DIABETES MELLITUS PREDICTION USING IBM AUTO AI SERVICE

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder described by perpetual hyperglycaemia because of impaired insulin secretions or insulin action in the body [1]. Type I DM is characterized by insulin deficiency due to autoimmune beta cell destruction in pancreas and type II DM is described as insulin resistance due to a progressive loss of beta cell insulin secretion [2]. At present, the evolution of DM is one of the most significant difficulties in therapeutic healthcare [3]. In accordance with the International Diabetes Federation (IDF), the worldwide prevalence on DM in 2017 was 425 million adults (20-45 years) and it is expected to reach 629 million adults by 2045. In South East Asia, the prevalence of DM in 2019 was 88 million and it is estimated to increase as 153 million individuals in 2045. Globally, 352 million people are at risk of type II DM and 212 million adults with DM were undiagnosed till now [4, 5]. The increase in type II DM individuals was found mainly in low and middle income countries [6, 7]. Type I DM is commonly diagnosed in children, and Type II DM is increasingly diagnosed in adults; the occurrence of type I DM is raising about 3 to 5 % rate per year [8, 9].

2. Literature survey

The decreased and increased skin surface temperature at lower and upper extremities observed in diabetic subjects signifies the initial changes in body metabolism. The results indicates that inner canthi of diabetic eyes are negatively correlated ($r = -0.462$, $p<0.01$) with HbA1c (biochemical parameter) between the groups. The internal body temperature decreases in diabetic subjects with decline in the body metabolism was observed by Sivanandam et al .

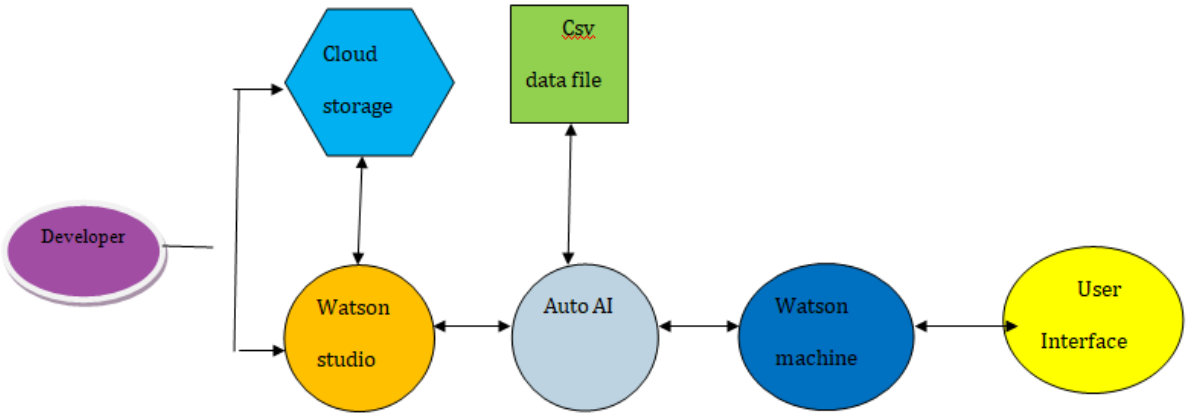
The changes in the human skin thermal distributions and serum asymmetric dimethylarginine (ADMA) in diabetic subjects without cardiovascular complications

were studied by Anburajan et al. The HbA1c values were found to be positively correlated with serum ADMA and statistically significant ($r=0.65$, $p<0.01$). The diabetic eye and nose skin surface temperatures were found to be negatively correlated with HbA1c values ($r=-0.57$ and $r=-0.55$, $p<0.01$) and statistically significant.

3. Theoretical Analysis

Block diagram:

3.



