

# **Effective Heart Disease Prediction Using IBM Auto AI Service**

**By,**  
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**Thanjavur – 613 401,**  
**India**

Resource list - IBM Cloud Node-RED : node-red-lztvt-2022- Node-RED Dashboard IBM Cloud Pak for Data

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## Resource list

Name	Group	Location	Product	Status	Tags	⋮
<input type="text"/> Filter by name or IP address...	<input type="text"/> Filter by group or org...	<input type="text"/> Filter...				
Satellite (0)						
Cloud Foundry apps (1)						
Node RED LZTVT 2022-07-25	pmpadmin / pmpadmin	Dallas	Node.js	<span>Started</span>		
Cloud Foundry services (1)						
node-red-lztvt-2022--cloudant-1658724...	pmpadmin / pmpadmin	Dallas	Cloudant	Provisioned		
Services and software (4)						
Continuous Delivery	Default	Dallas	Continuous Delivery	<span>Active</span>		
Machine Learning-rn	Default	Dallas	Machine Learning	<span>Active</span>	cpdaas	
Watson Studio-a7	Default	Dallas	Watson Studio	<span>Active</span>		
node-red-lztvt-2022--cloudant-1658724...	Default	Sydney	Cloudant	<span>Active</span>		
Storage (1)						
Cloud Object Storage-nq	Default	Global	Cloud Object Storage	<span>Active</span>	cpdaas	
Network (0)						

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Resource list - IBM Cloud Node-RED : node-red-lztvt-2022- Node-RED Dashboard IBM Cloud Pak for Data

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## Resource list

Name	Group	Location	Product	Status	Tags	Actions
<input type="text"/> Filter by name or IP address...	<input type="text"/> Filter by group or org...	<input type="text"/> Filter...	<input type="text"/> Filter...	<input type="text"/> Filter...	<input type="text"/> Filter...	<input type="text"/> Filter...
<input checked="" type="checkbox"/> Services and software (4)						
<input checked="" type="checkbox"/> node-red-lztvt-2022--cloudant-1658724...	Default	Sydney	Cloudant	<input checked="" type="checkbox"/> Active	-	<input type="button"/>
<input checked="" type="checkbox"/> Storage (1)						
<input checked="" type="checkbox"/> Cloud Object Storage-nq	Default	Global	Cloud Object Storage	<input checked="" type="checkbox"/> Active	cpdaas	<input type="button"/>
<input checked="" type="checkbox"/> Network (0)						
<input checked="" type="checkbox"/> Functions namespaces (0)						
<input checked="" type="checkbox"/> Apps (1)						
<input checked="" type="checkbox"/> Node RED LZTVT 2022-07-25	Default	Global	Cloud Application	-	-	<input type="button"/>
<input checked="" type="checkbox"/> Developer tools (1)						
<input checked="" type="checkbox"/> NodeREDLZTVT2022-07-25	Default	Dallas	Toolchain	-	-	<input type="button"/>
<input checked="" type="checkbox"/> VMware (0)						
<input checked="" type="checkbox"/> Schematics workspaces (0)						
<input checked="" type="checkbox"/> Code Engine (0)						

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## Projects

Your projects				
Project		Actions		
<input type="checkbox"/>	Name	Date created	Your role	Collaborators
<input type="checkbox"/>	FinalHFPM	2 hours ago	Admin	 <span>PM</span> <span>⋮</span>
<input type="checkbox"/>	HFPM AutoAI	2 hours ago	Admin	 <span>PM</span> <span>⋮</span>
<input type="checkbox"/>	HFPM	2 hours ago	Admin	 <span>PM</span> <span>⋮</span>
<input type="checkbox"/>	Final Project	3 hours ago	Admin	 <span>PM</span> <span>⋮</span>

Items per page: 20 ▾



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IN 25/07/22

Catalog - IBM Cloud Node-RED : node-red-lztvt-2022 Node-RED Dashboard IBM Cloud Pak for Data

dataplatform.cloud.ibm.com/projects/ce223c4e-1a75-41db-9aa3-3e0002bef95f/assets?context=cpdaas

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Projects / FinalHFPN Overview Assets Jobs Manage

Find assets Add asset New asset

3 assets All assets

All assets

Name	Last modified
HFPN AutoAI - P8 Snap Random Forest Classifier Model	2 hours ago Priya Mohan (You)
HFPN AutoAI AutoAI experiment	2 hours ago Priya Mohan (You)
patientdataV6.csv CSV	2 hours ago Priya Mohan (You)

Asset types

- Data 1
- Experiments 1
- Models 1

Items per page: 20 1–3 of 3 items 1 of 1 pages

Drop data files here or browse for files to upload

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Service Details - IBM Cloud

IBM Cloud Pak for Data

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Projects / FinalHFP / HFP AutoAI

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

Relationship map ⓘ Prediction column: HEARTFAILURE

FEATURE TRANSFORMERS

PIPLINES

TOP ALGORITHMS

patientdataV6.csv

Progress map Swap view

Experiment completed ✓  
8 PIPELINES GENERATED  
8 pipelines generated from algorithms. See pipeline leaderboard below for more detail.

Time elapsed: 5 minutes

View log Save code

Pipeline leaderboard

Catalog - IBM Cloud Node-RED : node-red-lztvt-2022 Node-RED Dashboard IBM Cloud Pak for Data

dataplatform.cloud.ibm.com/ml/auto-ml/e0b6b9ff-fae3-43c6-8f1f-2fb353d6149b/train?projectid=ce223c4e-1a75-41db-9aa3-3e0002bef95f&context=cpdaas

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Projects / FinalHFP / HFP AutoAI

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

Prediction column: HEARTFAILURE Swap view

```
graph LR; RD[Read dataset] --> SD[Split holdout data]; SD --> RTD[Read training data]; RTD --> PP[Preprocessing]; PP --> MS[Model selection]; MS --> XBC[XGB Classifier]; MS --> SRFC[Snap Random Forest Classifier]; XBC --> HO1[Hyperparameter optimization]; SRFC --> HO2[Hyperparameter optimization]; HO1 --> FE1[Feature engineering]; HO2 --> FE2[Hyperparameter optimization]; FE1 --> P1((P1)); FE2 --> P5((P5)); P1 --> P2((P2)); P5 --> P6((P6)); P2 --> P3((P3)); P6 --> P7((P7)); P3 --> P4((P4)); P7 --> P8((P8)); P4 --> P8
```

