Detail Report

Topic: Demonstration of Azure Face API to collect face attributes from face images

Problem: To collect data intelligence from people's faces , their expressions and kind of attendance for a specific public gathering/event with use of Azure Cognitive Services - Face API, Azure Storage and Visualization with Pandas.

Data Set: Input Data source is, JPG Image database from Georgia Tech Face DB - http://www.anefian.com/research/face_reco.htm
Database has multiple color images (127 MB in size) of different people in variety of lighting conditions. The data is publicly available for research purpose. I used a manageable subset for purpose of this demo and used them as input to my program as a directory location.

Hardware: Intel i5-6300U CPU 2.4Ghz, 16 GB RAM, 64 bit Windows 7 OS

Software:

Technology / Tools	Description
Azure Cognitive Services – Face API	Azure's Face API services
Azure Storage - Table	Azure's Storage services - Table
Python 2.7 & 3.6	Python 2.7 & 3.6 (Used 2.7 for Visualization due to 3.6 installation issues)
Microsoft Azure Storage Explorer	To manage Azure Table data

Result Analysis:

In test demo I ran, program picked up all images from input directory to process them as Batch. Azure Face API was called per image to detect face attributes. Though Face API collect a bunch of attributes, I have limited results to Age, Gender, Glasses and Smile attribute for purpose of Demo. Once results are retrieved, attribute values are stored in Azure Storage Table. I created a Data Visualization code using Pandas and gave extract from stored face attributes from Azure table to find average age of all faces and average smiling face attribute of this test group to display as graph. If we consider this input source as set of people attending a public event, we can see average age of attending group and whether they were smiling or not in event. Including other attributes, such results can provide public reception of any social events.

Lessons Learnt :

- There are multiple image data sources available to test with but lot of images are in non JPG format mostly RAW format. I could not get Python packages working with non JPG format images. I also saw that Azure Face API only works with JPG, BMP, PNG and GIF files.
- Azure Face API (Free pricing Tier) can only run 20 calls per minute. So when I was running for big batch, I was getting errors. I reduced down my input to < 20 for Demo. We can use time delay function to overcome this limit to some extent.

Pros :

1. Azure Face API accurately delivers face attributes and specially age
2. Face API can detect very small faces in images correctly. In one of my test image, it captured a face in picture on shirt person wearing in image
3. Free pricing Tier is available for use

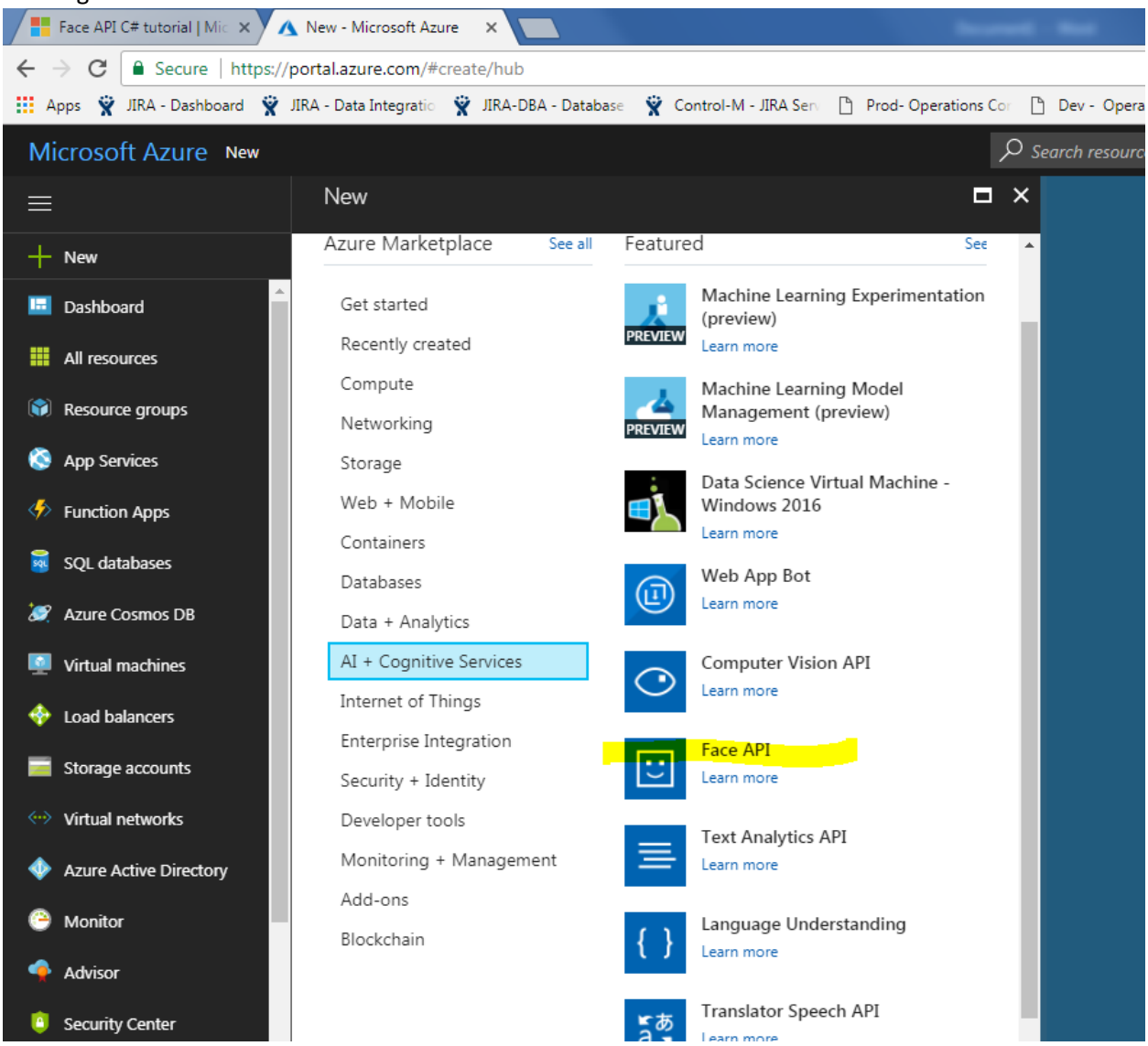
Cons:

1. Azure Face API does not work with RAW image formats produced by cameras. It only works with JPG, BMP, GIF and PNG
2. Free tier has limitation to run 20 calls in a minute

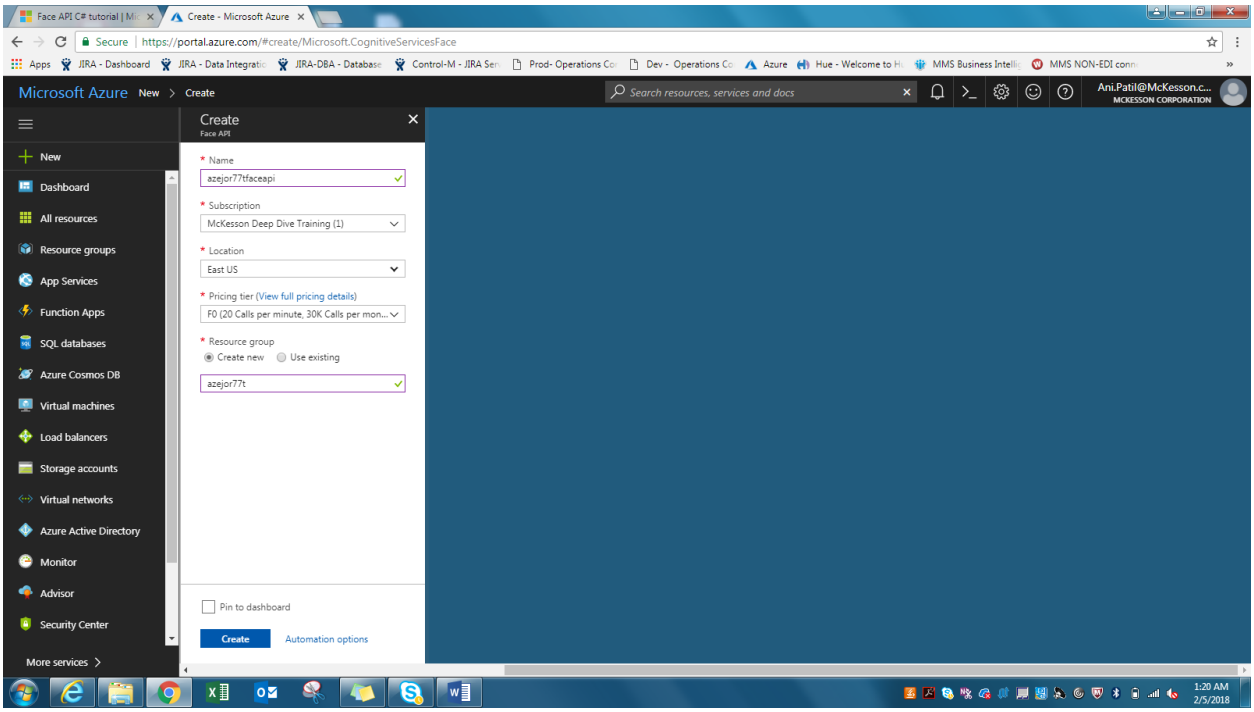
Steps followed in Detail:

All steps for installation and configuration of software are given below-

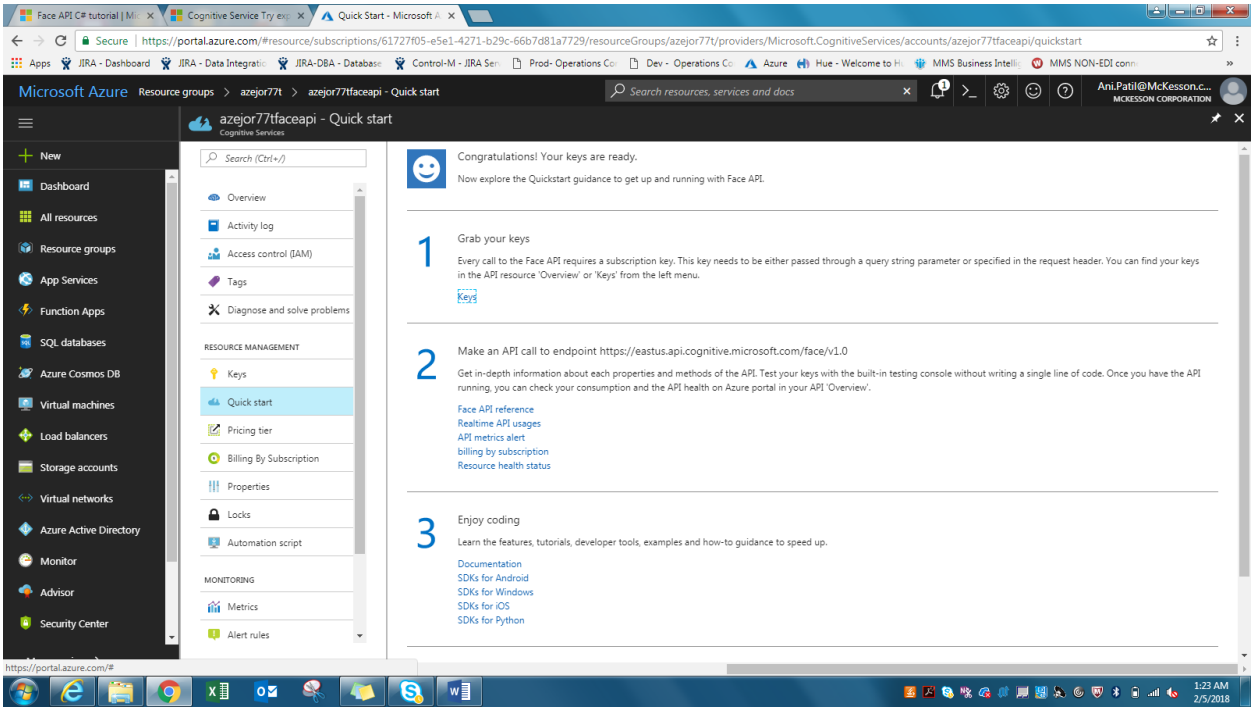
First login to Azure Portal and Subscribe to Face API



Create Face API.
Below see that we have selected Free pricing Ties with 20 calls per minute limit.



Get your Keys

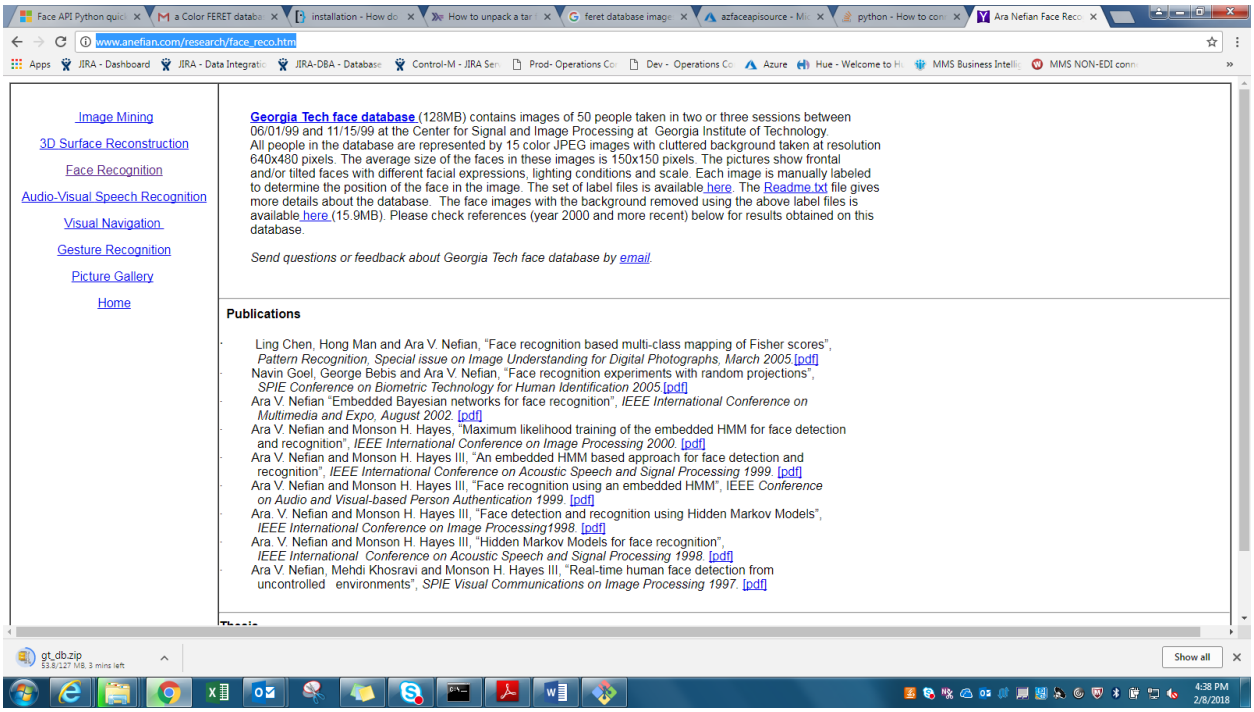


Key is - xxxxxxxxxxxxxxxxx

Now lets download input image source database.

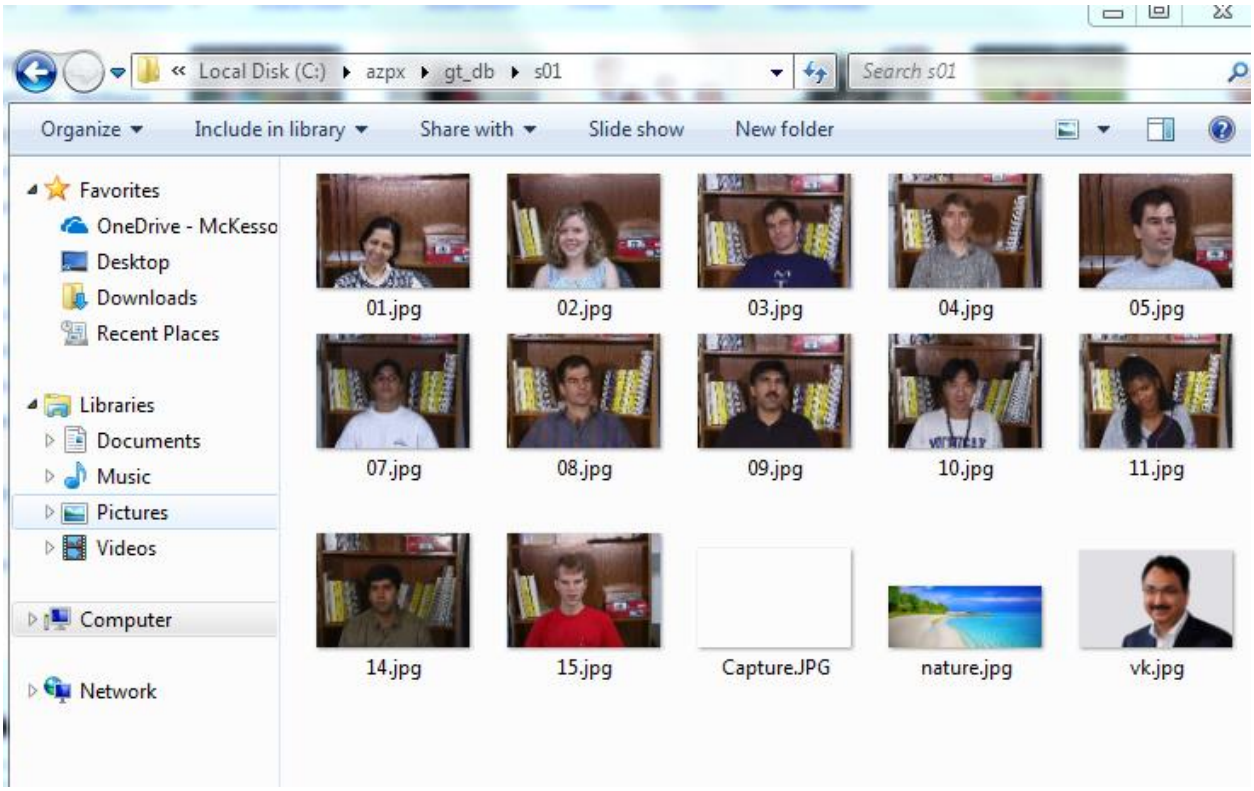
Image database
http://www.anefian.com/research/face_reco.htm