3.2 Harware/Software designing

IBM Watson studio
IBM Watson machine learning
NODE-RED
IBM cloud storage

4. Experimental Investigations

I. Building Model using Auto AI

- **At starting point, diabetes mellitus data is collected from the data base**
- **Then login to My IBM account**
- **Watson studio service created**
- **Project created in Watson studio**
- **Data set added and Auto AI is added to the project**
- **Watson machine learning instance created**
- **Run the experiment and deploy the model**

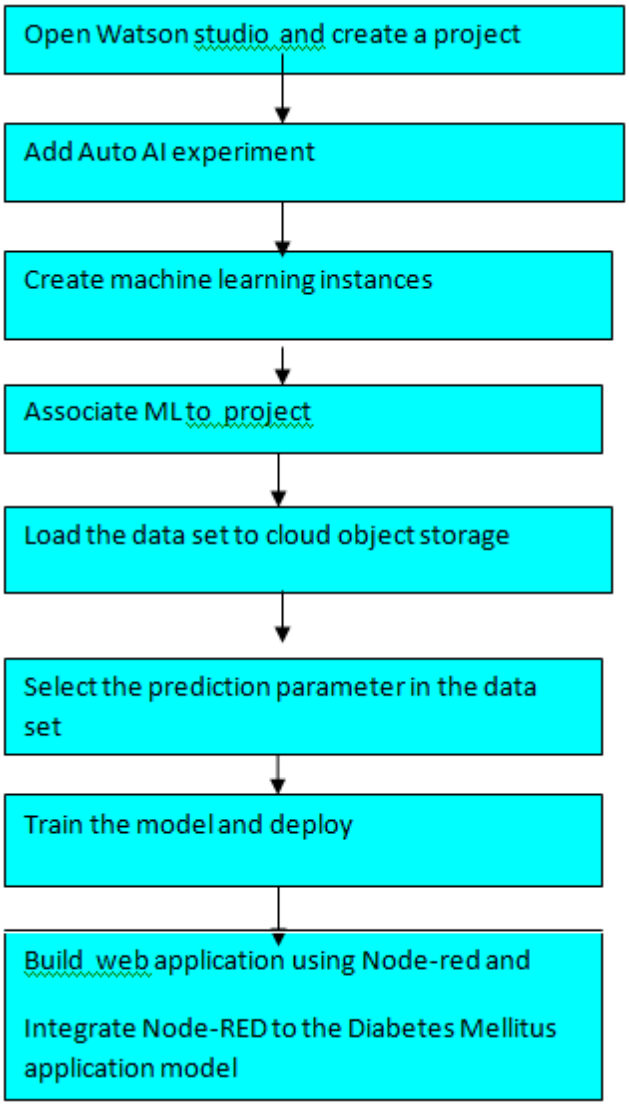
II. Application Building

- **Node red is created by using following procedure**
- **Go to IBM cloud catalog and find the Node-RED starter**
- **Create the application**
- **Continuous delivery feature is enabled**
- **Node-red application is opened**
- **Node –RED application is configure**d
- Extra nodes are added to Node-**Red palatte**

