed will help us get the prediction as Yes(Y) or No(N) according to the input given in that so that people can use this webpage and check their heart health status.It is very useful for elderly as well as mid age group people as now a days they are also prone to heart failure due to habits and other health circumstances like less amount of sleep, obesity etc.

2. LITERATURE SURVEY

2.1 Existing problem

This problem can be solved in python or jupyter notebook by providing inputs in the programming environment.

We can model any algorithm in the above mentioned ways and get output there.

We can also develop a webpage using HTML and CSS and link it to the model output obtained from jupyter notebook or python.

2.2 Proposed solution

First we build an AutoAI experiment using watson studio by IBM and create a machine learning service which can be linked with auto ai .We can then load the dataset , obtain the algorithm wise pipeline analysis and get the best model or algorithm suited for the dataset which is major plus with respect to machine learning.

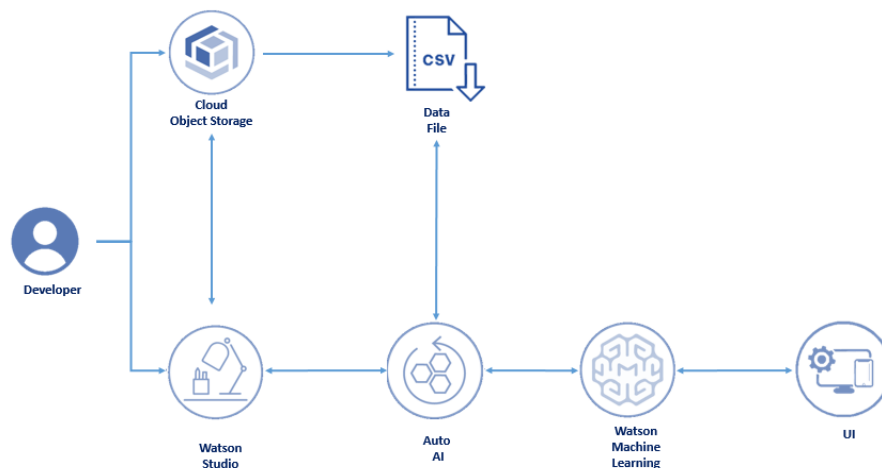
This makes our job easier compared to traditional coding methods.

Then we can create a web page using node red application in IBM and link the endpoint generated by the ai model to this code and get a prediction output in the web page displayed.We can modify the color and other graphic design parameter of our created website form using node red which can enhance the visual parameter for the user.

3 . THEORETICAL ANALYSIS

3.1 Block diagram

Diagrammatic overview of the project:-



3.2 Hardware / Software designing

Software requirements:

IBM cloud account, IBM Cloud, IBM Watson, Node- RED, IBM Machine Learning, IBM Cloud Object Storage.

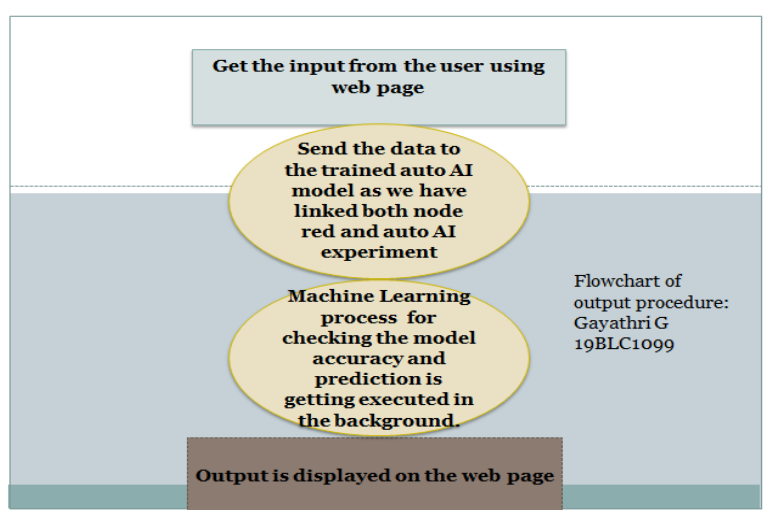
4 . EXPERIMENTAL INVESTIGATIONS

Analysis or the investigation made while working on the solution.