To download, click 'Georgia Tech face database' below



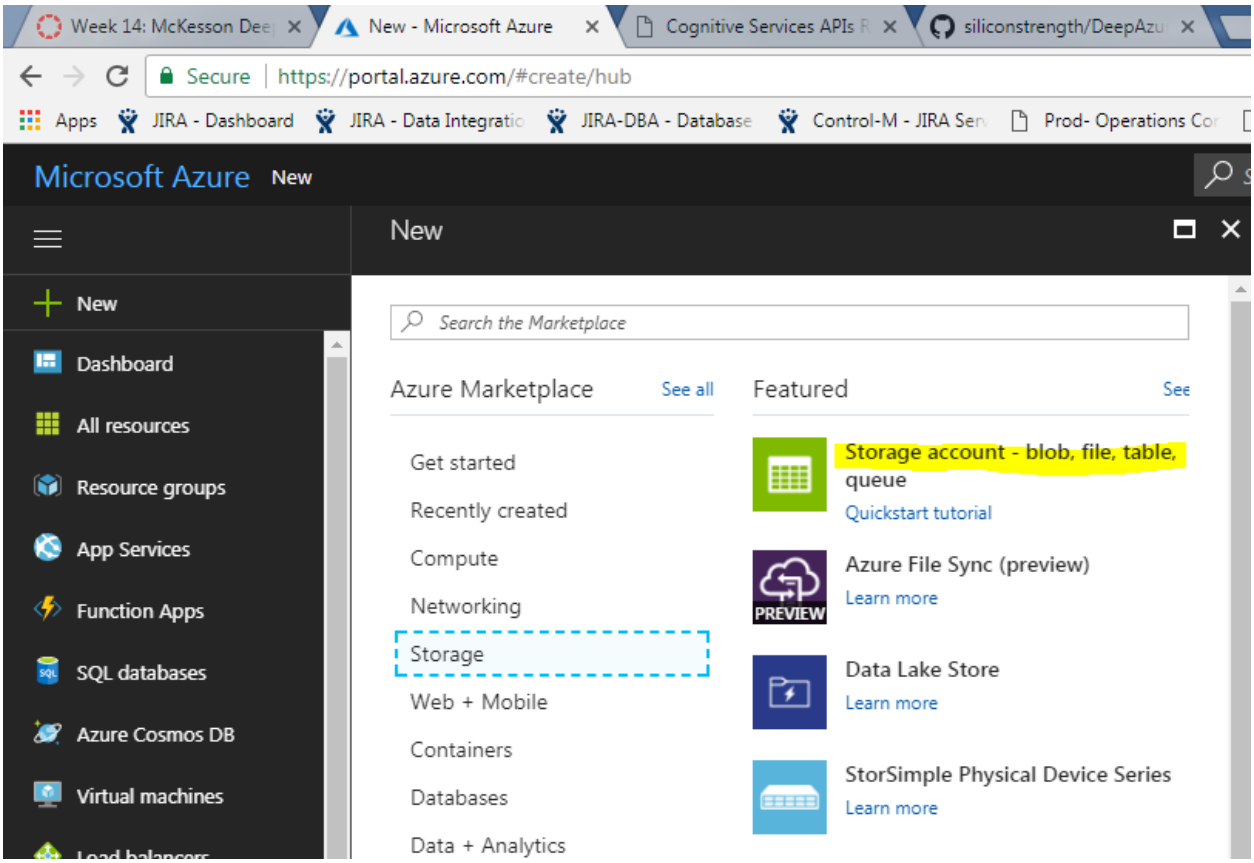
This Database has JPG images of multiple people in different lighting conditions. Complete database is about 128MB in size.

Download image database and take subset of images in a directory for Project demo. Below is a subset I used for this demo.

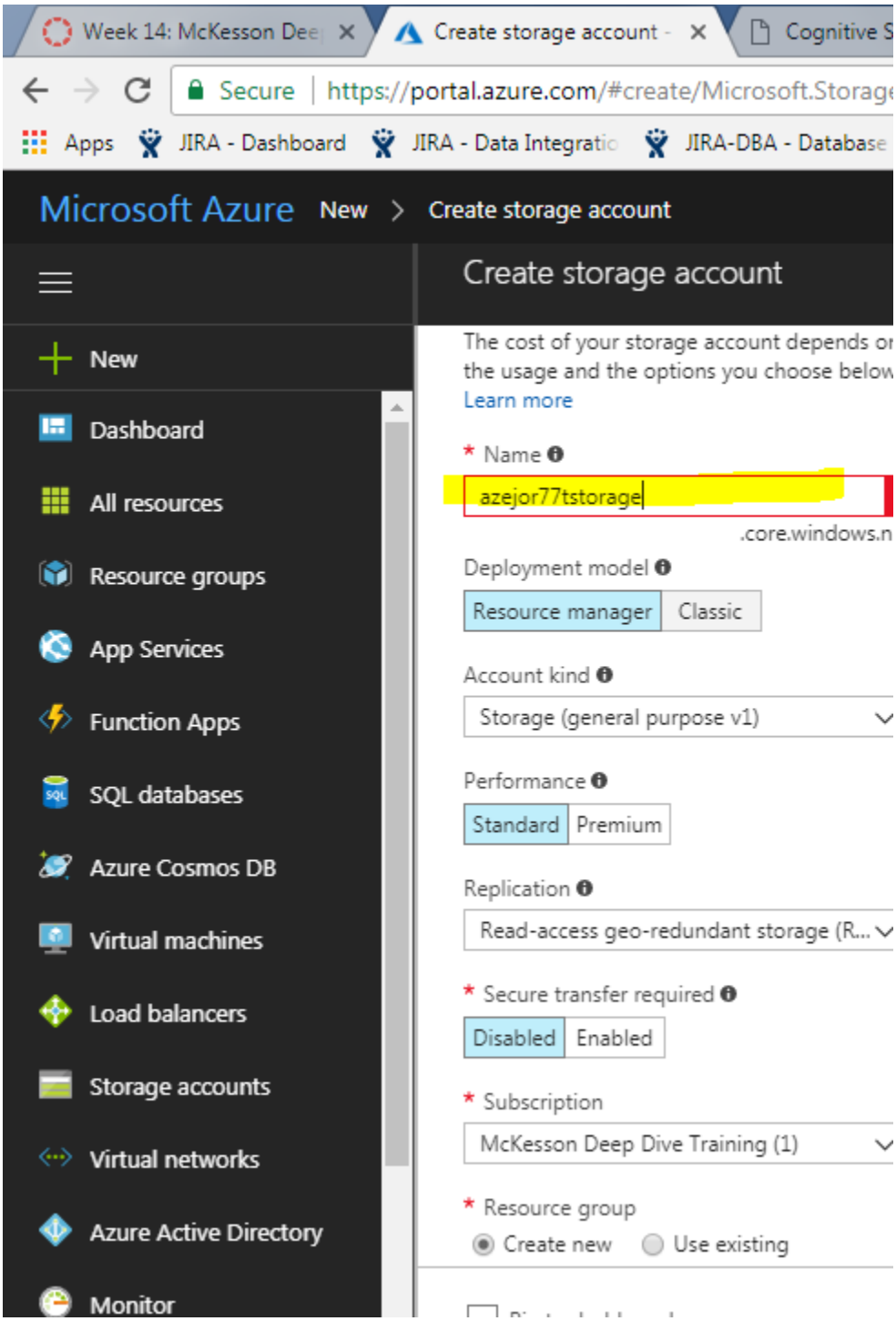


If you see above image of input images, I have added some random pictures which does not have any face in them. This is to test if Face API identify it correctly to not detect faces.