Experiment completed ✓  
8 PIPELINES GENERATED  
8 pipelines generated from algorithms. See pipeline leaderboard below for more detail.  
Time elapsed: 5 minutes

View log Save code

## Pipeline leaderboard

Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time
1	P1	XGB Classifier	95.5%	1 enhancement	5 minutes



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Projects / FinalHFP / HFP AutoAI

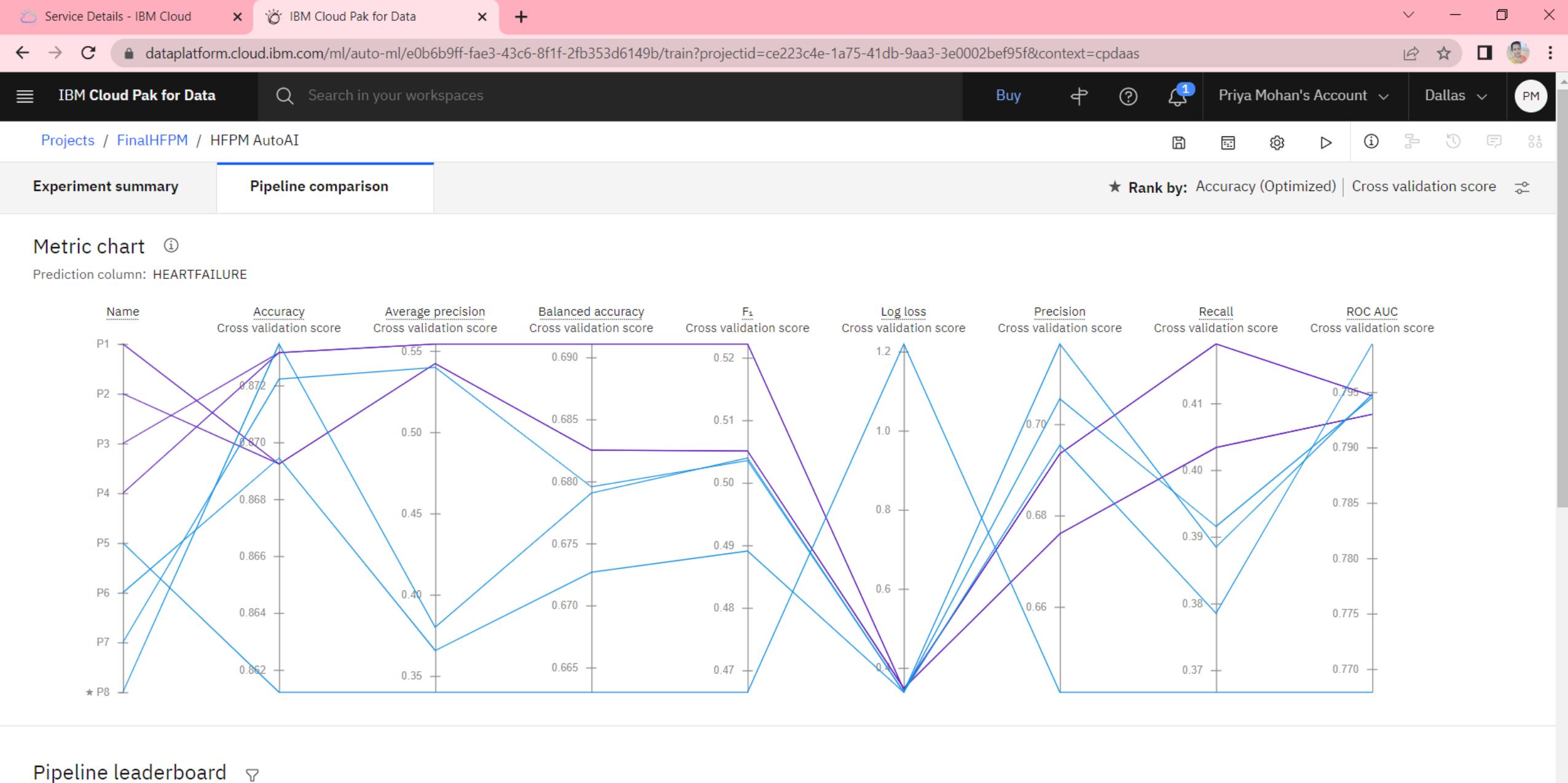
Experiment summary Pipeline comparison ★ Rank by: Accuracy (Optimized) | Cross validation score

Pipeline leaderboard

Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time
1	Pipeline 8	Snap Random Forest Classifier	0.873	HPO-1 FE HPO-2	00:01:17
2	Pipeline 3	XGB Classifier	0.873	HPO-1 FE	00:00:43
3	Pipeline 4	XGB Classifier	0.873	HPO-1 FE HPO-2	00:01:30
4	Pipeline 7	Snap Random Forest Classifier	0.872	HPO-1 FE	00:00:54
5	Pipeline 6	Snap Random Forest Classifier	0.869	HPO-1	00:00:09
6	Pipeline 1	XGB Classifier	0.869	None	00:00:01
7	Pipeline 2	XGB Classifier	0.869	HPO-1	00:00:13
8	Pipeline 5	Snap Random Forest Classifier	0.861	None	00:00:01

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IBM Cloud Pak for Data		Experiment summary					
		Pipeline comparison			Build time		
Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time		
Rank	Name	Algorithm	Accuracy (Optimized) Cross Validation	Enhancements	Build time		
1	Pipeline 8	Snap Random Forest Classifier	0.873	HPO-1 FE HPO-2	00:01:17		
2	Pipeline 3	XGB Classifier	0.873	HPO-1 FE	00:00:43		
3	Pipeline 4	XGB Classifier	0.873	HPO-1 FE HPO-2	00:01:30		
4	Pipeline 7	Snap Random Forest Classifier	0.872	HPO-1 FE	00:00:54		
5	Pipeline 6	Snap Random Forest Classifier	0.869	HPO-1	00:00:09		
6	Pipeline 1	XGB Classifier	0.869	None	00:00:01		
7	Pipeline 2	XGB Classifier	0.869	HPO-1	00:00:13		
8	Pipeline 5	Snap Random Forest Classifier	0.861	None	00:00:01		

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dataplatform.cloud.ibm.com/ml/models/9e0775f7-fd41-40f7-874d-7cf4fdb2445e?projectId=ce223c4e-1a75-41db-9aa3-3e0002bef95f&context=cpdaas&wmlv4=true

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Projects / FinalHFP / HFP AutoAI - P8 Snap Random ...