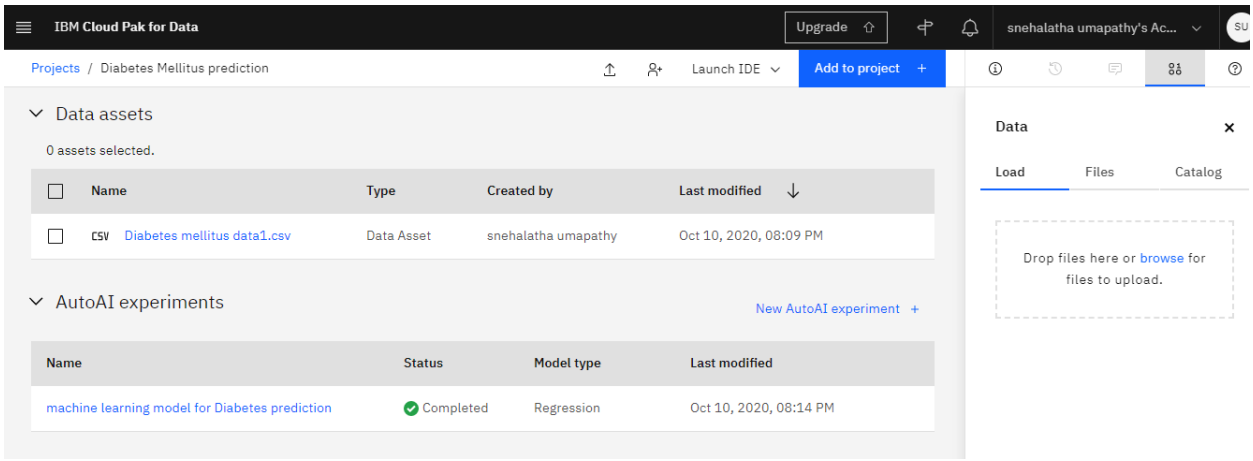
III. Integrate Node red to model

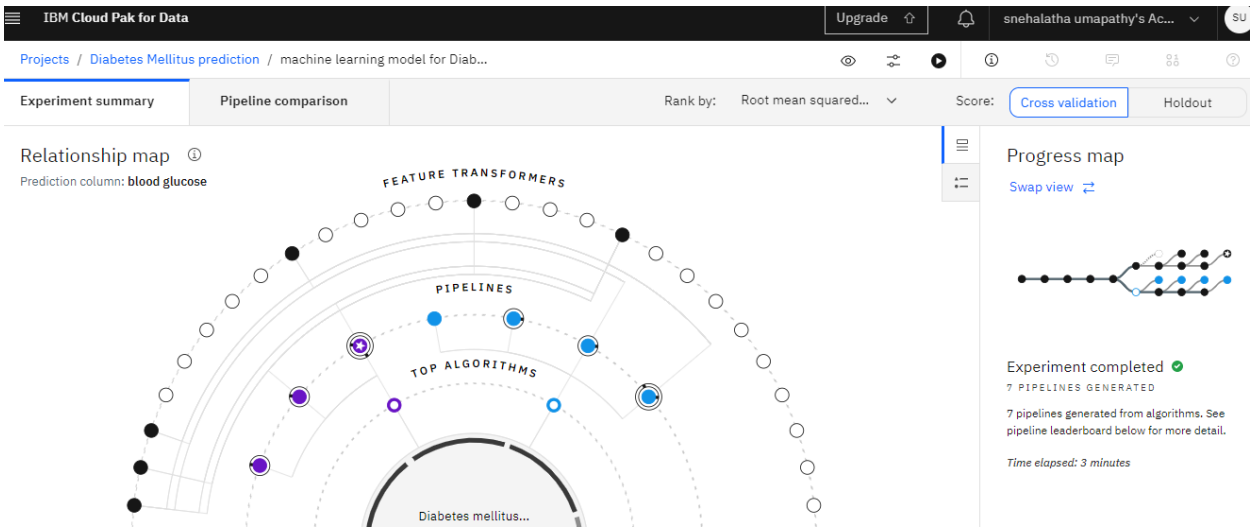
- **Install the dashboard nodes from the manage pallete and create UI accordingly by making use of form nodes and text nodes.**
- **Now use the HTTP request nodes to request the model API which was generated when the model was built.**
- **Then API key is pasted in the Second HTTP request nodes and deployed.**
- **The predictions are displayed in the right hand side.**