1. According to the dataset , the model is trained and the input values from the user are used for testing and getting the predicted value.
2. The model best suited for the dataset taken was gradient boosting classifier.
As it gave more accuracy compared to other classification algorithms.
3. Node red helps us integrate to the dashboard and help us create forms or webpages where we can get input from the user and display their respective outputs.

5. FLOWCHART

Diagram showing the control flow of the solution



6. RESULT

Final findings (Output) of the project along with screenshots of the created services.

IBM AutoAI and watson studio for heart failure prediction Services created screen shots and output predicted values for test values.

IBM Cloud

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Resource list

Create resource +

Name	Group	Location	Product	Status	Tags
<div>Filter by name or IP address...</div> <div>Filter by group or org...</div> <div>Filter...</div> <div>Filter...</div> <div>Filter...</div> <div>Filter...</div>					

Cloud Foundry apps (1)					
Node RED NYOBQ 2021-08-04	gayathri.g2019@vitstudent.ac.in / dev	London	SDK for Node.js™	Started	—
Cloud Foundry services (1)					
node-red-nyobq-2021--cloudant-16280...	gayathri.g2019@vitstudent.ac.in / dev	London	Cloudant	Provisioned	—
Services and software (4)					
Continuous Delivery	Default	London	Continuous Delivery	Active	—
Machine Learning-fe	Default	London	Machine Learning	Active	cpdaas
Watson Studio-kh	Default	London	Watson Studio	Active	—
node-red-nyobq-2021--cloudant-16280...	Default	Dallas	Cloudant	Active	—
Storage (1)					
Cloud Object Storage-qj	Default	Global	Cloud Object Storage	Active	cpdaas
Network (0)					

IBM Cloud Pak for Data

All

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What's new

Add a serving name for an online deployment (Watson Machine Learning)

Aug 06, 2021

Overview

Recent projects

heart_failure

Aug 04, 2021 03:05 PM

insurance_project

Jul 27, 2021 07:03 PM

Your services

node-red-nyobq-2021--cloudant-1628071450063-72491

Aug 04, 2021 03:37 PM

Cloudant

node-red-nyobq-2021--cloudant-1628071450063

Aug 04, 2021 03:34 PM

Cloudant

Machine Learning-fe

Aug 04, 2021 03:05 PM

Machine Learning

Notifications

Online deployment ready

The online deployment heart_failure_ds in space heartfailure_deploy is ready to acco

Aug 04, 2021 03:18 PM

New in gallery

NOTEBOOK

Calculating Thermodynamics Observables

AUTHOR IBM

MODIFIED Aug 04, 2021

Nature Quantum

Deployment spaces

heartfailure_deploy

Aug 04, 2021 03:16 PM

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Projects / heart_failure

Launch IDE

Add to project

Data assets

0 assets selected.

Name	Type	Created by	Last modified
CSV patientdata16.csv	Data Asset	GAYATHRI G	Aug 04, 2021, 03:09 PM

AutoAI experiments

New AutoAI experiment +

Name	Status	Model type	Last modified
heart_autoai	Completed	Binary Classification	Aug 04, 2021, 03:14 PM

