Programming Assignment 2, Using of spark mllib on 4 ec2 instances with docker and container environment.

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#github link: https://github.com/jalajsharma93/cloudcomputingproject2

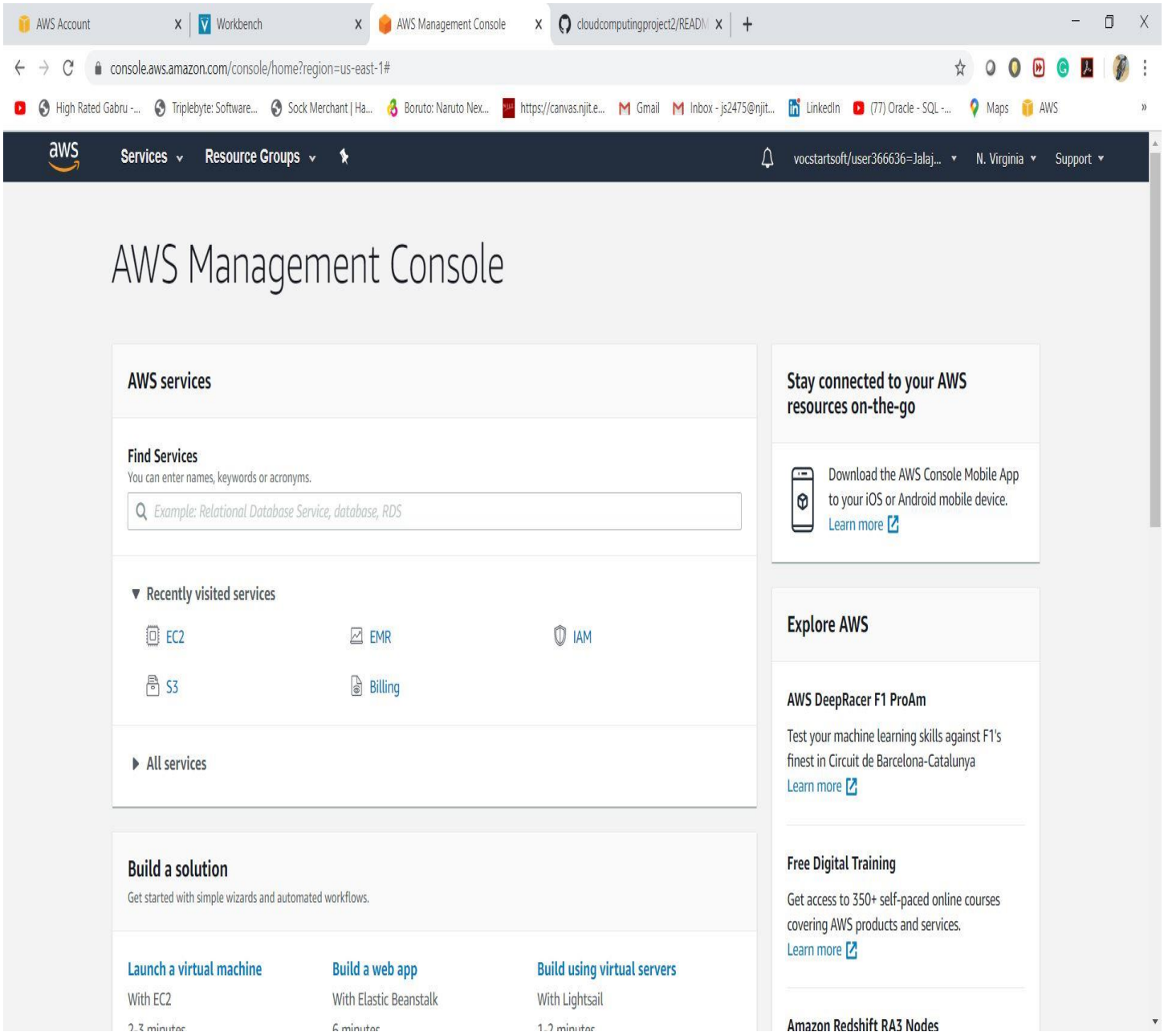
#docker link : https://hub.docker.com/u/jalajsharma93