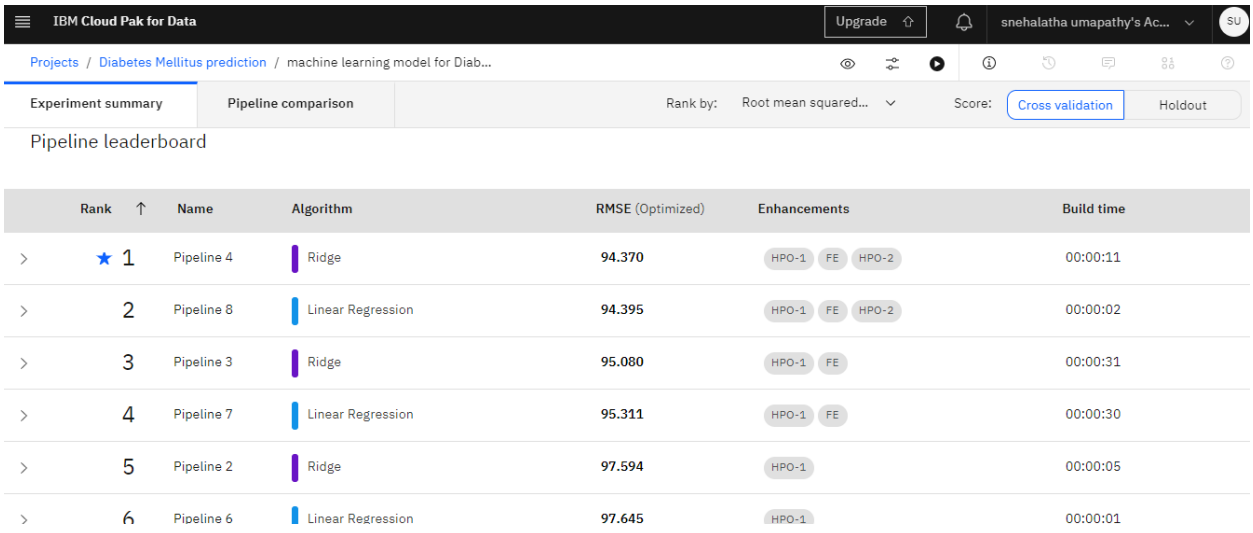
5 .Flow chart


Open Watson studio and create a project
Add Auto AI experiment
Create machine learning instances
Associate ML to project
Load the data set to cloud object storage
Select the prediction parameter in the data set
Train the model and deploy
Build web application using Node-red and
Integrate Node-RED to the Diabetes Mellitus application model