Models

Watson Machine Learning models

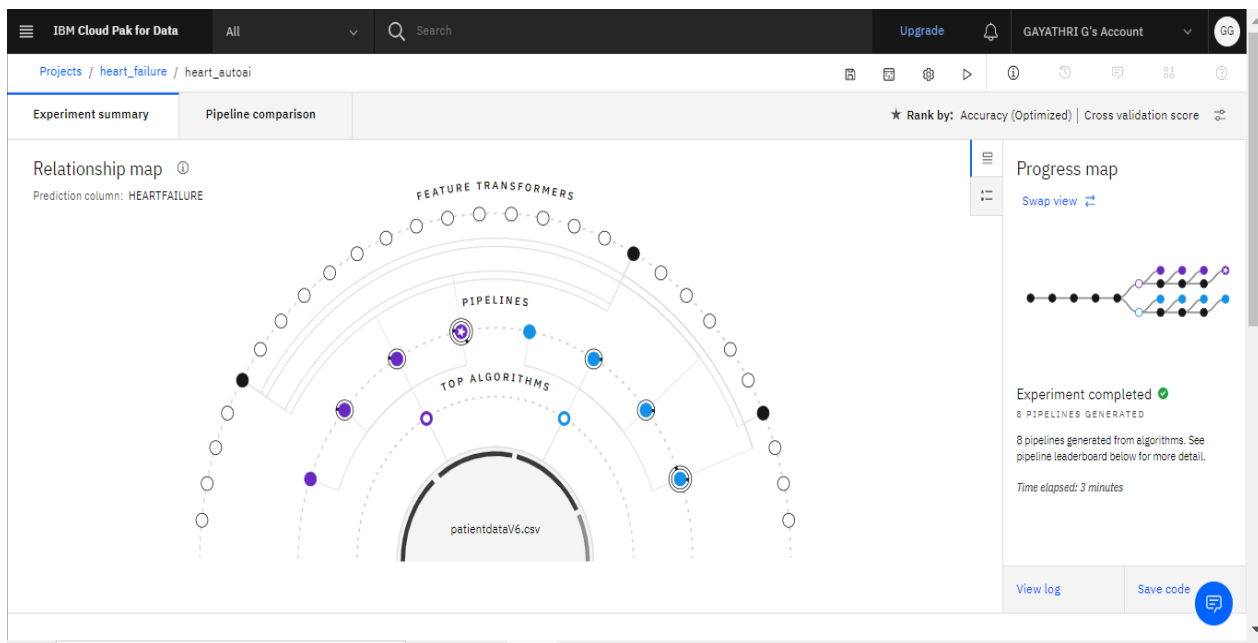
New Model from file +

Name	Type	Software specification	Last modified
heart_autoai - P4 Gradient Boosting Classifier	wml-hybrid_0.1	hybrid_0.1	Aug 04, 2021

Data

Load Files Catalog

Drop files here or browse for files to upload.

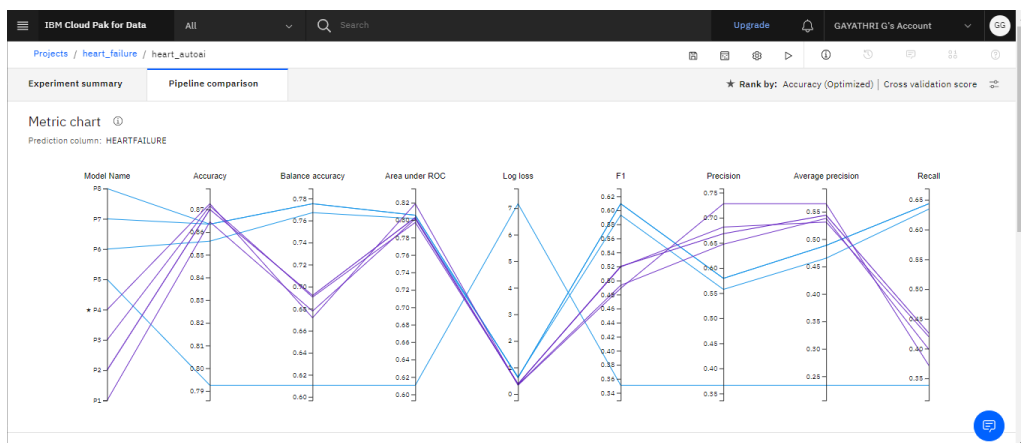


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Projects / heart_failure / heart_autotai

Experiment summary | Pipeline comparison | ★ Rank by: Accuracy (Optimized) | Cross validation score

	Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time
★	1	Pipeline 4	Gradient Boosting Classifier	0.872	HPO-1 FE HPO-2	00:00:23
	2	Pipeline 3	Gradient Boosting Classifier	0.872	HPO-1 FE	00:00:53
	3	Pipeline 2	Gradient Boosting Classifier	0.870	HPO-1	00:00:10
	4	Pipeline 1	Gradient Boosting Classifier	0.864	None	00:00:02
	5	Pipeline 7	Decision Tree Classifier	0.863	HPO-1 FE	00:00:20
	6	Pipeline 8	Decision Tree Classifier	0.863	HPO-1 FE HPO-2	00:00:09
	7	Pipeline 6	Decision Tree Classifier	0.856	HPO-1	00:00:03