Please comment out line no. 13 for testing on ValidationDataset.csv,

And comment in 14 for same, if want to test on TestDataset.csv please do not remove anything from **PA2-1.11_Validation.py**

Creating EMR cluster,

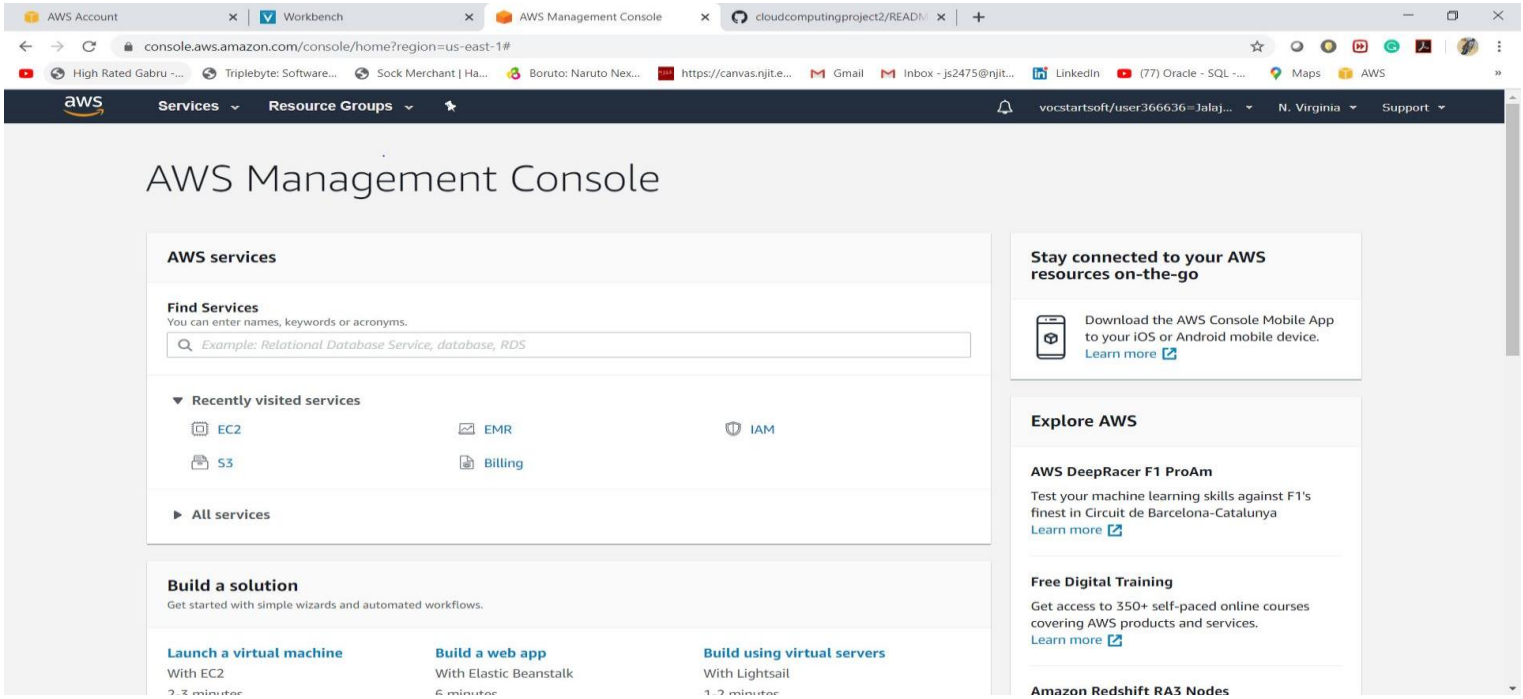
For creating cluster got to AWS account



click on EMR,

if emr is not there search on search bar and select it.

Click on create cluster.