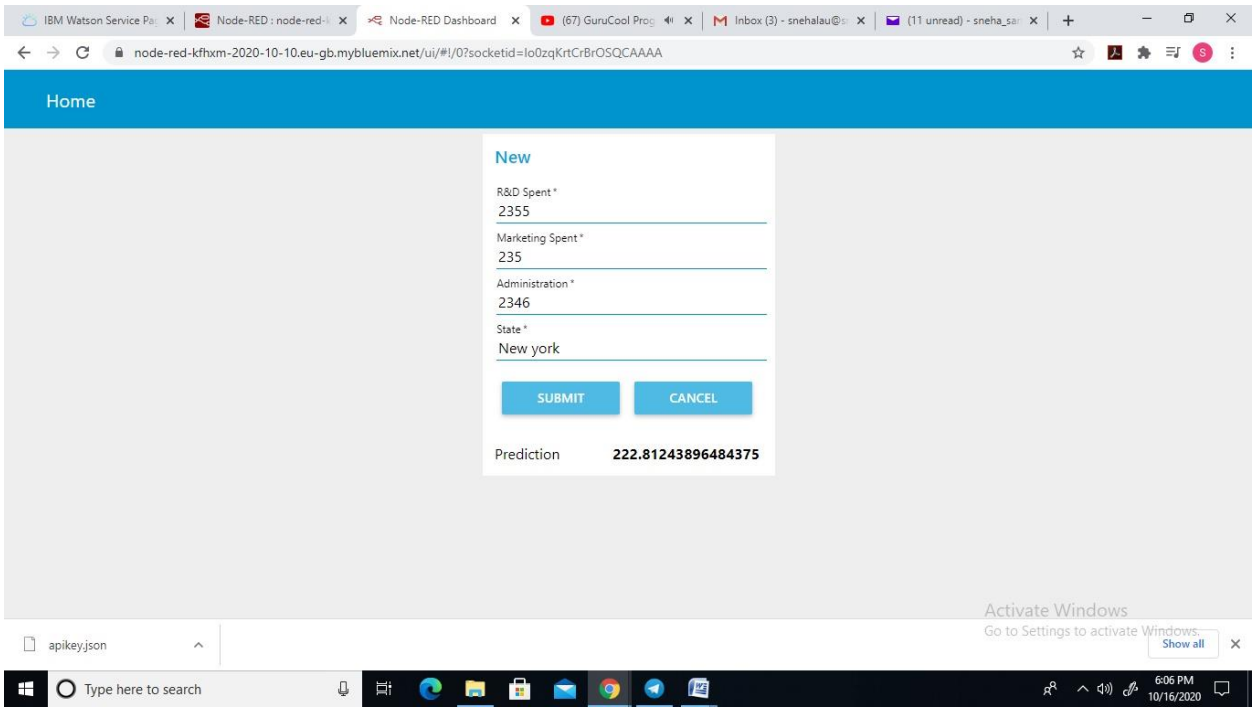
6.RESULT

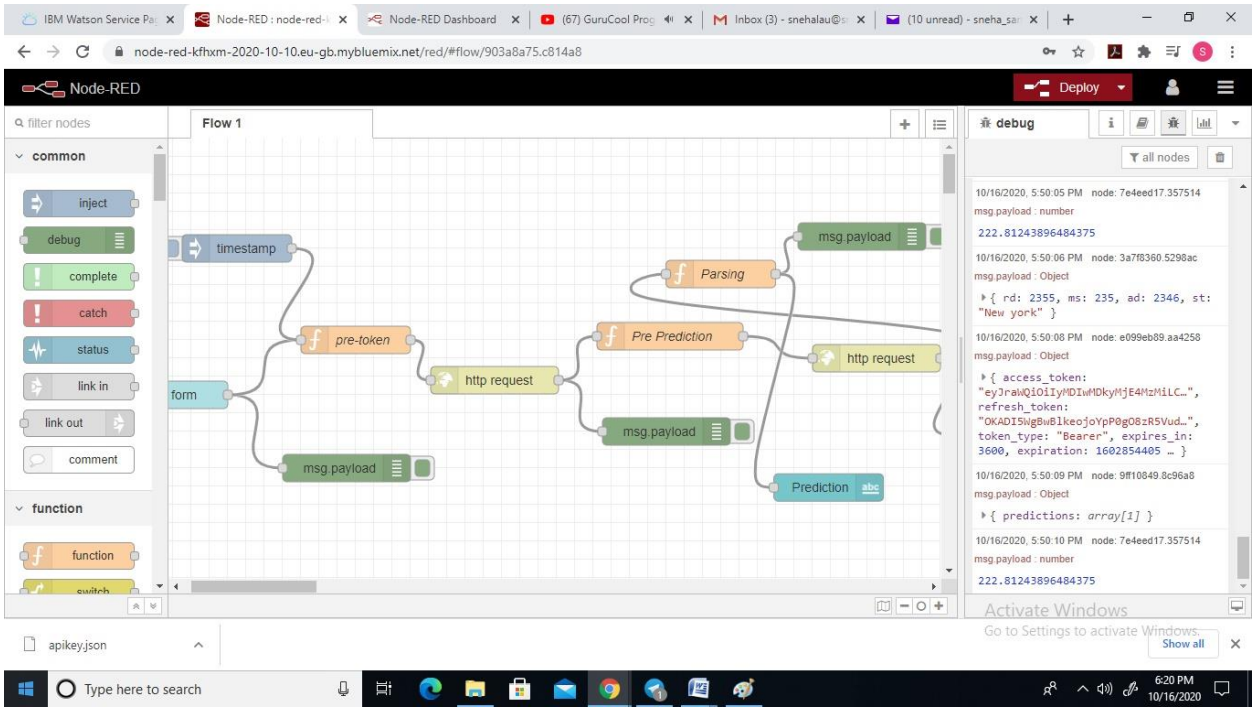






Rank	Name	Algorithm	RMSE (Optimized)	Enhancements	Build time
★ 1	Pipeline 4	Ridge	94.370	HPO-1 FE HPO-2	00:00:11
2	Pipeline 8	Linear Regression	94.395	HPO-1 FE HPO-2	00:00:02
3	Pipeline 3	Ridge	95.080	HPO-1 FE	00:00:31
4	Pipeline 7	Linear Regression	95.311	HPO-1 FE	00:00:30
5	Pipeline 2	Ridge	97.594	HPO-1	00:00:05
6	Pipeline 6	Linear Regression	97.645	HPO-1	00:00:01


IBM Watson Service Pa
Node-RED : node-red-k
Node-RED Dashboard
(67) GuruCool Prog
Inbox (3) - snehalau@s
(11 unread) - sneha_sar
node-red-kfhxm-2020-10-10.eu-gb.mybluemix.net/ui/#!/0?socketid=lo0zqKrtCrBrOSQCAAAA
Home
New
R&D Spent *
2355
Marketing Spent *
235
Administration *
2346
State *
New york
SUBMIT
CANCEL
Prediction
222.81243896484375
Activate Windows
Go to Settings to activate Windows.
apikey.json
Show all
Type here to search
6:06 PM
10/16/2020



5. ADVANTAGES AND DISADVANTAGES

Advantages

Easy user interface and less time consumption to create the model and deployment

Disadvantages

Coding is little bit difficult to understand

8.APPLICATIONS

IBM service can be used for many more medical applications such as diabetes mellitus prediction, Rheumatoid arthritis prediction and cardiovascular prediction

6. CONCLUSION

IBM AutoAI is best service for diabetes mellitus prediction

10.FUTURE SCOPE