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Projects / heart_failure / heart_autoai - P4 Gradient Boost...

heart_autoai - P4 Gradient Boosting Classifier

Promote to deployment space

Overview | Activities

Input Schema

Column	Type
AGE	"integer"
AVGHEARTBEATSPERMIN	"integer"
BMI	"integer"
CHOLESTEROL	"integer"
EXERCISEMINPERWEEK	"integer"
FAMILYHISTORY	"other"

heart_autoai - P4 Gradient Boosting Classifier
Last modified at Aug 8, 2021 11:33 PM

Description
No description provided.

Created
Aug 4, 2021 3:14 PM

Type
wml-hybrid_0.1

Model ID
c7f56691-b046-4052-9f48-7fe...

Software specification
hybrid_0.1

Hybrid pipeline software specifications
autoai-kb_3.4-py3.8

Tags
Add tags to make assets easier to find.

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Deployments / heartfailure_deploy / heart_autoai - P4 Gradient Boost... / heart_failure_ds

heart_failure_ds

Deployed | Online

API reference | Test

Direct link

Endpoint

https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/cb292ec4-6c05-4511-8215-2881cc50228d/predictions?version=2021-08-04

Bearer <token> | IAM

Code snippets

cURL	Java	JavaScript	Python	Scala
<pre># NOTE: you must set \$API_KEY below using information retrieved from your IBM Cloud account. curl --insecure -X POST --header "Content-Type: application/x-www-form-urlencoded" --header "Accept: application/json" --data-urlencode "grant_type=urn:ibm:params:oauth:grant-type-token-request" --data-urlencode "client_id=your_client_id" --data-urlencode "client_secret=your_client_secret" --data-urlencode "refresh_token=your_refresh_token" --data-urlencode "scope=your_scope" --data-urlencode "apikey=\$API_KEY" https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/cb292ec4-6c05-4511-8215-2881cc50228d/predictions?version=2021-08-04 # the above CURL request will return an auth token that you will use as \$IAM_TOKEN in the scoring request below # TODO: manually define and pass values to be scored below curl -X POST --header "Content-Type: application/json" --header "Accept: application/json" --header "Authorization: Bearer \$IAM_TOKEN" -d '{"input_data": [{"AGE": 45, "AVGHEARTBEATSPERMIN": 75, "BMI": 25, "CHOLESTEROL": 180, "EXERCISEMINPERWEEK": 15, "FAMILYHISTORY": 0}]}' https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/cb292ec4-6c05-4511-8215-2881cc50228d/predictions?version=2021-08-04</pre>				

heart_failure_ds

Created
Aug 4, 2021 3:17 PM

Updated
Aug 4, 2021 3:17 PM

Deployment ID
cb292ec4-6c05-4511-8215-2...