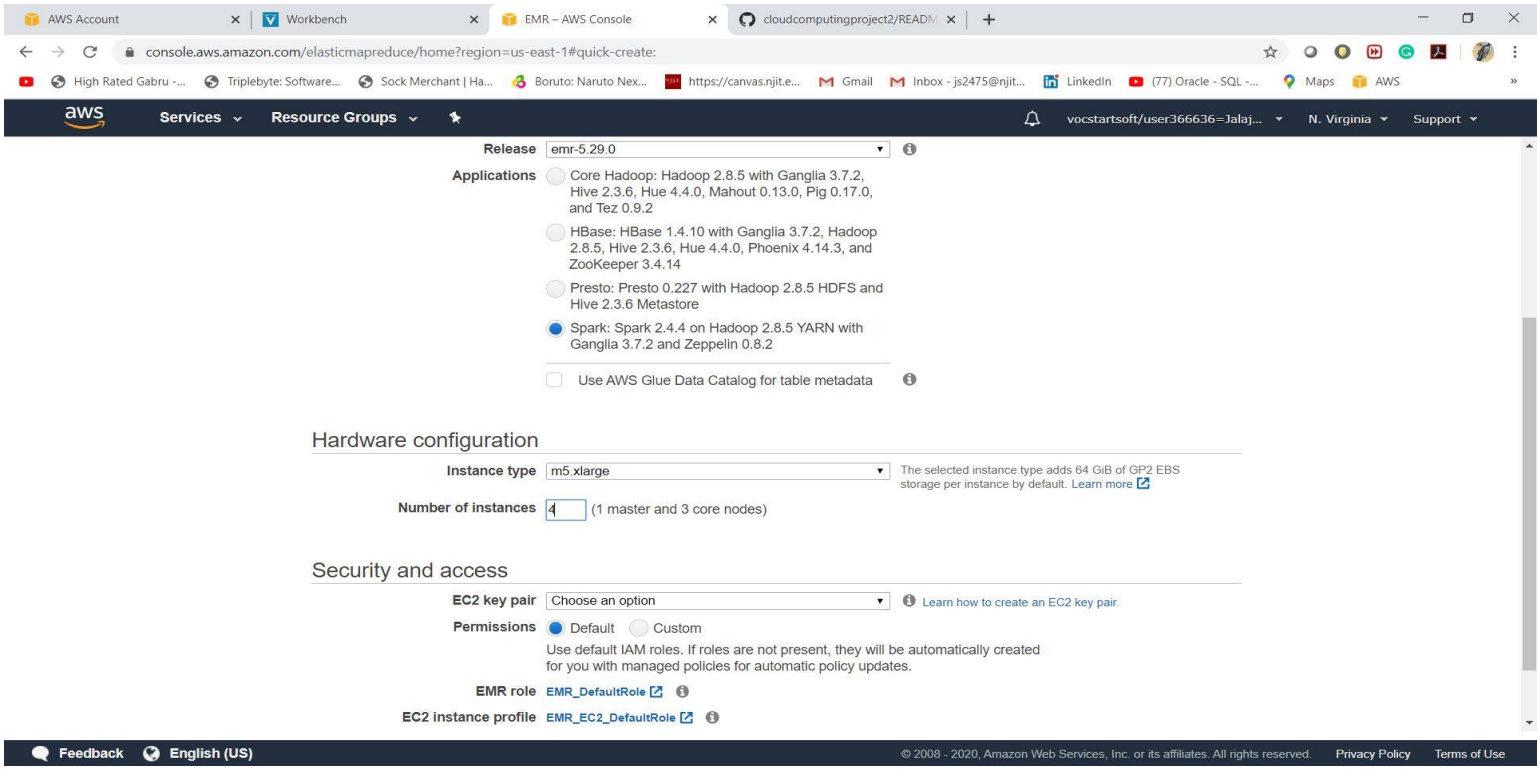


Select if next click on create cluster and then a page apper with config.

Name cluster with name you want for project.