IBM service application can be used for many more medical applications and many more parameters predictions.

References

References:

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4. https://www.diabetesatlas.org/upload/resources/material/20191218_144459_2019_global_factsheet.pdf
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6. Narayan, K.V., & Fleck, F., (2016). The mysteries of type 2 diabetes in developing countries. *Bull World Health Organ*, *94*, 233-308.
7. Kaiser, A.B., Zhang, N., & Van Der Pluijm, W., (2018). Global prevalence of type 2 diabetes over the next ten years (2018-2028).
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BIBILOGRAPHY

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APPENDIX

Source code

Machine learning DM deployed code

```
# retrieve your $IAM_SERVICE_CREDENTIALS_USERNAME,
$IAM_SERVICE_CREDENTIALS_PASSWORD, and
$IAM_SERVICE_CREDENTIALS_URL from the
# Service credentials associated with your IBM Cloud.

curl --basic --user
$IAM_SERVICE_CREDENTIALS_USERNAME:$IAM_SERVICE_CREDENTIALS_PAS
SWORD $IAM_SERVICE_CREDENTIALS_URL/identity/token

# the above CURL request will return an auth token that you will use as
$IAM_AUTH_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  $IAM_AUTH_TOKEN" -d '{"fields":
[$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/bf965454-01da-4318-b27e-
4d9fccc32975/predictions
```