Software specification
hybrid_0.1

Hybrid pipeline software specifications
autoai-kb_3.4-py3.8

Copies
1

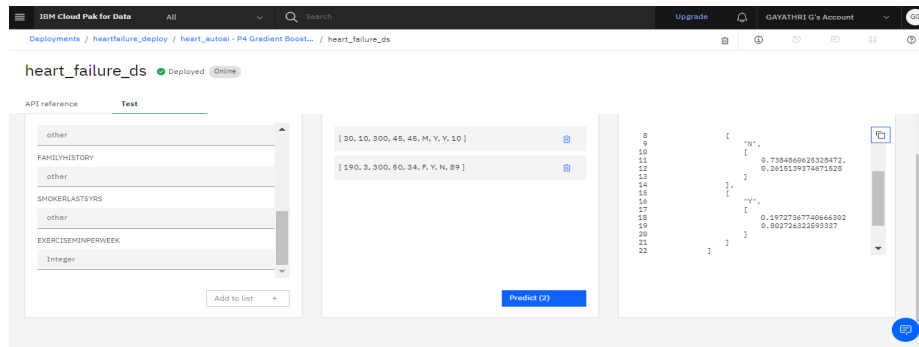
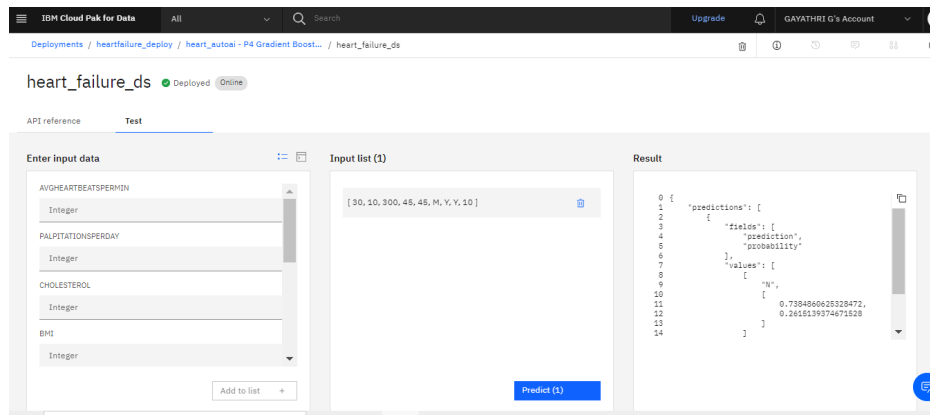
Description
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Tags
Add tags to make assets easier to find.