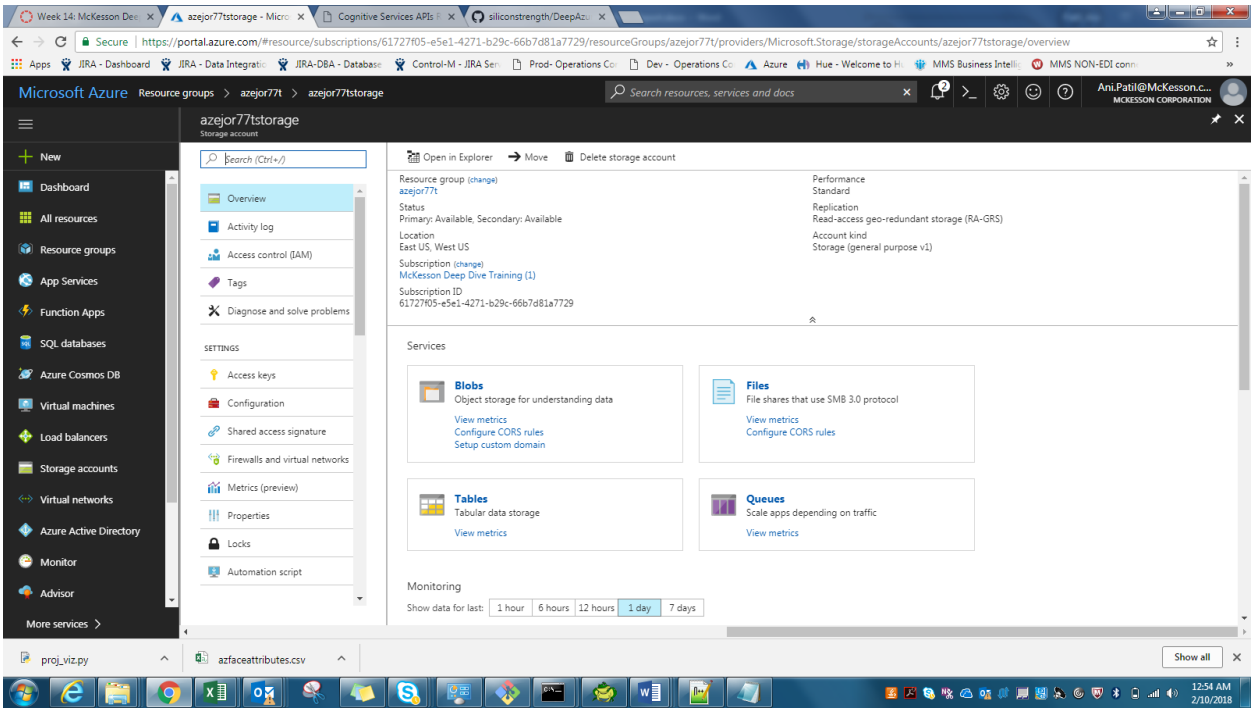
Now we will create a new storage account on Azure portal



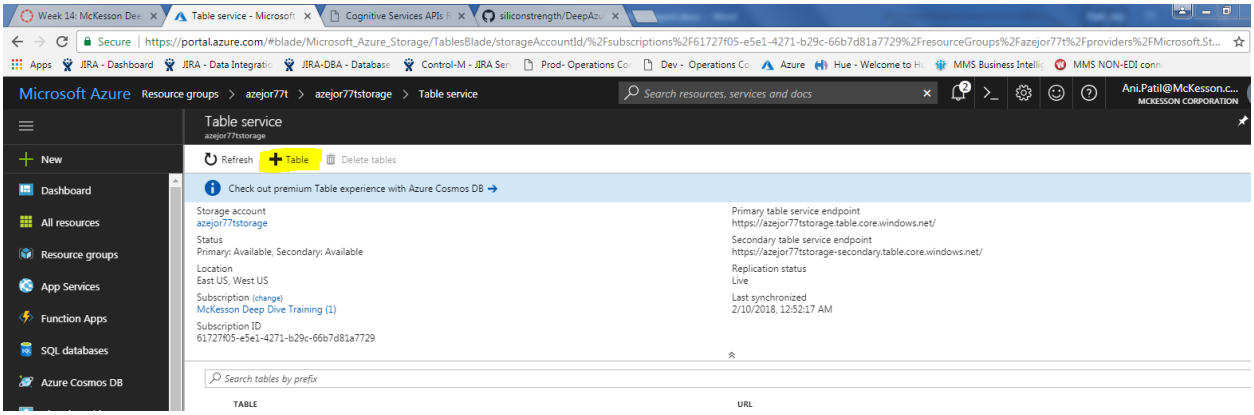
Create storage account



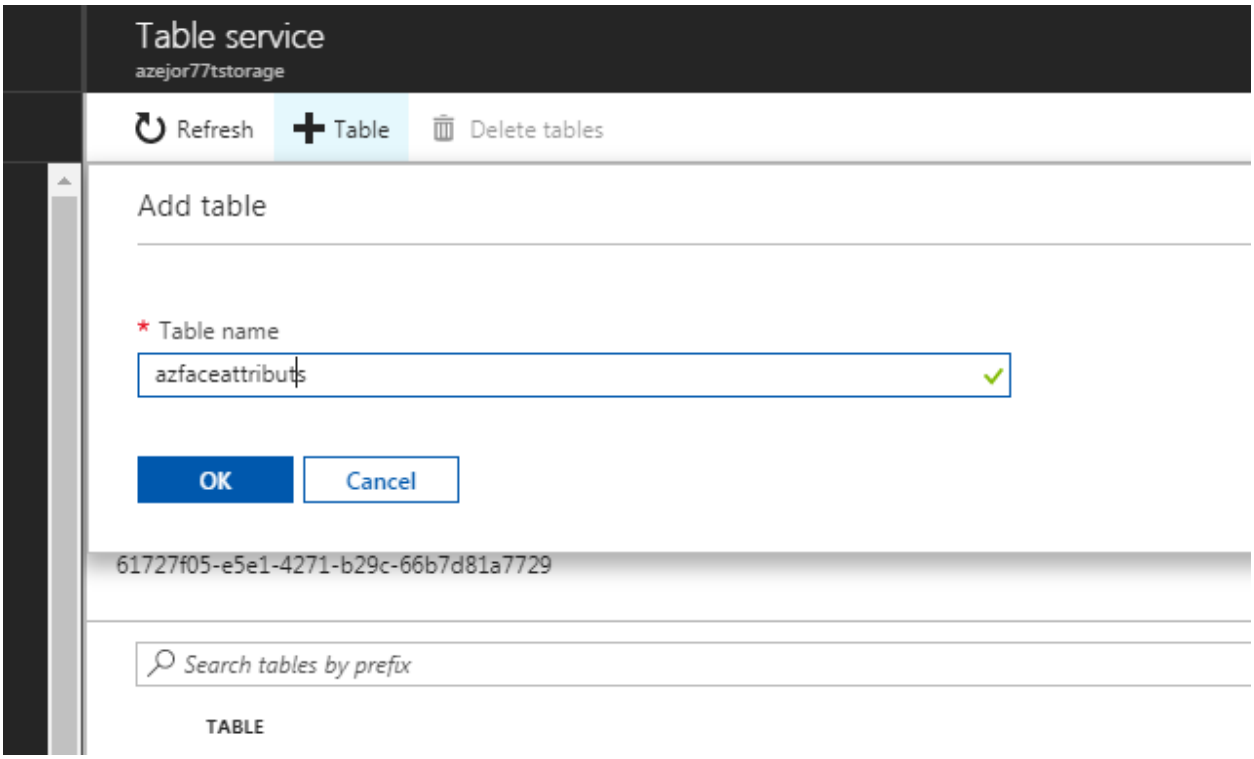
Once storage account is created, it look like below-



