

Assignment 3: Machine Learning as a Service in Microsoft Azure ML

Under guidance of:

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Team 1

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Step 1: Data Preparation in R

The first step is preparation of data. We have followed the same procedures as previous assignments for pre-processing and wrangling of data in R. To summarize:

- API calls for weather data and holiday data
- Pre-processing of data
- Imputation of missing values
- Removal of outliers
- The clean data from R is uploaded to Microsoft Azure ML Studio datasets

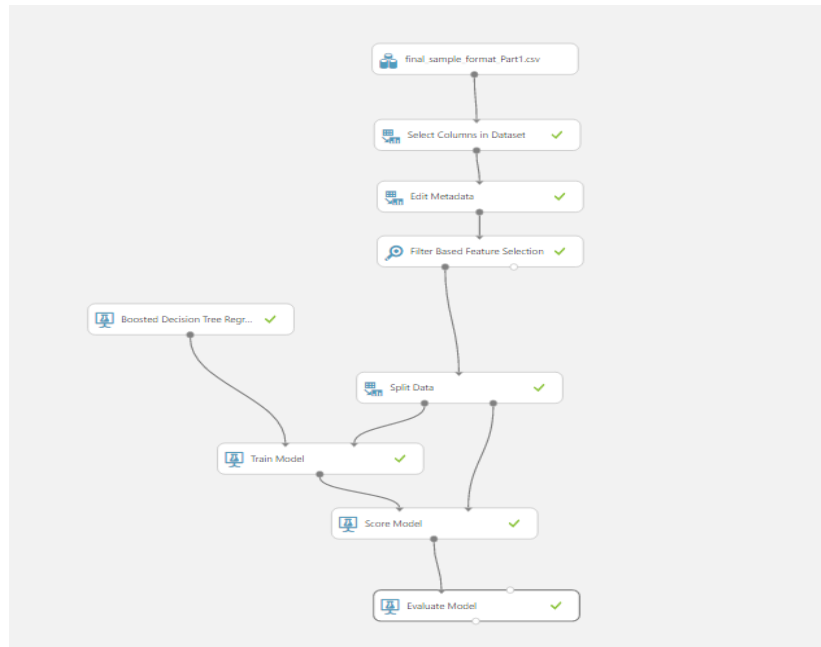
Step 2: Microsoft Azure ML Studio – Building model

The following are the steps to create an experiment in Microsoft Azure ML Studio:

- Select the required column using **Column Selector**
- Specify the data types and categorical variables using **Edit Metadata**
- Selection of features using **Filter based Feature Selection**
- Splitting data into Training and Testing using **Split**
- Training of model using **Train Model**
- Scoring and Evaluation of model using **Score Model** and **Evaluate Model**

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Step 3: Building customized model in R

The following are the steps to create a model in R in Microsoft Azure ML Studio. We noticed that KNN and Hierarchical Clustering are not pre-present in Microsoft Azure. To implement that, we had to use **Create R model** feature in Microsoft Azure ML. It has a Trainer script and Scorer script:

▲ Create R Model

Trainer R script

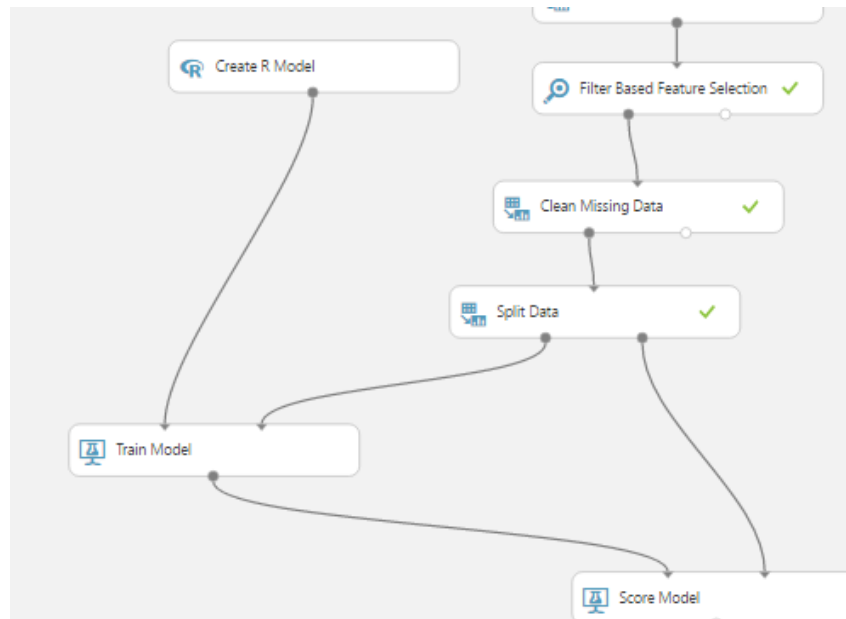
```
1 # Input: dataset
2 # Output: model
3
4 # The code below is an example which can be replaced with your own code.
5 # See the help page of "Create R Model" module for the list of predefined functions and constants.
6
7 library(kknn)
8 model <- train.kknn(Norm_Consumption ~ .,dataset, kmax = 15, kernel = c("optimal"), distance = 2)
```