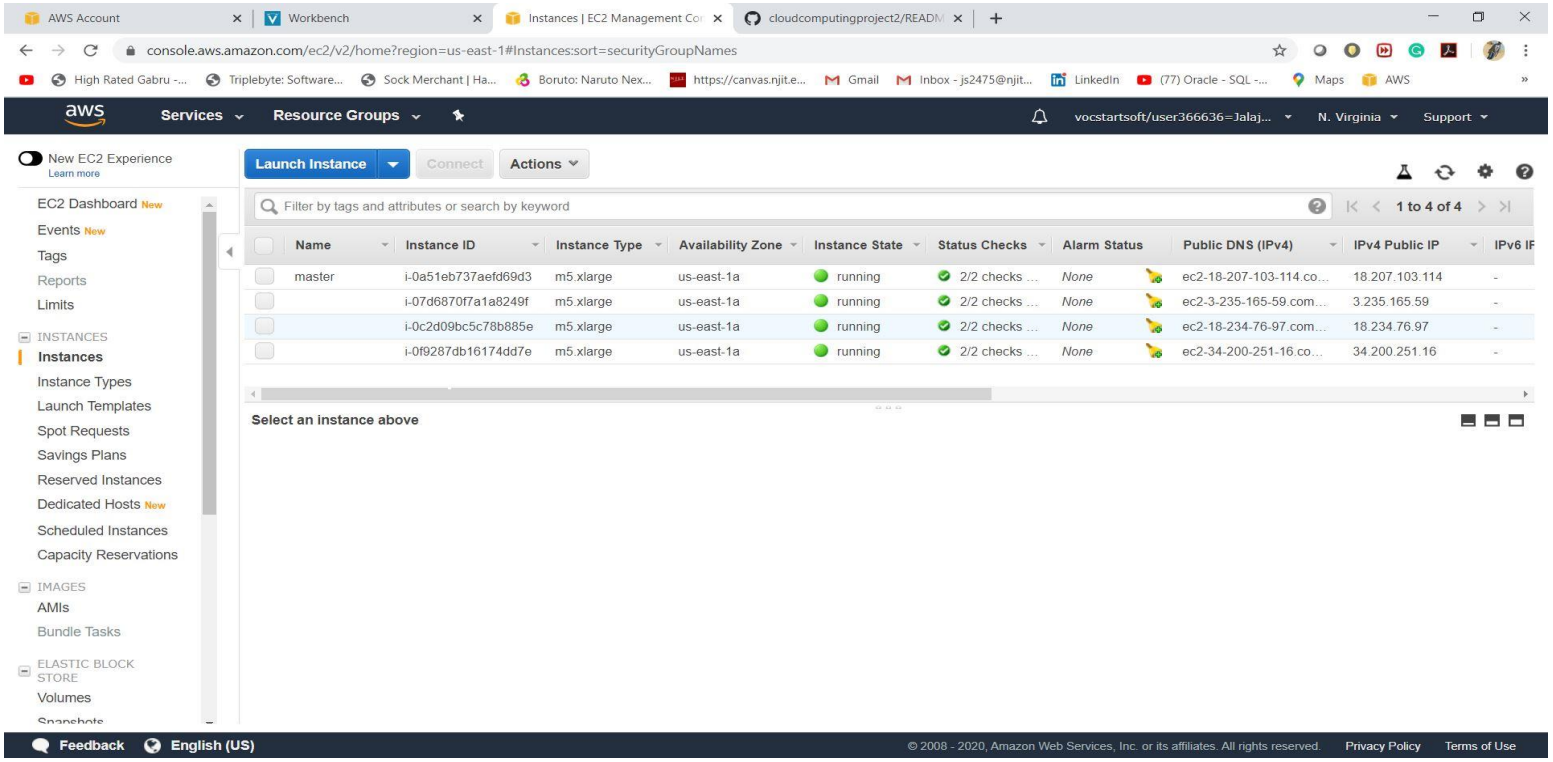
Select spark Hadoop, yarn with ganglia and Zeppline

Bellow select number of Instance to 4.