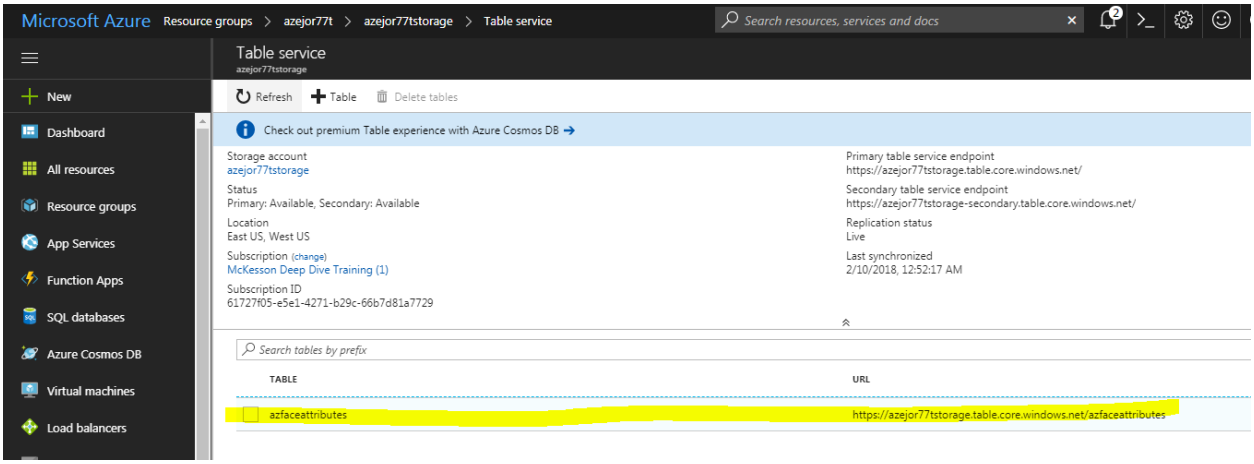
Select 'Tables' above and then click on + sign as below to create a new table



Give name of new table-

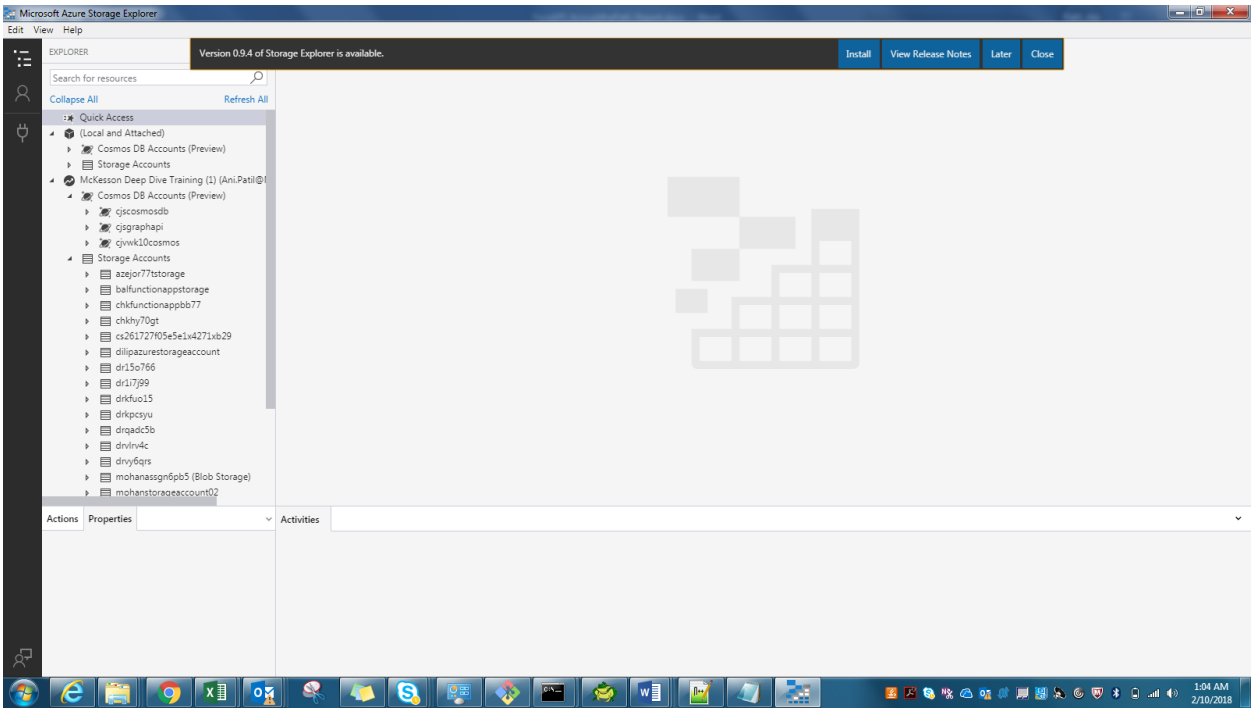


Once table created, it will look as below-

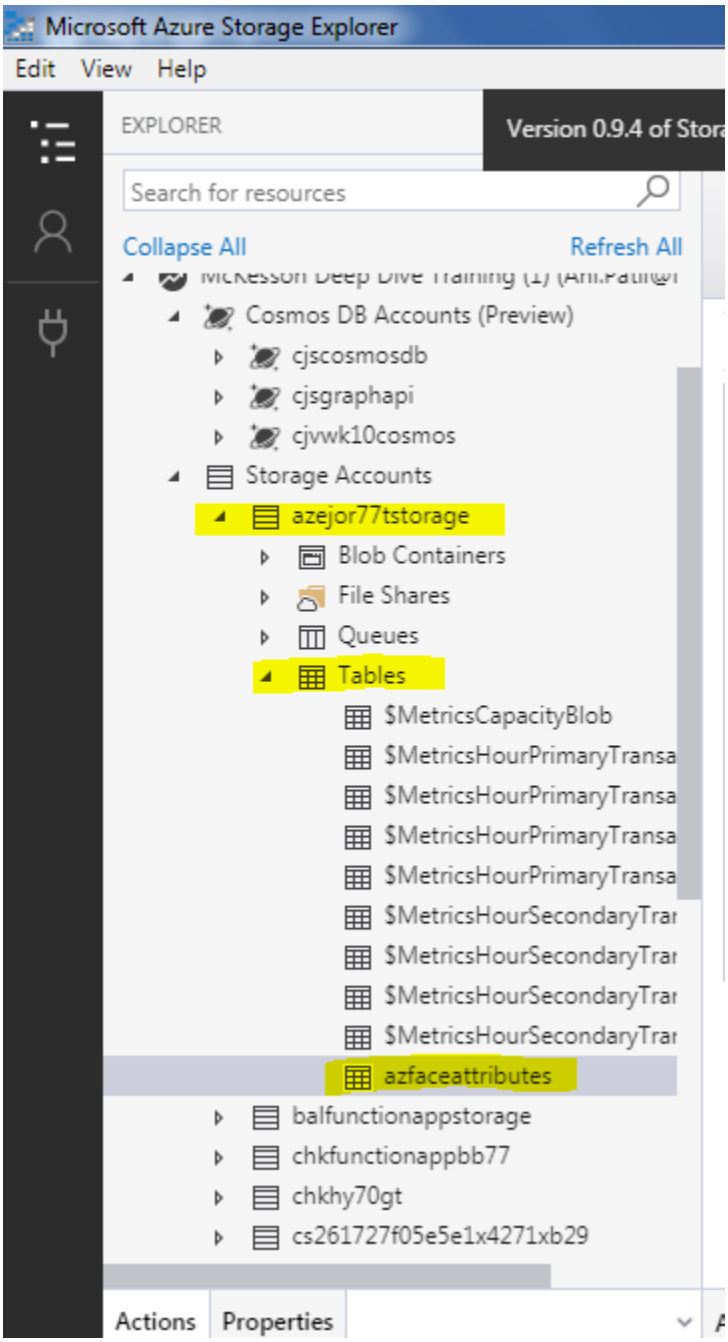


To access and manage this table, we will need to install – Microsoft Azure Storage Explorer. You can download it from-
https://azure.microsoft.com/en-us/features/storage-explorer/

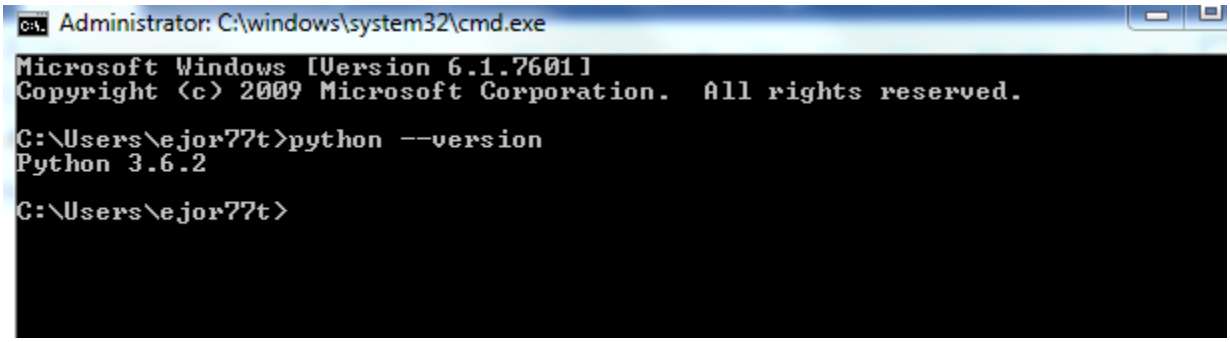
Microsoft Azure Storage Explorer, when first opened, will ask for your Azure login credentials to connect to Azure storage. It looks as below-