HFP AutoAI - P8 Snap Random Forest Classifier

Promote to deployment space

**Input Schema**

**Input**

Column	Type
AGE	"integer"
AVGHEARTBEATSPERMIN	"integer"
BMI	"integer"
CHOLESTEROL	"integer"
EXERCISEMINPERWEEK	"integer"
FAMILYHISTORY	"other"
PALPITATIONSPERDAY	"integer"
SEX	"other"
SMOKERLAST5YRS	"other"

**HFPM AutoAI - P8 Snap Random Forest Classifier**  
Last modified at Jul 25, 2022 11:38 AM

Description  
No description provided.

Created  
Jul 25, 2022 11:38 AM

Type  
wml-hybrid\_0.1

Model ID  
9e0775f7-fd41-40f7-874d-7cf4...

Software specification  
hybrid\_0.1

Hybrid pipeline software specifications  
autoai-kb\_rt22.1-py3.9

Tags  
Add tags to make assets easier to find.

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Overview Assets Jobs Manage

Find assets Add asset ⌂ New asset +

3 assets All assets

All assets

Name	Last modified
HFPN AutoAI - P8 Snap Random Forest Classifier Model	6 minutes ago Priya Mohan (You)
HFPN AutoAI AutoAI experiment	14 minutes ago Priya Mohan (You)
patientdataV6.csv CSV	20 minutes ago Priya Mohan (You)

Asset types

- > Data 1
- > Experiments 1
- > Models 1

Items per page: 20 ▾ 1–3 of 3 items 1 of 1 pages ⌂ ↺ ↻

Data in this project

Drop data files here or browse for files to upload

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Projects / FinalHFFPM / HFFPM AutoAI - P8 Snap Random ...

HFFPM AutoAI - P8 Snap Random Forest Classifier

Promote to deployment space

Successfully promoted HFFPM AutoAI - P8 Snap Random Forest Classifier to the associated deployment space. Go to the deployment space to prepare the assets for deployment.

Timestamp 11:49:27 AM

No description provided.

Created Jul 25, 2022 11:38 AM

Type wml-hybrid\_0.1

Model ID 9e0775f7-fd41-40f7-874d-7cf4... □

Software specification hybrid\_0.1

Hybrid pipeline software specifications autoai-kb\_rt22.1-py3.9

Tags Add tags to make assets easier to find.

Feedback

### Input Schema

Column	Type
AGE	"integer"
AVGHEARTBEATSPERMIN	"integer"
BMI	"integer"
CHOLESTEROL	"integer"
EXERCISEMINPERWEEK	"integer"
FAMILYHISTORY	"other"
PALPITATIONSPERDAY	"integer"
SEX	"other"
SMOKERLAST5YRS	"other"

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Windows Taskbar icons: File Explorer, Mail, OneDrive, Firefox, Edge, Google Chrome, Microsoft Edge, Powerpoint, Word, Excel, and others.

System tray icons: Volume, Network, Battery, and Date/Time (11:49 AM, 25/07/22).

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dataplatform.cloud.ibm.com/ml-runtime/spaces/b0a38dfe-38ca-4159-8a2c-792081e37a2f/assets?context=cpdaas

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Deployments / Add to space + ① ⚙️ ⏱️ 📄 81

## HFPModel

Overview Assets Deployments Jobs Manage

What assets are you looking for?

Models (1) Import model +

Name	Type	Software specification	Tags	Last modified
HFPModel AutoAI - P8 Snap Random Forest Classifier	wml-hybrid_0.1	hybrid_0.1		Jul 25, 2022 11:49 AM

Drop files here or browse for files to upload.

Stay on the page until upload completes.  
Incomplete uploads are cancelled.

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## Create a deployment

 Associated asset  
HFPM AutoAI - P8 Snap Random Forest Classifier

### Deployment type

**Online**   
Run the model on data in real-time, as data is received by a web service.

**Batch**  
Run the model against data as a batch process.

Name \_\_\_\_\_

## HFPMDeploy

Serving name [\(i\)](#)

### Deployment serving name

[Cancel](#)

Create

Service Details - IBM Cloud x IBM Cloud Pak for Data x +

dataplatform.cloud.ibm.com/ml-runtime/deployments/508c41c0-d254-4c39-861d-48e5b29184f8/implementation?space\_id=b0a38dfe-38ca-4159-8a2c-792081e37a2f&context=cpdaas&flush=true

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Deployments / HFFPMModel / HFFPM AutoAI - P8 Snap Random ... /

Online

## HFFPMDeploy ✓ Deployed Online

API reference

Test

Direct link

Endpoint

Bearer <token> ⓘ

<https://us-south.ml.cloud.ibm.com/ml/v4/deployments/508c41c0-d254-4c39-861d-48e5b29184f8/predictions?version=2022-07-25>



IAM

## Code snippets

cURL

Java

JavaScript

Python

Scala

# 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:apikey"
--data-urlencode "apikey=$API_KEY" "https://iam.cloud.ibm.com/identity/token"
```

# 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 $IAM_TOKEN" -d '{"input_data": [{"fields": [$ARRAY_OF_INPUT_FIELDS], "values": [$ARRAY_OF_VALUES_TO_BE_SCORED],
$ANOTHER_ARRAY_OF_VALUES_TO_BE_SCORED]}]}' "https://us-south.ml.cloud.ibm.com/ml/v4/deployments/508c41c0-d254-4c39-861d-48e5b29184f8/predictions?version=2022-07-25"
```



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## HFFPM AutoAI - P8 Snap Random Forest Classifier test prediction x

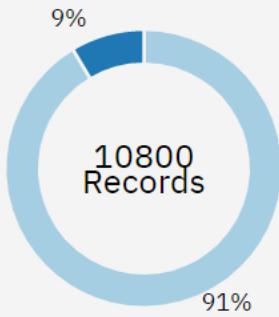
Prediction type

Table view  JSON view

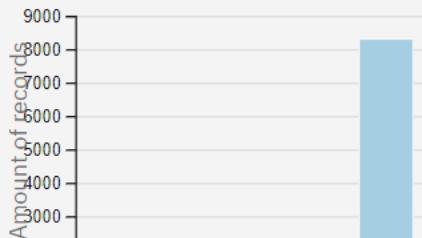
HFFPM AutoAI - P8 Snap Random Forest Classifier test prediction