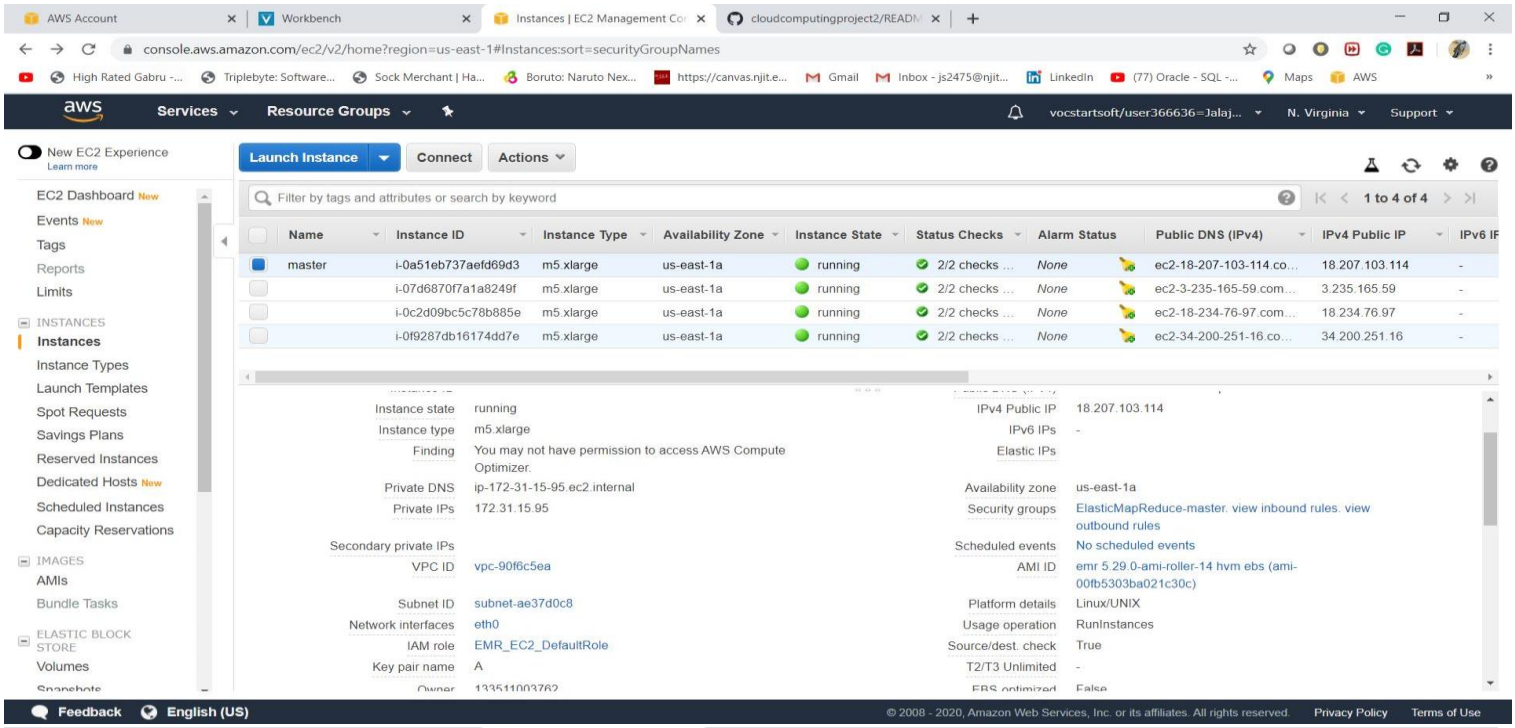
After that you can see your 4 Intances with 1 master and 3 slave are ready in EC2 instances,