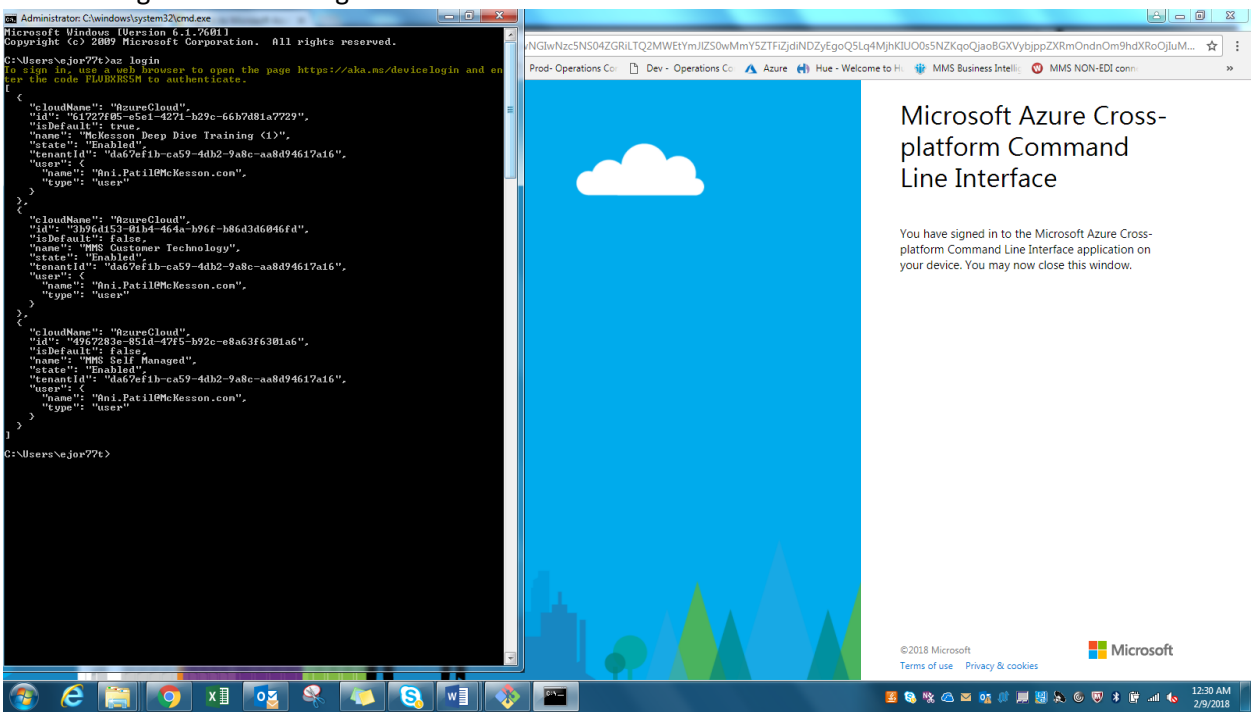
Once you click your storage Account, it will display respective tables inside it



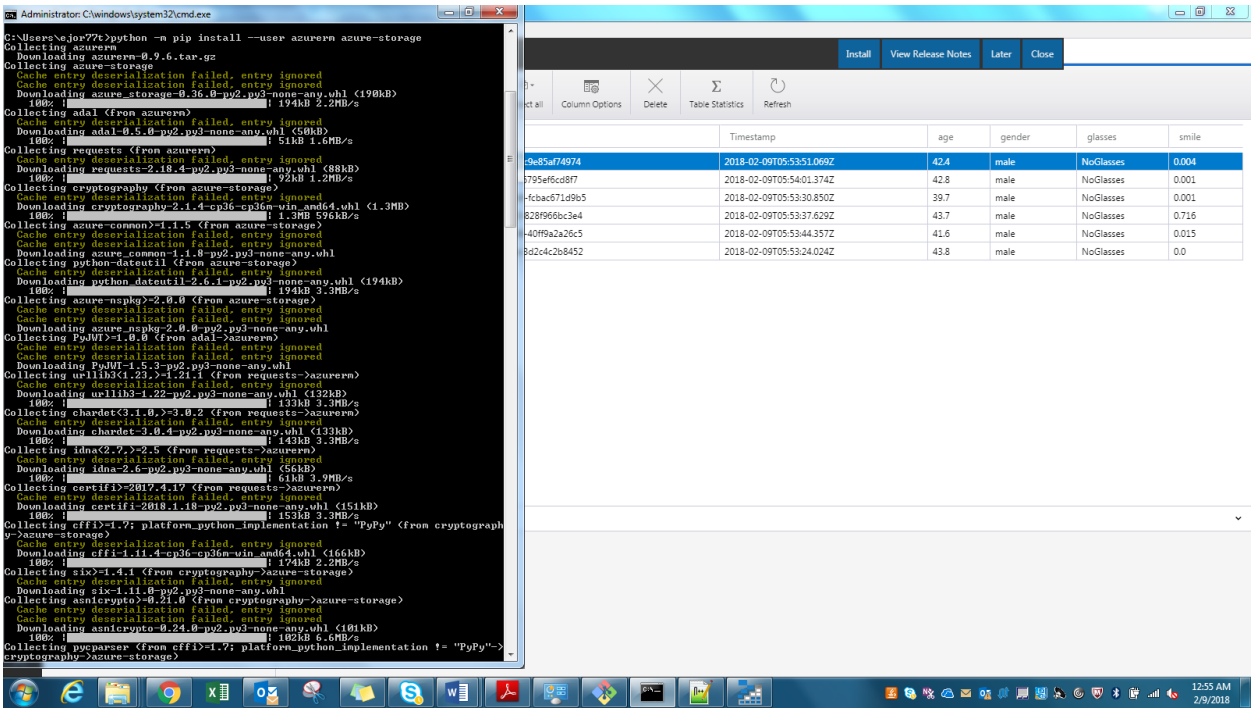
Then check that your machine has Python 3.6 installed (if not get it installed).



Now lets login to Azure using Azure CLI



Install storage package needed for working with Azure storage table



Install wheel and pandas – This we will need later for visualization.

```
c:\azpx>pip install wheel
'pip' is not recognized as an internal or external command,
operable program or batch file.

c:\azpx>python -m pip install wheel
Collecting wheel
  Downloading wheel-0.30.0-py2.py3-none-any.whl (49kB)
    100% |                                        | 51kB 365kB/s
Installing collected packages: wheel
Successfully installed wheel-0.30.0

c:\azpx>python -m pip install pandas
Collecting pandas
  Downloading pandas-0.22.0-cp36-cp36m-win_amd64.whl (9.1MB)
    100% |                                        | 9.1MB 124kB/s
Collecting pytz>=2011k (from pandas)
  Downloading pytz-2017.3-py2.py3-none-any.whl (511kB)
    100% |                                        | 512kB 839kB/s
Requirement already satisfied: python-dateutil>=2 in c:\users\ejor77t\appdata\ro
aming\python\python36\site-packages (from pandas)
Collecting numpy>=1.9.0 (from pandas)
  Downloading numpy-1.14.0-cp36-none-win_amd64.whl (13.4MB)
    100% |                                        | 13.4MB 85kB/s
Requirement already satisfied: six>=1.5 in c:\users\ejor77t\appdata\roaming\pyth
on\python36\site-packages (from python-dateutil>=2->pandas)
Installing collected packages: pytz, numpy, pandas
Successfully installed numpy-1.14.0 pandas-0.22.0 pytz-2017.3

c:\azpx>
```