### Binary classification

Prediction percentage



Confidence level distribution



	Prediction	Confidence
1	N	92%
2	N	92%
3	N	92%
4	N	57%
5	N	92%
6	N	88%
7	N	82%
8	N	92%
9	N	92%
10	N	92%
11	N	92%
12	Y	81%
13	Y	50%
14	N	91%
15	N	92%

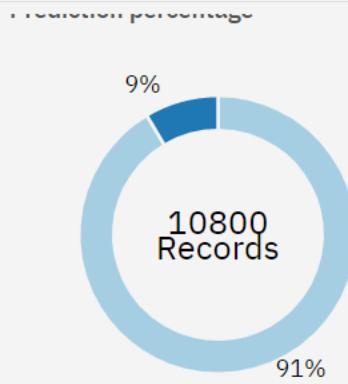
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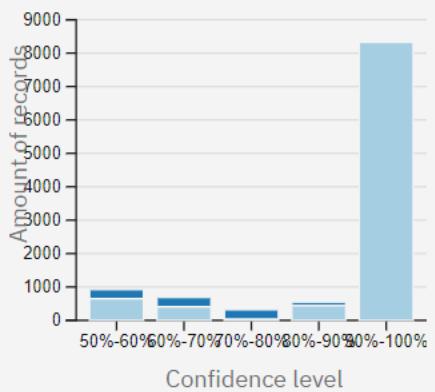


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## HFFPM AutoAI - P8 Snap Random Forest Classifier test prediction



### Confidence level distribution



```
        0.921966994115535,  
        0.07803300588446505  
    ],  
    [  
        "N",  
        [  
            0.9211453440434793,  
            0.07885465595652075  
        ],  
        [  
            "N",  
            [  
                0.9236087362994166,  
                0.0763912637005834  
            ],  
            [  
                "N",  
                [  
                    0.921966994115535,  
                    0.07803300588446505  
                ]  
            ]  
        ]  
    ]  
}
```

HFFPM AutoAI - P8 Snap Random Forest Classifier test prediction

Download



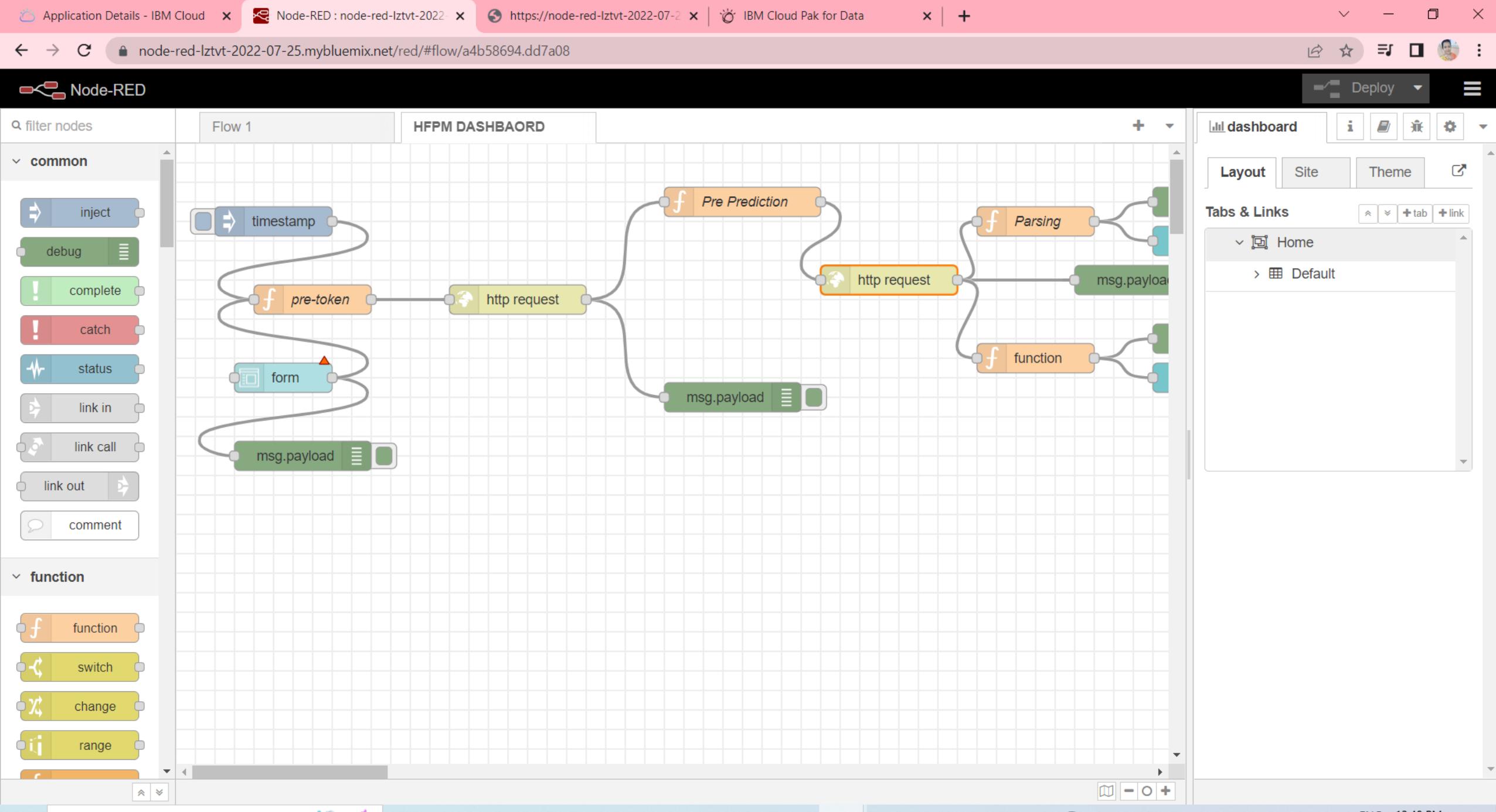
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## Home