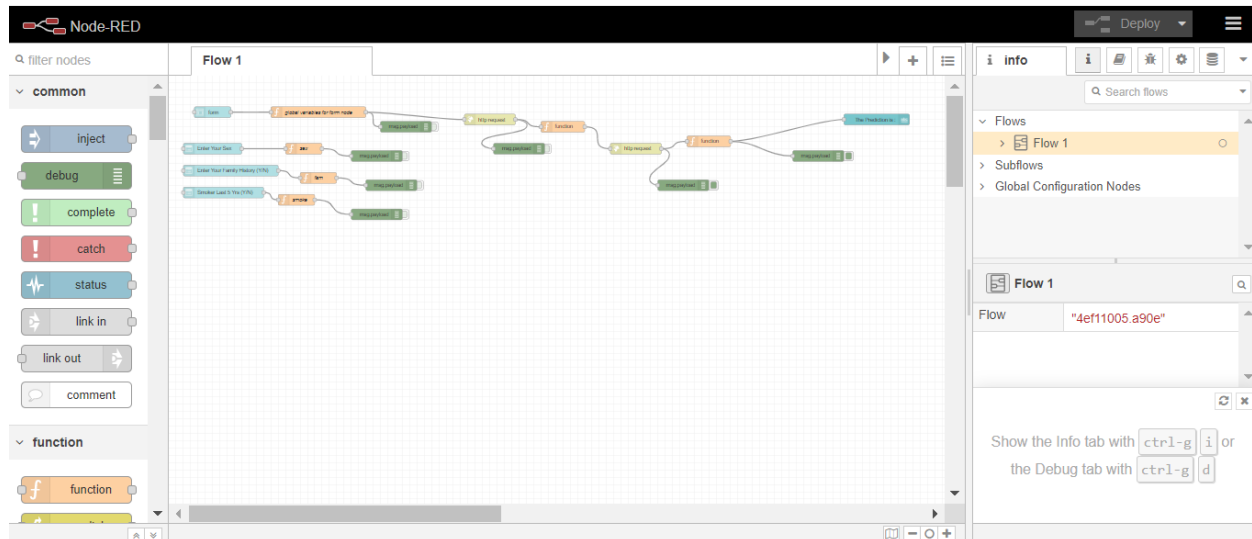
IAM endpoint - direct link -

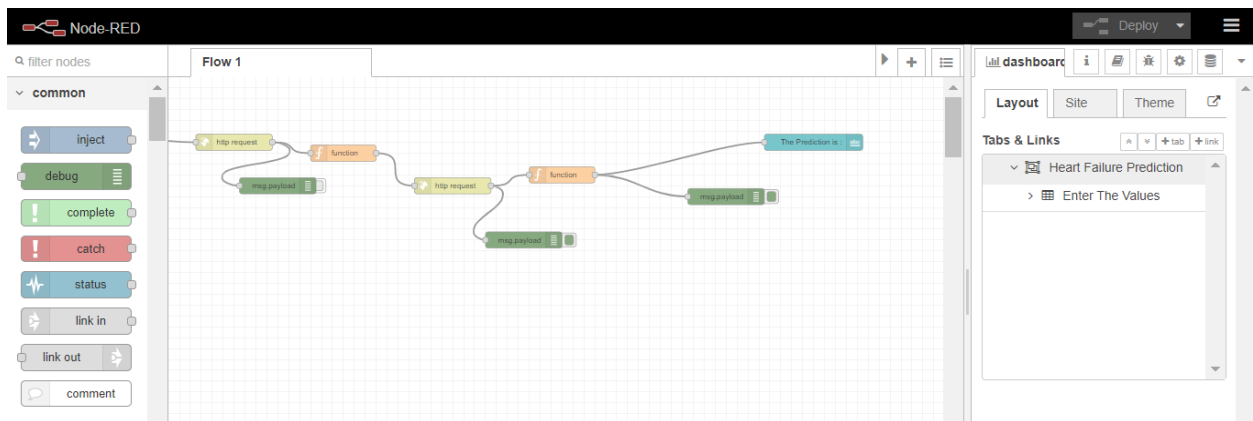
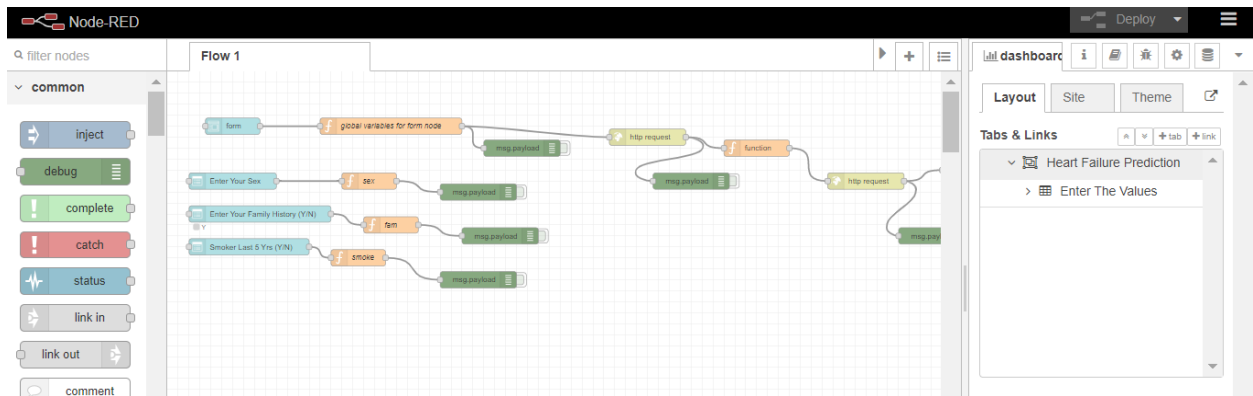
<https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/cb292ec4-6c05-4511-8215-2881cc50228d/predictions?version=2021-08-04>

Test values Along with predicted output for - heart failure prediction



Node Red Flow and output screenshots:





Heart Failure Prediction

Enter The Values

Enter Your Sex

F

Enter Your Family History (Y/N)

N

Smoker Last 5 Yrs (Y/N)

N

AVGHEARTBEATSPERMIN

Heart Failure Prediction

PALPITATIONS PER DAY

CHOLESTEROL

BMI

AGE

EXERCISE MIN PER WEEK

Heart Failure Prediction

AGE
78

EXERCISE MIN PER WEEK
45

SUBMIT CANCEL

The Prediction is : **N**

Test values for Node red :

Heart Failure Prediction

Enter The Values

Enter Your SexF

Enter Your Family History (Y/N)Y

Smoker Last 5 Yrs (Y/N)N

AVGHEARTBEATSPERMIN190

Heart Failure Prediction

PALPITATIONSPERDAY3

CHOLESTEROL300

BMI50

AGE34

EXERCISEMINPERWEEK89

Heart Failure Prediction

AGE34

EXERCISEMINPERWEEK89

SUBMITCANCEL

The Prediction is : Y

Node red link:

<https://node-red-nyobq-2021-08-04.eu-gb.mybluemix.net/ui/#!/0?socketid=9wYVmzMatAM>

7. ADVANTAGES & DISADVANTAGES

Advantages:

With this prediction, users can approach a doctor to get themselves checked at the early stages. In case of emergencies, it can predict heart failure and the user would make necessary arrangements in advance.