Install seaborn – needed for data visualization later

```
c:\azpx>python -m pip install seaborn
Collecting seaborn
  Downloading seaborn-0.8.1.tar.gz (178kB)
    100% |████████████████████████████████| 184kB 1.6MB/s
Collecting scipy (from seaborn)
  Downloading scipy-1.0.0-cp36-none-win_amd64.whl (30.8MB)
    100% |████████████████████████████████| 30.8MB 36kB/s
Collecting matplotlib (from seaborn)
  Downloading matplotlib-2.1.2-cp36-cp36m-win_amd64.whl (8.7MB)
    100% |████████████████████████████████| 8.7MB 130kB/s
Requirement already satisfied: numpy>=1.8.2 in c:\program files\python36\lib\sit
e-packages (from scipy->seaborn)
Requirement already satisfied: six>=1.10 in c:\users\ejor77t\appdata\roaming\pyt
hon\python36\site-packages (from matplotlib->seaborn)
Requirement already satisfied: pytz in c:\program files\python36\lib\site-packag
es (from matplotlib->seaborn)
Collecting pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 (from matplotlib->seaborn)
  Downloading pyparsing-2.2.0-py2.py3-none-any.whl (56kB)
    100% |████████████████████████████████| 61kB 3.9MB/s
Requirement already satisfied: python-dateutil>=2.1 in c:\users\ejor77t\appdata\
roaming\python\python36\site-packages (from matplotlib->seaborn)
Collecting cycler>=0.10 (from matplotlib->seaborn)
  Downloading cycler-0.10.0-py2.py3-none-any.whl
Building wheels for collected packages: seaborn
  Running setup.py bdist_wheel for seaborn ... done
  Stored in directory: C:\Users\ejor77t\AppData\Local\pip\Cache\wheels\29\af\4b\
ac6b04ec3e2da1a450e74c6a0e86ade83807b4aaf40466ecda
Successfully built seaborn
Installing collected packages: scipy, pyparsing, cycler, matplotlib, seaborn
Successfully installed cycler-0.10.0 matplotlib-2.1.2 pyparsing-2.2.0 scipy-1.0.
0 seaborn-0.8.1
```

Now lets start writing code for Face API call and do some face detection and get face attributes.

Below is code snippet of my Face API program- azfaceapi.py

Setting up subset of input images pulled from above Face Database to be processed by Face API-

```
import string,random,time,azurerm,json
from azure.storage.table import TableService, Entity
import time
import requests
import sys
import glob

# Input image directory
imagerepo = glob.glob('C:/azpx/gt_db/s01/*.jpg')

list_face = imagerepo[:]
```

Set subscription key for face API and header and params for request

```
# Add subscription key.
subscription_key = '9fa0a02b4fc54e1bb1d0490f1785586b'


# Request headers for locally stored files.
headers = {
    'Content-Type': 'application/octet-stream',
    'Ocp-Apim-Subscription-Key': subscription_key,
}

# Request parameters.
params = {
    'returnFaceId': 'true',
    'returnFaceAttributes': 'age,gender,smile,glasses,hair,emotion',
}
```

Next will call Face API for each of input image to analyze and collect face attributes

```
def az_face_api(img_filename, params, headers ):
#Pass images to Face API

    uri_base = 'https://eastus.api.cognitive.microsoft.com'

    # Get the data from file
    with open(img_filename, 'rb') as f:
        img_data = f.read()

    try:
        response = requests.post(uri_base + '/face/v1.0/detect', data=img_data, headers=headers, params=params)
        #print (response)

        #print ('Response:')
        parsed = response.json()

        return parsed

    except Exception as e:
        print('Error:')
        print(e)
```

Once we get requested face attributes, result will be in JSON format. We will collect respective values and store them in Azure Storage table as below

```
for image_file in image_list:

    # calling sleep to avoid rate limit error
    time.sleep(5)

    face_id = az_face_api(image_file, params, headers)


    if face_id:
        response_list.append(face_id)
        f_id = face_id[0]['faceId']
        f_age = str(face_id[0]['faceAttributes']['age'])
        f_gender = face_id[0]['faceAttributes']['gender']
        f_glasses = face_id[0]['faceAttributes']['glasses']
        f_smile = str(face_id[0]['faceAttributes']['smile'])
        print ("\n" + "Face ID: " + f_id)
        print ("Age: " + f_age)
        print ("Gender: " + f_gender)
        print ("Glasses: " + f_glasses)
        print ("Smile: " + f_smile)

    # Insert data in Azure Storage Table
        table_service = TableService(account_name='azejor77tstorage', account_key='VozCDR8v4W6uvu0Vue1AaAs
        time.sleep(1)
        simages = Entity()
        simages.PartitionKey = 'imageinfo'
        simages.RowKey = f_id
        simages.age = f_age
        simages.gender = f_gender
        simages.glasses = f_glasses
        simages.smile = f_smile
        table_service.insert_entity('azfaceattributes', simages)
        print('Created entry in table...')
```

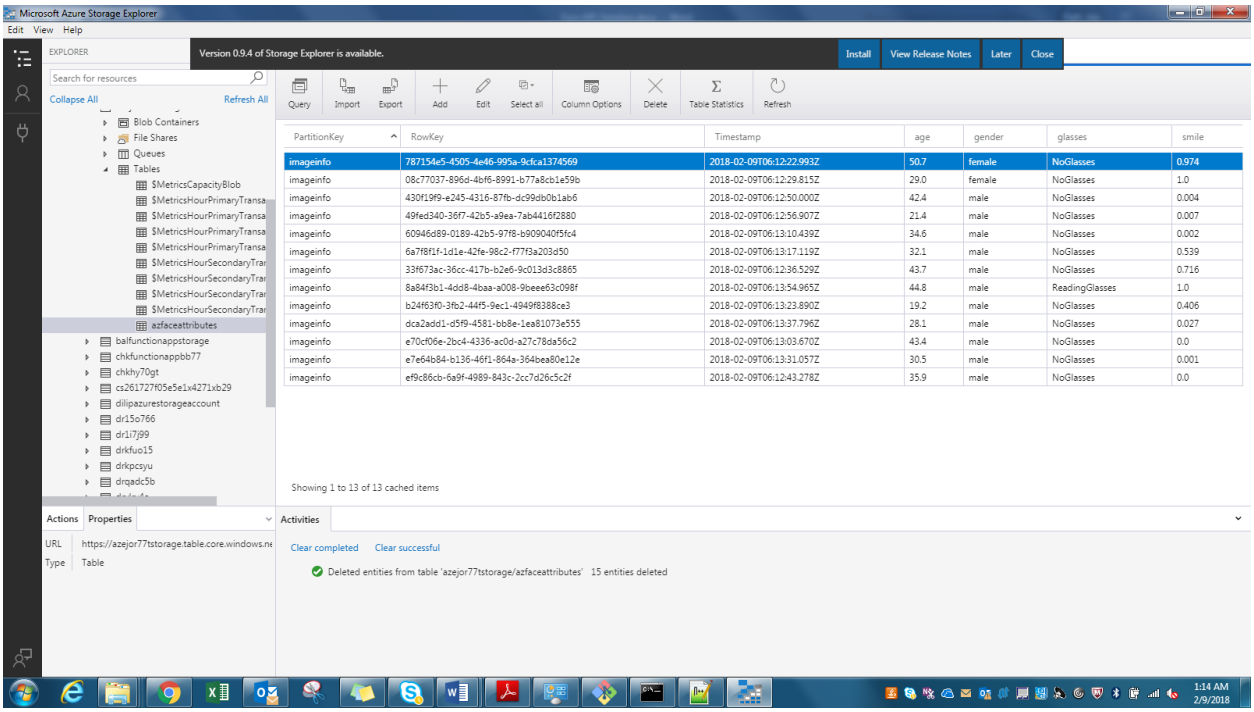
We will also be checking for images with no faces in it and will count such images as below

```
    else:
        response_list.append([{'faceId': None, 'faceRectangle': None}])
        no_faces_not_detected += 1

print ("\n **** Number of images analyzed: {}".format(len(response_list)),
       " **** Images with no faces detected : {}".format(no_faces_not_detected))
```

We can run program as below-

```
Administrator: C:\windows\system32\cmd.exe

c:\azpx>python azfaceapi.py

Face ID: 34a8643e-7bbd-47d2-9232-d59673dab69b
Age: 50.7
Gender: female
Glasses: NoGlasses
Smile: 0.974
Created entry in table...

Face ID: 095feb88-0d12-46b5-ba64-6760d86a50a5
Age: 29.0
Gender: female
Glasses: NoGlasses
Smile: 1.0
Created entry in table...

Face ID: cf36551b-0c27-4be6-aba5-2858e08c3717
Age: 43.7
Gender: male
Glasses: NoGlasses
Smile: 0.716
Created entry in table...

Face ID: 5a5c2d3f-b27e-42ff-9185-e0f0354991b6
Age: 35.9
Gender: male
Glasses: NoGlasses
Smile: 0.0
Created entry in table...

Face ID: 97842806-3658-4bbd-bbd0-239f322afd50
Age: 42.4
Gender: male
Glasses: NoGlasses
Smile: 0.004
Created entry in table...

Face ID: 9b903f5f-b3fa-40e0-998a-b0fc983b875c
Age: 21.4
Gender: male
Glasses: NoGlasses
Smile: 0.007
```

Output of Face Detection Analysis is stored in Azure Table Storage and when looked through Microsoft Azure Storage Explorer will look as below-



Now we will run some data visualization on output data in above storage table. Please extract this table data as csv file – azfaceattributes.csv

Now we will use Pandas to run visualization. I have created python program proj_viz.py for same. Python 3.6 on windows 7 machine was giving error on some of python pandas package installation so I ran visualization using Python 2.7 on Windows 10 machine.