### Default

AVERAGE HEART BEATS ( Per Minute ) \*

93

PALPITATIONS PER DAY \*

22

CHOLESTEROL \*

163

BMI \*

25

AGE \*

49

SEX (M or F) \*

F

FAMILY HISTORY (Y or N) \*

N

SMOKER ( In Last 5 Years : Y or N ) \*

N

EXERCISE ( Minutes Per Week ) \*

110

SUBMIT

CANCEL

Prediction

Score



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## Default

AVERAGE HEART BEATS ( Per Minute ) \*

93

PALPITATIONS PER DAY \*

22

CHOLESTEROL \*

163

BMI \*

25

AGE \*

49

SEX (M or F) \*

F

FAMILY HISTORY (Y or N) \*

N

SMOKER ( In Last 5 Years : Y or N ) \*

N

EXERCISE ( Minutes Per Week ) \*

110

SUBMIT

CANCEL

Prediction

Score

## Home

### Default

AVERAGE HEART BEATS ( Per Minute ) \*

PALPITATIONS PER DAY \*

CHOLESTEROL \*

BMI \*

AGE \*

SEX (M or F) \*

FAMILY HISTORY (Y or N) \*

SMOKER ( In Last 5 Years : Y or N ) \*

EXERCISE ( Minutes Per Week ) \*

**SUBMIT**

**CANCEL**

**Prediction**

**Not at Risk**

**Score**

**0.9210792406516917**



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## Home

### Default

AVERAGE HEART BEATS ( Per Minute ) \*

PALPITATIONS PER DAY \*

CHOLESTEROL \*

BMI \*

AGE \*

SEX (M or F) \*

FAMILY HISTORY (Y or N) \*

SMOKER ( In Last 5 Years : Y or N ) \*

EXERCISE ( Minutes Per Week ) \*

SUBMIT

CANCEL

Prediction

Not at Risk

Score

0.53526991973905



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node-red-lztvt-2022-07-25.mybluemix.net/ui#!/0?socketid=-\_PFUsV3jtSMJ5J8AAAB

Home

Default

AVERAGE HEART BEATS ( Per Minute ) \*

16

PALPITATIONS PER DAY \*

0

CHOLESTEROL \*

190

BMI \*

10

AGE \*

70

SEX (M or F) \*

M

FAMILY HISTORY (Y or N) \*

Y

SMOKER ( In Last 5 Years : Y or N ) \*

Y

EXERCISE ( Minutes Per Week ) \*

0

SUBMIT CANCEL

Prediction Not at Risk

Score 0.53526991973905



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Home

Default

AVERAGE HEART BEATS ( Per Minute ) \*

0

PALPITATIONS PER DAY \*

0

CHOLESTEROL \*

200

BMI \*

3

AGE \*

32

SEX (M or F) \*

M

FAMILY HISTORY (Y or N) \*

Y

SMOKER ( In Last 5 Years : Y or N ) \*

Y

EXERCISE ( Minutes Per Week ) \*

0

SUBMIT CANCEL

Prediction Not at Risk

Score 0.6066898575600456

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My projects / FinalHFP / patientdataV6.csv

Preview Visualization

**LINE CHART**  
→ Data is sampled ⓘ

X-axis\* PALPITATIONSPERDAY

Y-axis\* AVGHEARTBEATSPERMIN

Split by ⓘ None

Area ⓘ Off

Smooth ⓘ Off

Show data points ⓘ On

Reorder ⓘ On

**CHART TYPE**  
Scatter pl... Line Multi-seri... Parallel Box plot  
• Suggested charts

ACTIONS

AVGHEA...

PALPITATIONSPERDAY

Information

Data asset patientdataV6.csv

Description No description available for this asset

Tags No tags available for this asset

Creator Priya Mohan

Usage Created on Jul 25, 2022, 11:24 AM

Size 308.556 KB

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dataplatform.cloud.ibm.com/projects/ce223c4e-1a75-41db-9aa3-3e0002bef95f/data-assets/1dce6752-0d23-42fa-a217-4a4a17ad1e8d/visualization?context=cpdaas

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My projects / FinalHFP / patientdataV6.csv

Preview Visualization

**PARALLEL CHART**  
→ Data is sampled ⓘ

**Columns\***

- AGE
- AVGHEARTBEATSPERMIN

Add another column +

**Color map ⓘ**

AVGHEARTBEATSPERMIN

**Primary title ⓘ**

**Subtitle ⓘ**

**Footnote ⓘ**

**CHART TYPE**  
• Suggested charts

Scatter pl... • Line • Multi-seri... • Parallel • Box plot •

ACTIONS

Information

Data asset

patientdataV6.csv

Description

No description available for this asset

Tags

No tags available for this asset

Creator

Priya Mohan

Usage

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Size

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Windows Taskbar: 34°C, ENG IN, 02:40 PM, 25/07/22

Catalog - IBM Cloud Node-RED : node-red-lztvt-2022- Node-RED Dashboard IBM Cloud Pak for Data

dataplatform.cloud.ibm.com/projects/ce223c4e-1a75-41db-9aa3-3e0002bef95f/data-assets/1dce6752-0d23-42fa-a217-4a4a17ad1e8d/visualization?context=cpdaas

IBM Cloud Pak for Data Search in your workspaces Buy Priya Mohan's Account Dallas PM