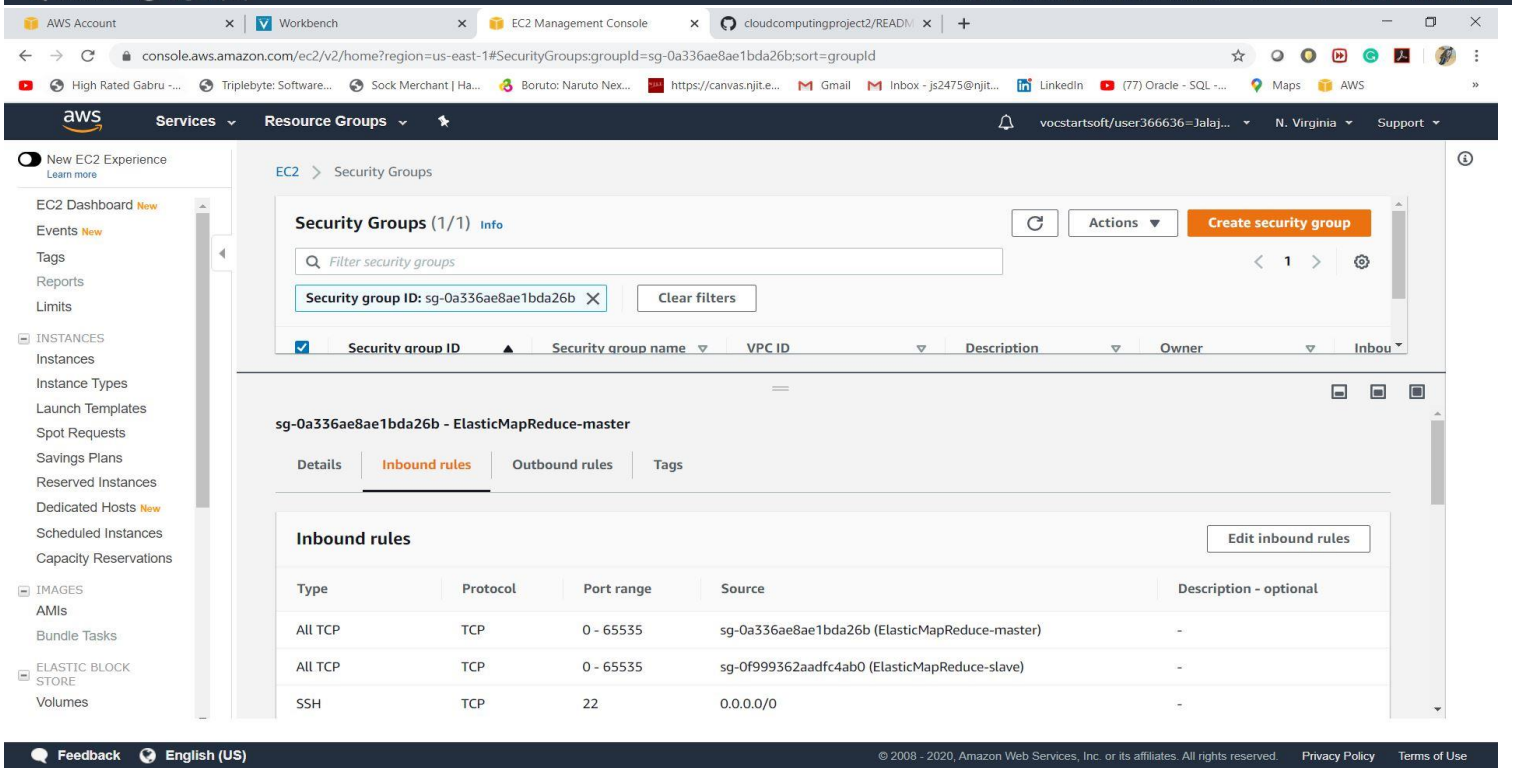
For that go to EC2 same as you search EMR and now Search EC2