Java script code

```
const XMLHttpRequest = require("xmlhttprequest").XMLHttpRequest;
const btoa = require("btoa");
const iam_credentials = new Map();

// NOTE: you must manually construct iam_credentials hash map below using information
retrieved
// from your IBM Cloud.

iam_credentials.set("url", iam_service_credentials_url);
iam_credentials.set("username", iam_service_credentials_username);
iam_credentials.set("password", iam_service_credentials_password);

function apiGet(url, username, password, loadCallback, errorCallback){
        const oReq = new XMLHttpRequest();
        const tokenHeader = "Basic " + btoa((username + ":" + password));
        const tokenUrl = url + "/identity/token";
```

```
            oReq.addEventListener("load", loadCallback);
            oReq.addEventListener("error", errorCallback);
            oReq.open("GET", tokenUrl);
            oReq.setRequestHeader("Authorization", tokenHeader);
            oReq.setRequestHeader("Content-Type", "application/json;charset=UTF-8");
            oReq.send();
}

function apiPost(scoring_url, token, payload, loadCallback, errorCallback){
            const oReq = new XMLHttpRequest();
            oReq.addEventListener("load", loadCallback);
            oReq.addEventListener("error", errorCallback);
            oReq.open("POST", scoring_url);
            oReq.setRequestHeader("Accept", "application/json");
            oReq.setRequestHeader("Authorization", token);
            oReq.setRequestHeader("Content-Type", "application/json;charset=UTF-8");
            oReq.send(payload);
}

apiGet(iam_credentials.get("url"),
            iam_credentials.get("username"),
            iam_credentials.get("password"),
            function (res) {
      let parsedGetResponse;
      try {
         parsedGetResponse = JSON.parse(this.responseText);
      } catch(ex) {
         // TODO: handle parsing exception
      }
      if (parsedGetResponse && parsedGetResponse.token) {
         const token = parsedGetResponse.token
         const iamToken = "Bearer " + token;

         // NOTE: manually define and pass the array(s) of values to be scored in the next
line
         const payload = '{"fields": [array_of_input_fields], "values":
[array_of_values_to_be_scored, another_array_of_values_to_be_scored]}';
         const scoring_url = "https://us-
south.ml.cloud.ibm.com/ml/v4/deployments/bf965454-01da-4318-b27e-
4d9fccc32975/predictions";

         apiPost(scoring_url, iamToken, payload, function (resp) {
            let parsedPostResponse;
            try {
```

```
                parsedPostResponse = JSON.parse(this.responseText);
            } catch (ex) {
                // TODO: handle parsing exception
            }
            console.log("Scoring response");
            console.log(parsedPostResponse);
        }, function (error) {
            console.log(error);
        });
    } else {
        console.log("Failed to retrieve Bearer token");
    }
        }, function (err) {
                console.log(err);
        }
);
```

Final Prediction code

```
{ rd: 2355, ms: 23546, ad: 234678, st: "Newyork" }
10/16/2020, 5:49:36 PMnode: e099eb89.aa4258msg.payload : Object
{ access_token: "eyJraWQiOiIyMDIwMDkyMjE4MzMiLC…", refresh_token: "OKByi-g_0OtIoYJQ9rAR_TQWSSVH7n…", token_type: "Bearer", expires_in: 3600, expiration: 1602854373 … }
10/16/2020, 5:49:38 PMnode: 9ff10849.8c96a8msg.payload : Object
{ predictions: array[1] }
10/16/2020, 5:49:39 PMnode: 7e4eed17.357514msg.payload : number
222.81243896484375
10/16/2020, 5:49:40 PMnode: 3a7f8360.5298acmsg.payload : Object
{ rd: 2355, ms: 23546, ad: 234678, st: "New york" }
10/16/2020, 5:49:42 PMnode: e099eb89.aa4258msg.payload : Object
{ access_token: "eyJraWQiOiIyMDIwMDkyMjE4MzMiLC…", refresh_token: "OKA1Rv5pcg7QqMz9REuU4qtyxE0Wu1…", token_type: "Bearer", expires_in: 3600, expiration: 1602854379 … }
10/16/2020, 5:49:43 PMnode: 9ff10849.8c96a8msg.payload : Object
{ predictions: array[1] }
10/16/2020, 5:49:44 PMnode: 7e4eed17.357514msg.payload : number
222.81243896484375
```