At hospitals, it could be of great help to identify heart failure patients and reduce doctors time complexity.

This prediction method is cost effective for the patients.

Disadvantages:

The prediction generated by an automated system alone does not assure accuracy.

The prediction is only as perfect as the data that is provided in the dataset.

The system is not fully automated as it needs an user to feed the diagnosis.

8. APPLICATIONS

It allows users to get instant predictions on their heart well being status.

This model can be used to predict future heart failure medical data for people of all ages.

People who need immediate medical attention could use this prediction to check out if it might be a heart failure.

It will be helpful for people with heart related disease in predicting heart failure at early stages.

In hospitals for initial diagnosis the prediction could detect if the patient might suffer from heart failure.

9. CONCLUSION

The heart failure prediction auto AI based project executed successfully using IBM watson machine learning service and auto AI experiment. It predicted the apt machine learning model for the heart dataset which is the 'Gradient boosting classifier' Machine learning algorithm which had the maximum accuracy among the classification models. The web page/form developed using node red was very useful for providing the inputs through dropdown and text and can help the user see the output instantly.

10. FUTURE SCOPE

In the future, the predictions scalability and accuracy can be improved in numerous ways.

Various other ways of normalizing the data can be analyzed and the results can be compared to give out better results. Advanced techniques and algorithms can be used to predict heart failure in less time complexity. Extra diagnostic factors can be too received from the user that can be helpful in increasing the effectiveness of the prediction. Even the user's old health history could

be collected and the predictions can be done with respect to that data. With the prediction, the users can be provided with necessary instructions to follow to avoid any further complications and bring them to a risk free level.

11. BIBLIOGRAPHY

These are some of the links which were helpful in completing this project:

<https://dataplatform.cloud.ibm.com/docs/content/wsj/getting-started/projects.html?audience=wdp&context=wdp>

<https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai-overview.html?audience=wdp&context=wdp>

<https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/autoai-build.html?audience=wdp&context=wdp>

APPENDIX

A. Source Code

Auto AI python code for heart failure prediction:

```
import requests

# NOTE: you must manually set API_KEY below using information retrieved from your IBM
Cloud account.

API_KEY = "<your API key>"

token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":
API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})

mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}

# NOTE: manually define and pass the array(s) of values to be scored in the next line
payload_scoring = {"input_data": [{"fields": [array_of_input_fields], "values":
[array_of_values_to_be_scored, another_array_of_values_to_be_scored]]}

response_scoring =
requests.post('https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/cb292ec4-6c05-4511-8215-28
81cc50228d/predictions?version=2021-08-04?version=2021-08-04', json=payload_scoring,
headers={'Authorization': 'Bearer ' + mltoken})

print("Scoring response")
print(response_scoring.json())
```

Node Red JSON code:

```
[{"id":"4ef11005.a90e","type":"tab","label":"Flow
1","disabled":false,"info":""},{ "id":"f6c8b3b3.7c0a8","type":"ui_tab","name":"Heart Failure
```

```
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Neue,sans-serif"},"edited":true,"reset":false},"darkTheme":{"default":"#097479","baseColor":"#09
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```

[illegible]

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msg;","outputs":1,"noerr":0,"initialize":"","finalize":"","libs":[],"x":1480,"y":180,"wires":[["1bea36af.27e269","2cf9a253.5074ce"]]],{"id":"1bea36af.27e269","type":"debug","z":"4ef11005.a90e","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","statusVal":"","statusType":"auto","x":1780,"y":220,"wires":[]},{id:"2cf9a253.5074ce","type":"ui_text","z":"4ef11005.a90e","group":"4f06d606.e90c28","order":5,"width":0,"height":0,"name":"","label":"The Prediction is :","format":"{{msg.payload}}","layout":"row-center","x":1940,"y":120,"wires":[]}]
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