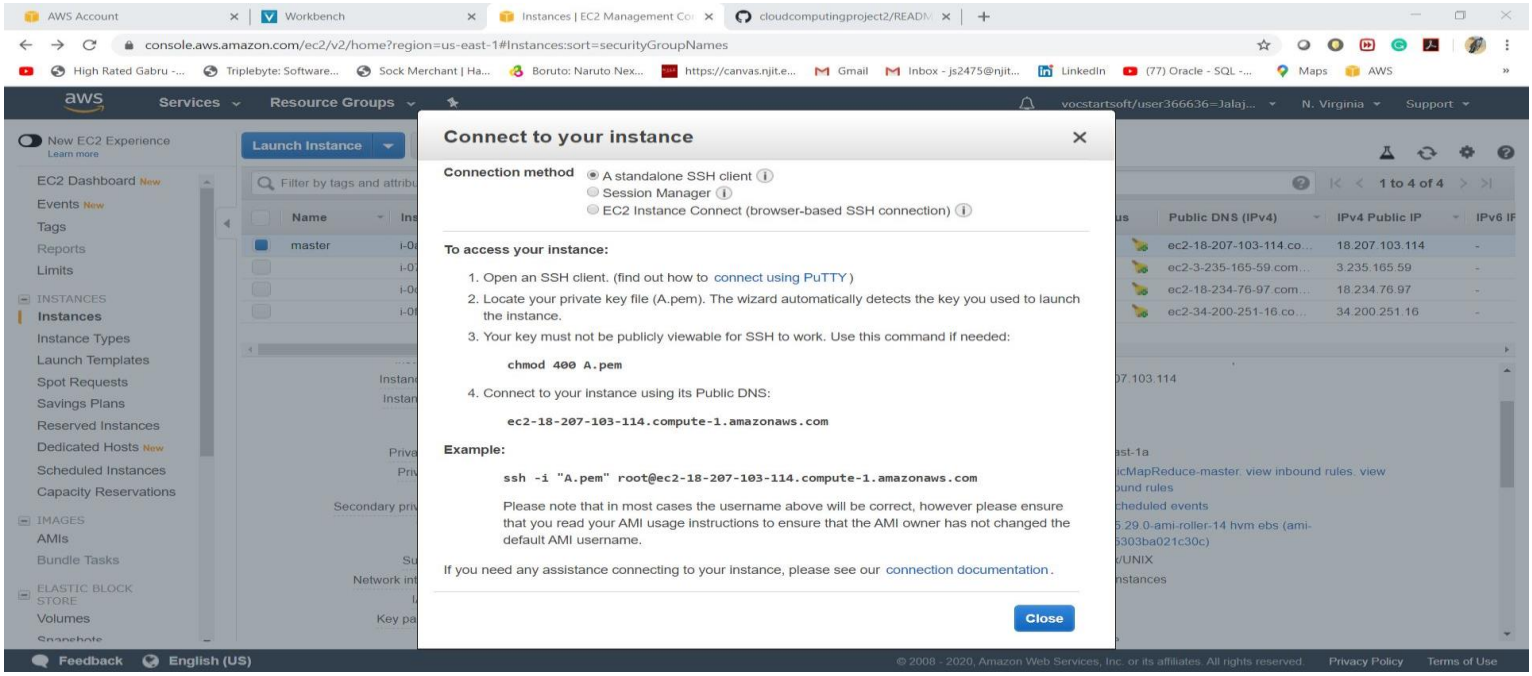
Now we have to change the inbound rule to allow ssh connection. For that select master on EC2 instance, scroll down and in description select *ElasticMapReduce* under security groups.

Inside It edit inboud rule on top right corner and there add SSH.