My projects / FinalHFP / patientdataV6.csv

Preview Visualization

**BOX PLOT CHART**

→ Data is sampled ⓘ

Off

Legend orient ⓘ

Horizontal

Vertical

Vertical bottom

Primary title ⓘ

Subtitle ⓘ

Footnote ⓘ

XAxis Label ⓘ

YAxis Label ⓘ

CHART TYPE

Scatter pl... Line Multi-seri... Parallel Box plot ⓘ

Suggested charts

ACTIONS

Information

Data asset

patientdataV6.csv

Description

No description available for this asset

Tags

No tags available for this asset

Creator

Priya Mohan

Usage

Created on Jul 25, 2022, 11:24 AM

Size

308.556 KB

Value

80.000

70.000

60.000

50.000

40.000

30.000

20.000

AGE

BMI

28.000

30.000

32.000

34.000

36.000

38.000

40.000

42.000

44.000

46.000

48.000

50.000

52.000

54.000

56.000

58.000

60.000

62.000

64.000

66.000

68.000

70.000

72.000

74.000

76.000

78.000

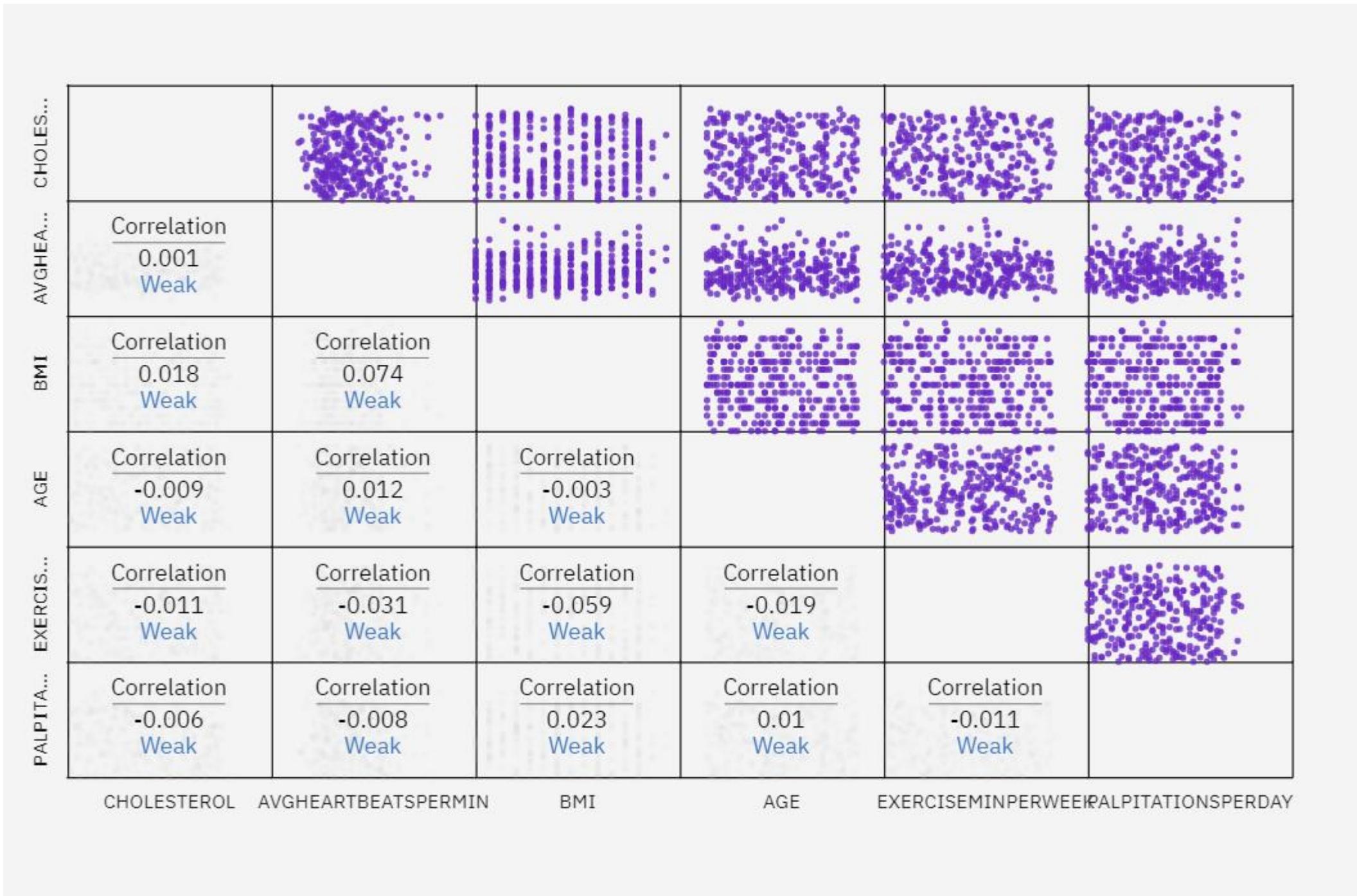
80.000

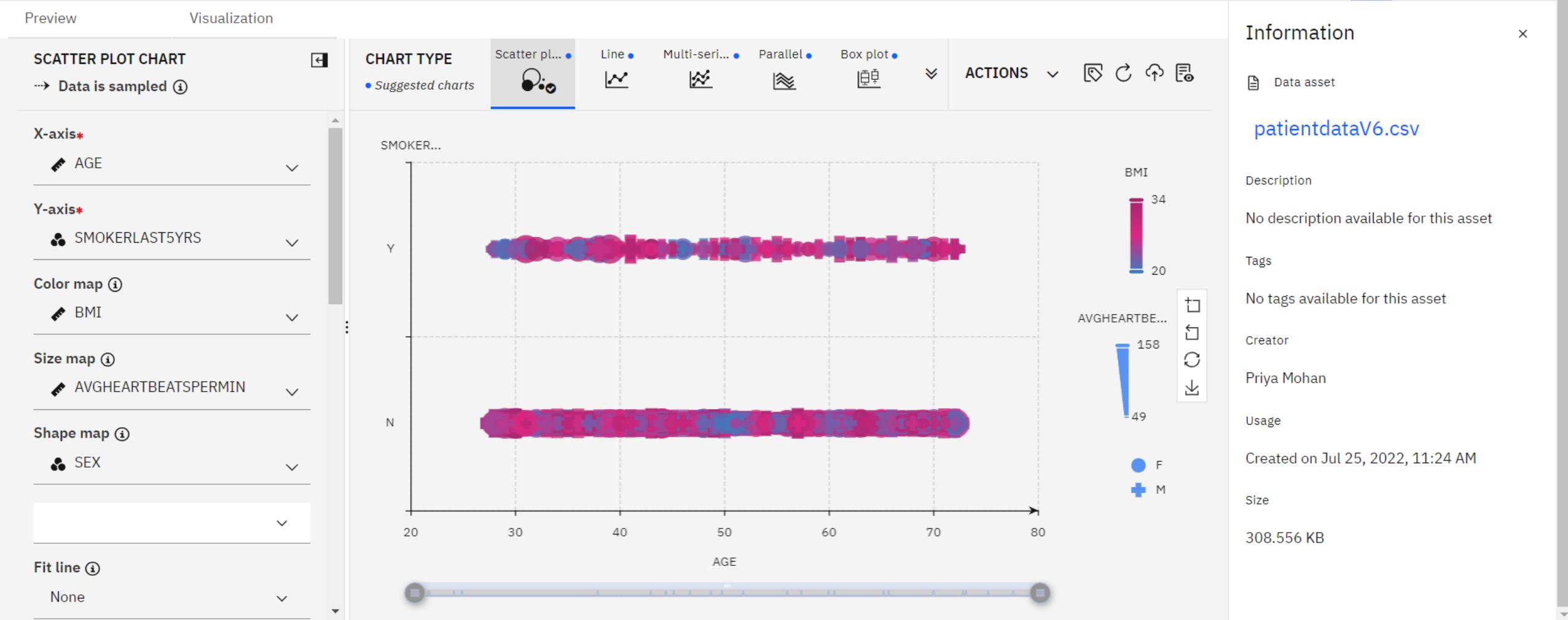
Y

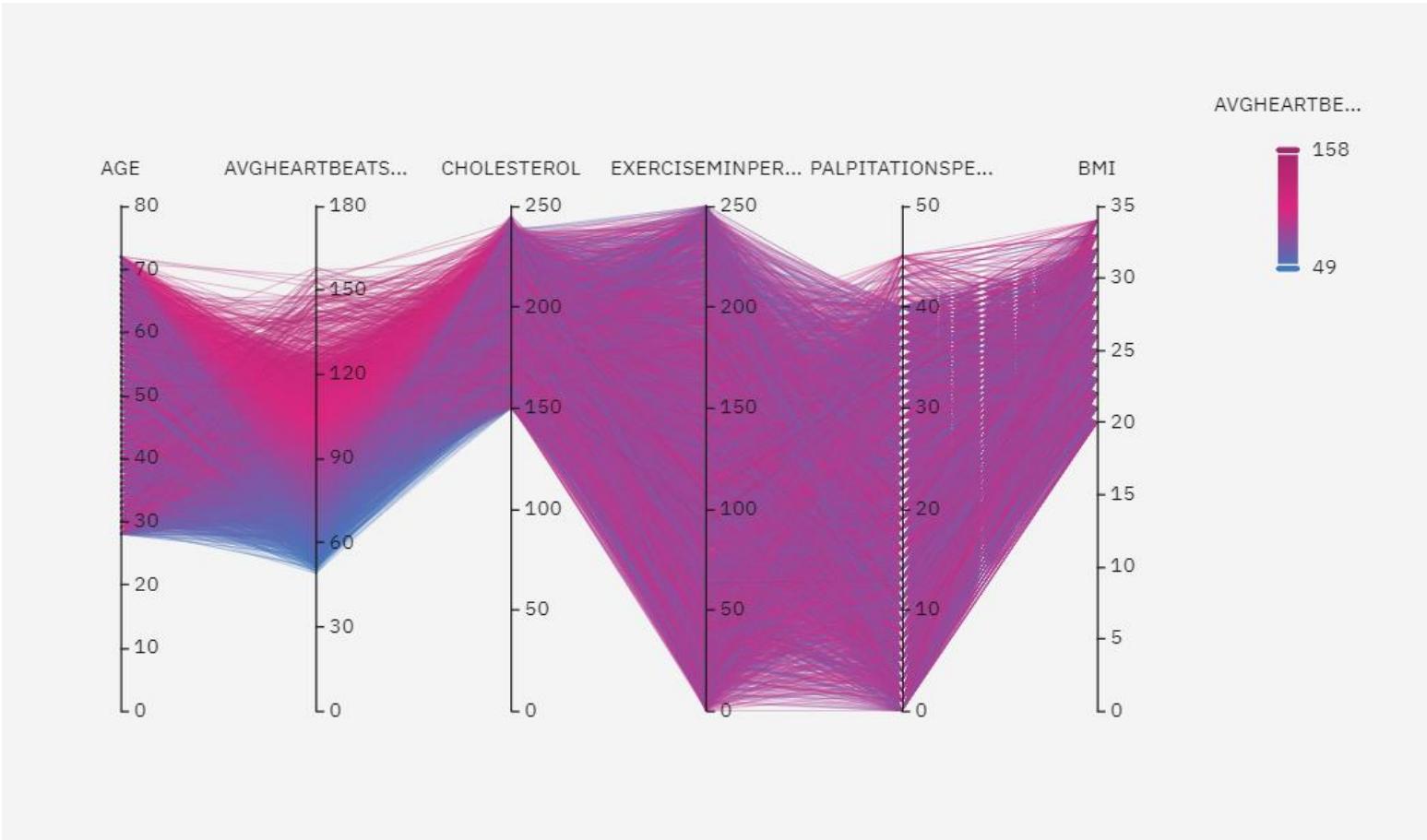
FAMILYHISTORY

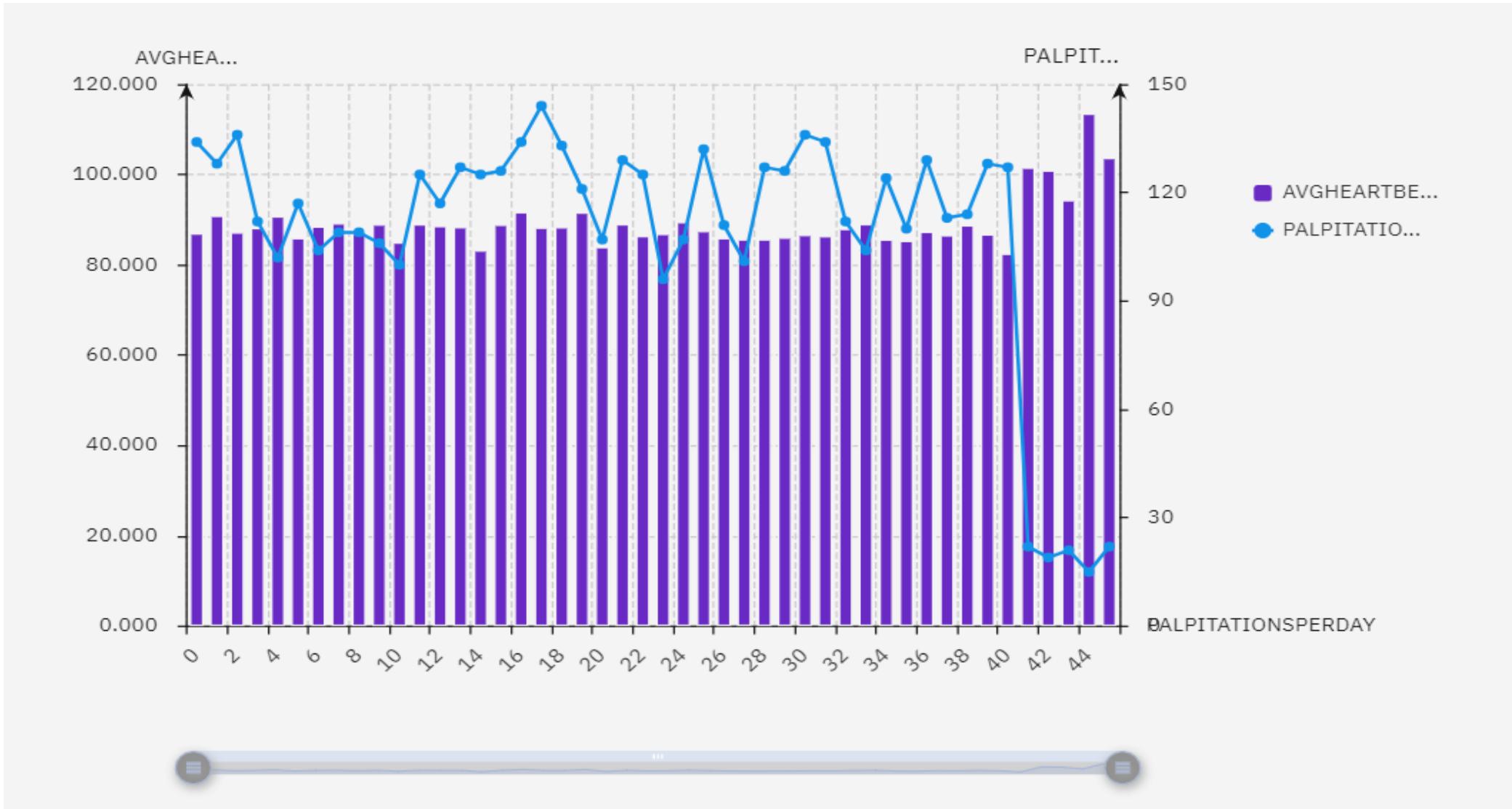