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Scorer R script

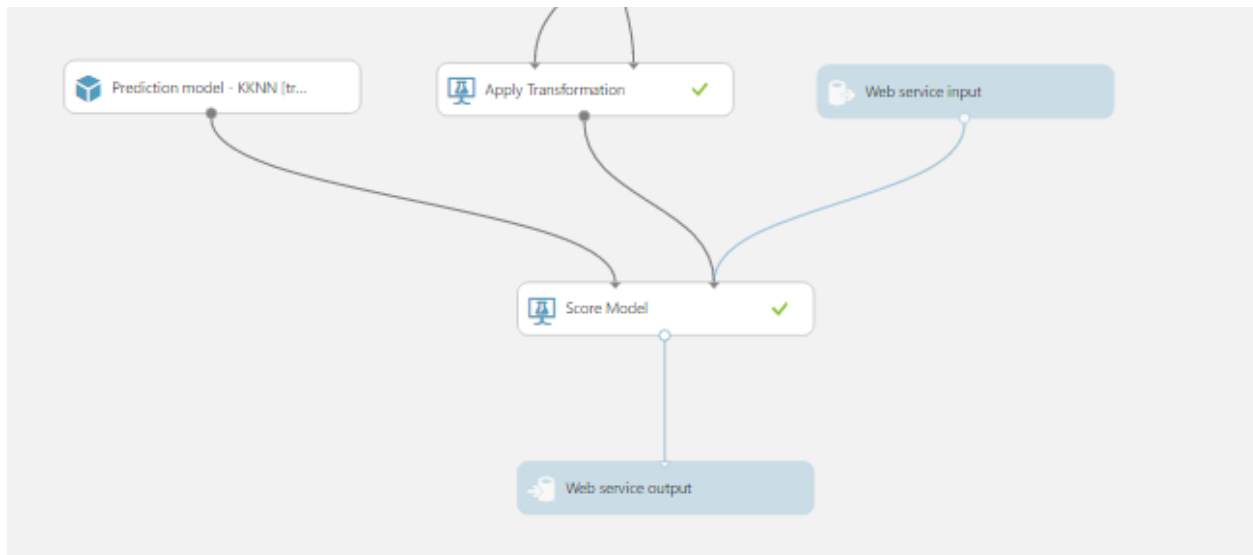
```
1 # Input: model, dataset
2 # Output: scores
3
4 # The code below is an example which can be replaced with your own code.
5 # See the help page of "Create R Model" module for the list of predefined functions and constants.
6
7 library(kknn)
8 scores <- data.frame(predict(model, subset(dataset, select = -c(Norm_Consumption))))
9
```



Step 4: Set up and Deploy Web Service

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General [New Web Services Experience](#) [preview](#)

Published experiment

[View snapshot](#) [View latest](#)

Description

No description provided for this web service.

API key

Default Endpoint

API HELP PAGE	TEST	APPS	LAST UPDATED
REQUEST/RESPONSE	Test Test preview	Excel 2013 or later Excel 2010 or earlier workbook	12/2/2016 12:05:52 PM
BATCH EXECUTION	Test preview	Excel 2013 or later workbook	12/2/2016 12:05:52 PM

Step 5: Building a website

We used HTML5, bootstrap and in the backend we have used Flask framework in Python 3+.