In this python code, I have calculated some statistical figures covering group of faces analyzed. It pulls minimum, maximum, average, mean, median age and smile factor of group.

Visualization shows average age and average smiling face attribute for group of faces analyzed. I created Bar chart showing these averages.

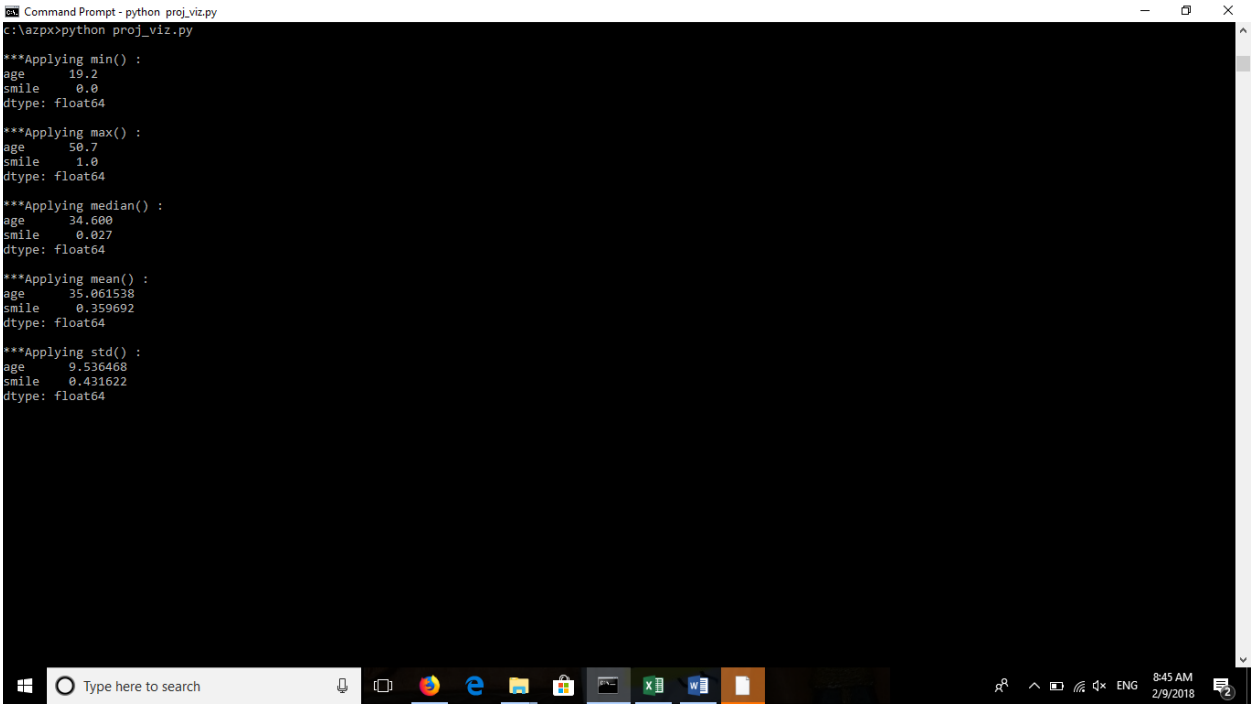
Below is code snippet-

Data visualization using Pandas on Face attribute data. Find average Age and average smiling face attribute of batch of input faces
Run on Python 2.7

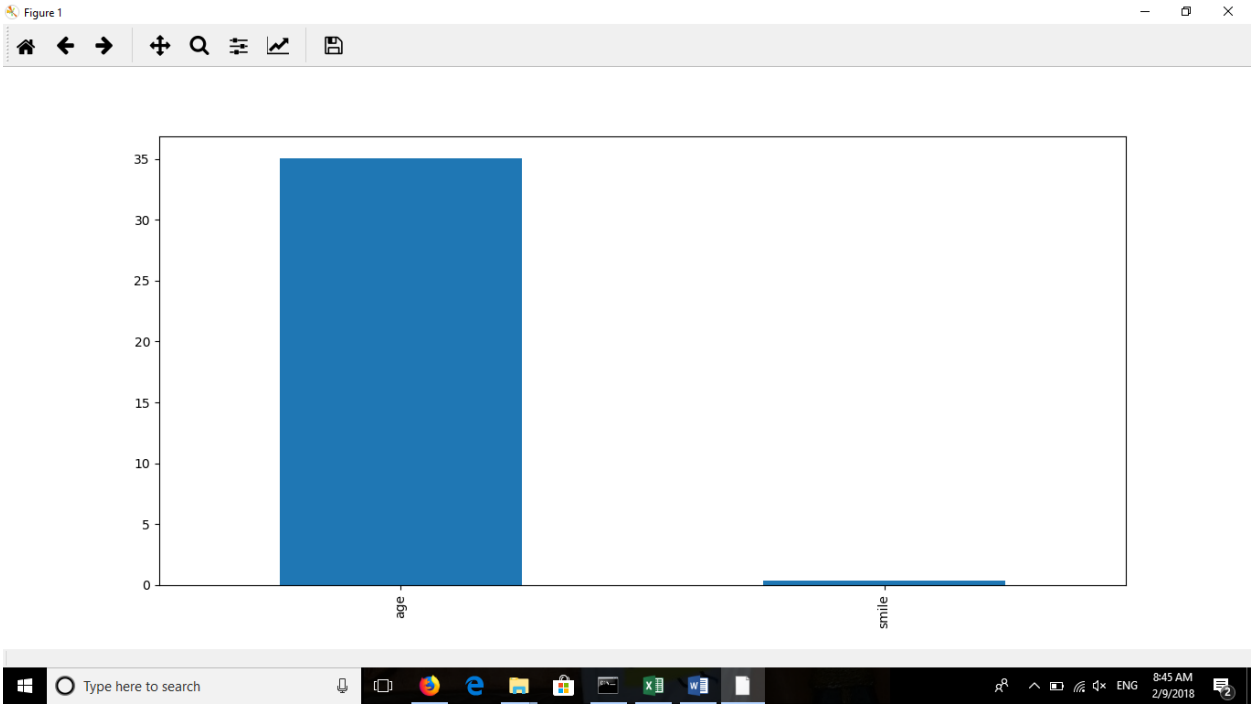
```
import pandas as pd
import seaborn as sns
from pandas.plotting import scatter_matrix
import matplotlib.pyplot as plt

#Read azfaceattributes.csv file which is export of Face API attributes from Storage table
df = pd.read_csv("azfaceattributes.csv")

#Drop non numeric columns and buid a Dataframe of remaining columns to work with

df1 = df.drop(['PartitionKey', 'RowKey','Timestamp','gender','glasses'], axis=1)
attributes=list(df1.columns)

#Use panda machinery to calculate basic statistics for all numerical columns, min, max, median, average
and standard deviation
print "\n***Applying min() : "
print df1.min()
print "\n***Applying max() : "
print df1.max()
print "\n***Applying median() : "
print df1.median()
print "\n***Applying mean() : "
print df1.mean()
print "\n***Applying std() : "
print df1.std()
#Present graphically average age and smiling attributes for attending group
df1.mean().plot(kind='bar')
##scatter_matrix(df1[attributes], figsize=(12,8))
plt.show()
-------------
```

Above program will show data visualization as bar chart for average age and smile face attribute for all image faces for input data. Such data can be used for deriving social intelligence from public events.

Visualization looks as below-



Visualization is as below



You can see that average age of group is 34.6 and Smile factor of 0.35.

This can give us some insight on how specific group reacted to situation at that time.

YouTube URLs :
Short: https://www.youtube.com/watch?v=l_3xt2chxns

Long: https://www.youtube.com/watch?v=7dBOHjJYPj4

Github :
https://github.com/siliconstrength/DeepAzureFinalProject

References:
https://azure.microsoft.com/en-us/services/cognitive-services/face/
http://www.anefian.com/research/face_reco.htm
https://docs.microsoft.com/en-us/azure/cognitive-services/face/overview