The chart displays two box plots side-by-side. The left box plot represents the variable 'AGE' and has a median value of approximately 50. The right box plot represents the variable 'BMI' and has a median value of approximately 27. Both plots show whiskers extending from the boxes to horizontal caps at the top and bottom. The Y-axis is labeled 'Value' and ranges from 20.000 to 80.000. The X-axis is labeled 'FAMILYHISTORY'.

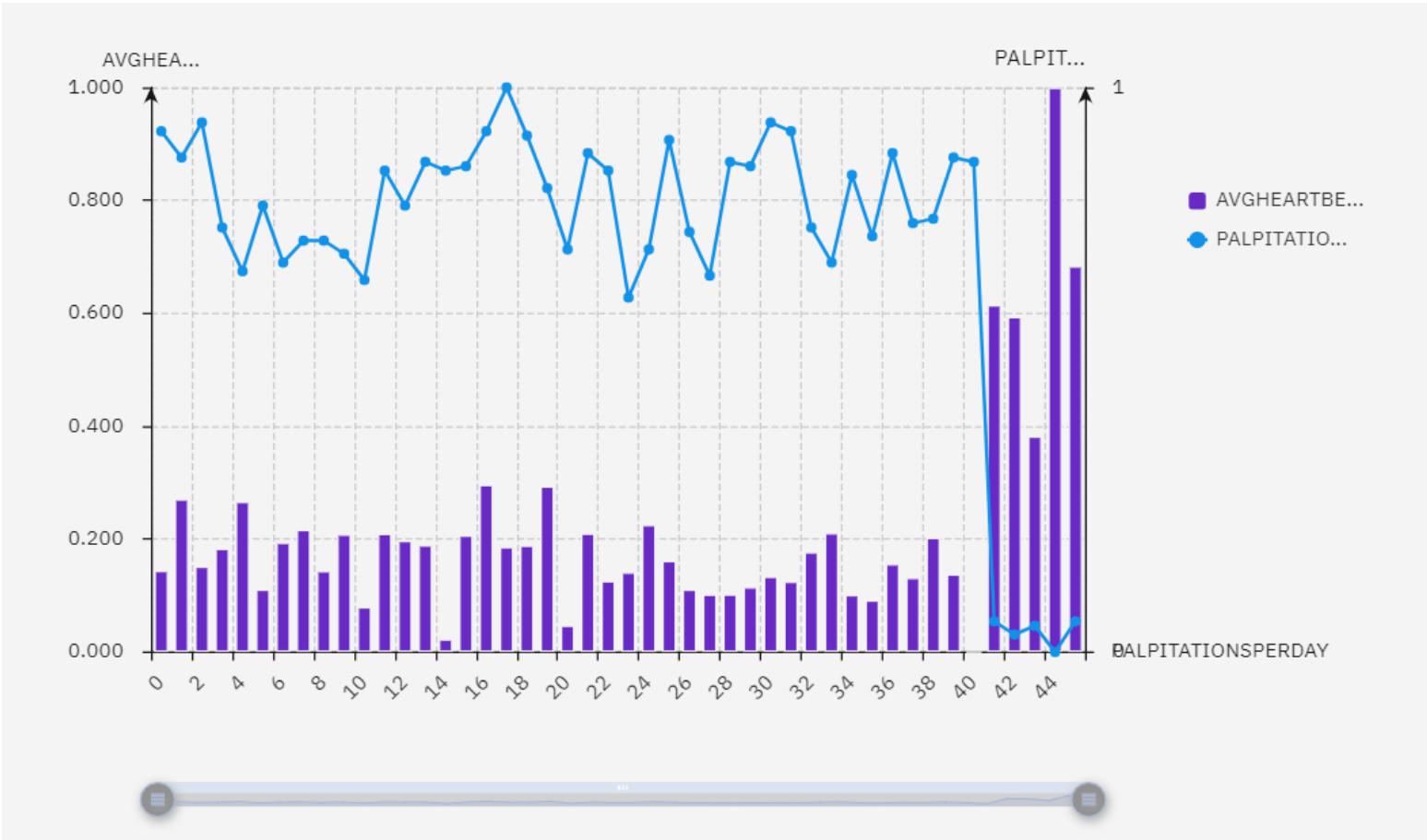












**Thank You**