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Request-Response Batch

C# Python Python 3+ R

```

import urllib.request
import json

data = {
    "Inputs": {
        "input1": [
            {
                'Norm_Consumption': "1",
                'Dew_PointF': "1",
                'TemperatureF': "1",
                'month': "1",
                'Conditions': "Clear",
                'Weekday': "1",
                'Base_hour_Flag': "false",
                'Wind_SpeedMPH': "1",
                'type': "Dist_Heating",
            }
        ],
    },
    "GlobalParameters": {
    }
}

```

```

controller.py
397 ##### Clustering Starts #####
398 @app.route('/cluster')
399 def runClust():
400     return render_template('/cluster.html')
401
402
403 @app.route('/cluster', methods=['POST'])
404 def get_data_clust():
405     #print("Inside POST")
406     data = request.form
407     area = data['area']
408     latitude = data['latitude']
409     longitude = data['longitude']
410     electric = data['electric']
411     heat = data['heat']
412
413
414     resultKMean = processClust(algo="KMean",area=area,latitude=latitude,longitude=longitude,electric=electric,heat=heat)
415     resultKMean = json.loads(resultKMean)
416
417     return render_template('/cluster.html',area=area,latitude=latitude,longitude=longitude,electric=electric,heat=heat,labelKMean=resultKMean)
418
419
420
421 ### function for calling K-Means Clustering Azure ML API
422 def cluster_KMean(body):
423
424     url = 'https://ussouthcentral.services.azureml.net/workspaces/4cf184d6c98d43debeddaef6ffe92725/services/6988ed21dd3348458d85615ae6f
425     api_key = '87825XP8oZ38LlvdPpM7xNNetRZx9AMK1be9j36dQWIRgndRIwJ5dP3cRoJNP/h1K12FUEJ9ZEF+vwMktIg=' # Replace this with the API ke
426     headers = {'Content-Type': 'application/json', 'Authorization': ('Bearer '+ api_key)}
427
428
429     req = urllib.request.Request(url, body, headers)
430     #print("request ready")
431
432     try:
433         response = urllib.request.urlopen(req)
434         result = response.read().decode("utf-8")
435         #print("Response ready")
436         return result
437     except urllib.error.HTTPError as error:
438         print("The request failed with status code: " + str(error.code))
439
440         # Print the headers - they include the request ID and the timestamp, which are useful for debugging the failure
441         print(error.info())
442         print(json.loads(error.read().decode("utf8", 'ignore'))))
443         return None
444
445

```

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127.0.0.1:5000/predict

Web services - Microsoft Azure Machine... Creating a Web App From Scratch Using... Classify

Home Predict Classify Cluster

Prediction

Select Type: Heat

Date (YYYY-MM-DD): 2015-10-10

Hour (0-23): 23

Temp: 32

Dew-Point: 43

Wind Speed MPH: 21

Conditions: Clear

Submit

Result from Regression	0.0198082366130114
Result from KNN	0.0154289683385569
Result from Forest	0.113777174723993
Result from Neural	0.0137602975592017

127.0.0.1:5000/classify

Web services - Microsoft Azure Machine... Creating a Web App From Scratch Using... Classify

Home Predict Classify Cluster

Classification

Select Type: Heat

Date (YYYY-MM-DD): 2015-05-05

Hour (0-23): 11

Temp: 55

Dew-Point: 43

Humidity: 44

Submit

Result from Logistic	High
Result from Forest	Low
Result from Tree	High
Result from Neural	Low

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127.0.0.1:5000/cluster

Web services - Microsoft Azure Machine... Creating a Web App From Scratch Using... Classify

Home Predict Classify Cluster

Clustering

Area (sq.m.)

Latitude

Longitude

Electricity Consumption

Heating Consumption

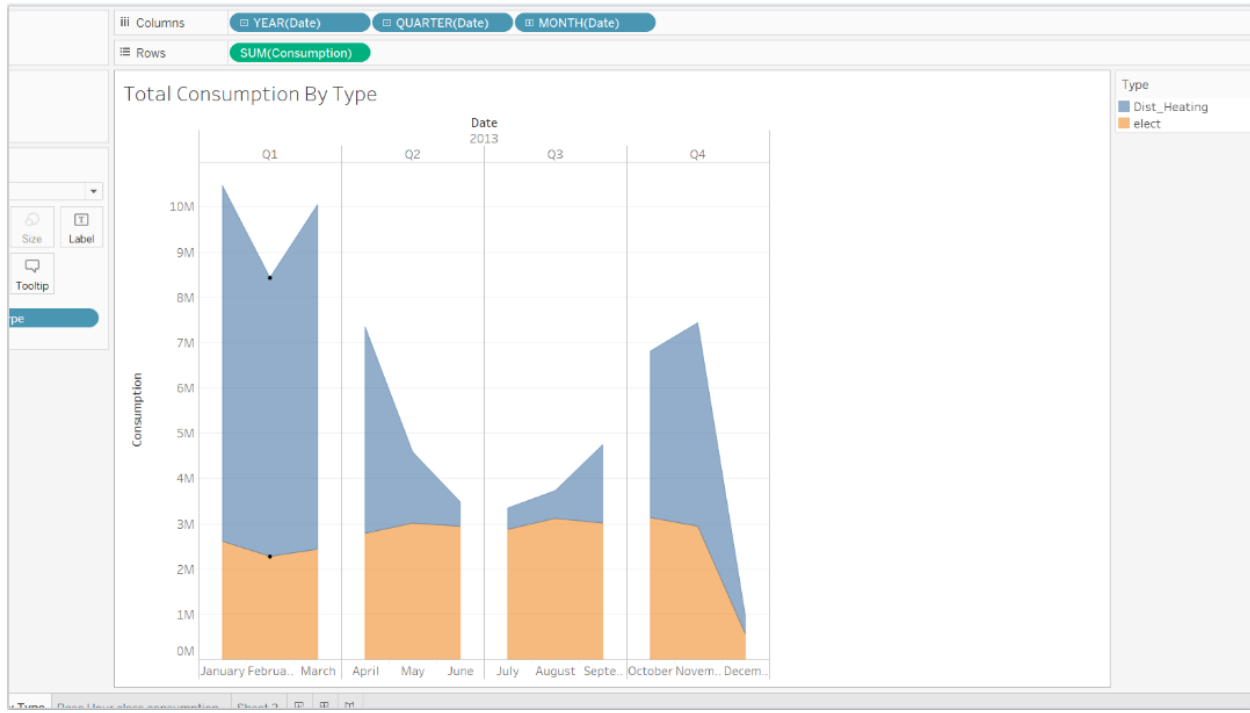
Result from K-Means



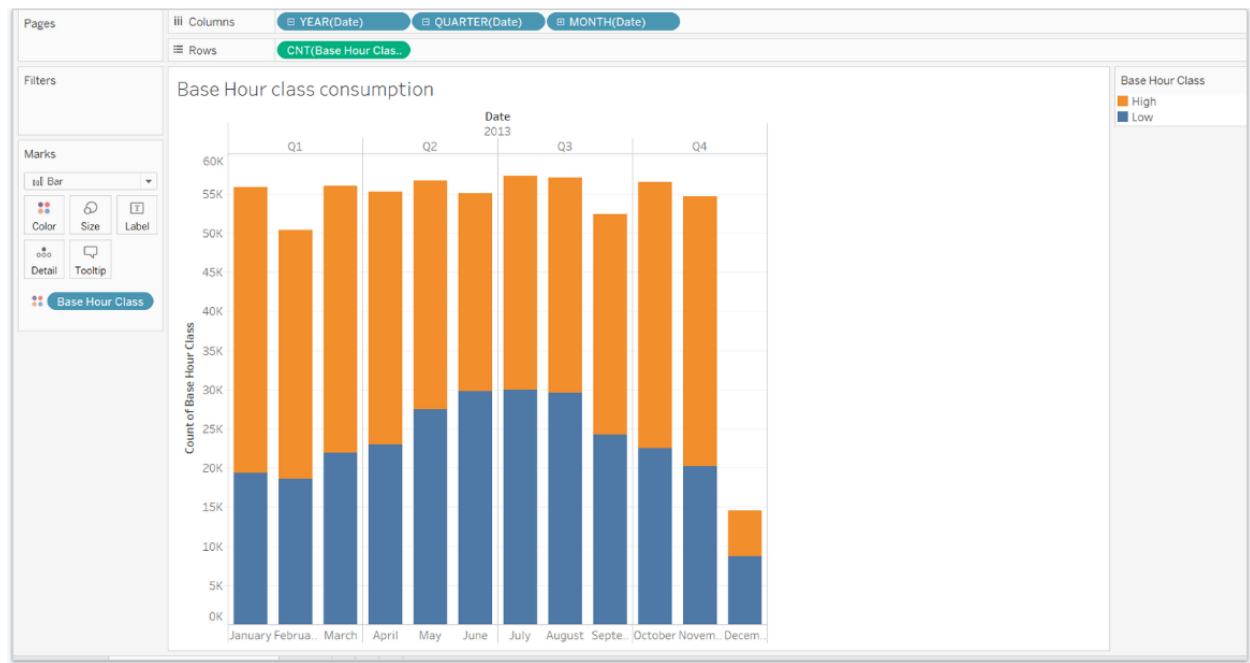
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Step 6: Data Visualization



- The Plot shows the total Energy consumption by type for entire year. This gives the consumption distribution for year.



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- The base hour class is used as a classified label for classification. The above plot shows the exploratory data analysis for count of base hour class values per month.