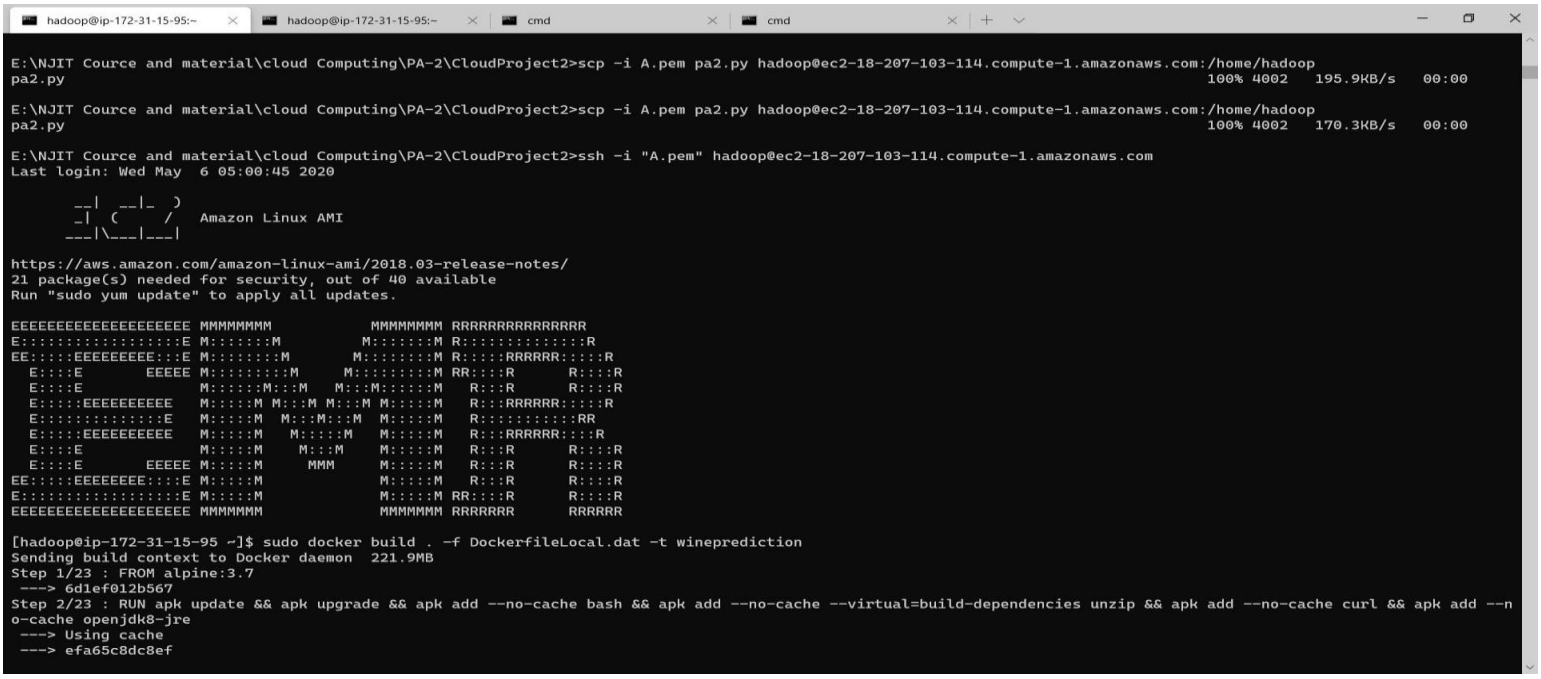


Now again select master and click on connect on top you will see window like this.



Now we will connect to EMR cluster.

```
ssh -i "A.pem" hadoop@<your address from above screenhot point 4 in TO access
your instance.
```



After connection from local terminal upload all data to instance using SCP command

Scp -i A.key * hadopp@<address from ec2 instance connect> :/home/Hadoop/

Then all file will be uploaded.

Make sure your key have correct permissions.

Now we have to install python, pyspark and docker

They need dependencies also.

For that we have to install in order to train model in EMR and Predict on the cluster.

Sudo yum install python3

pip3 install wheel

pip3 install pyspark==2.4.5 --no-cache-dir

pip3 install findspark

if pip3 don't work try pip or try sudo pip or sudo pip3.

After that install docker

Sudo yum install docker

Now we are ready to run our application for that we have to train our model on hdfs system

For that

Use command

1. hadoop fs -put TrainingDataset.csv /
2. hadoop fs -put ValidationDataset.csv

This will add file to hdfs system for training and validation.

After that we have to run our training for that run command

python PA2-1.10.py

--python <training file name>.py

This will train the model, which we have to make sure that we upload it into our doker Image.

```
[hadoop@ip-172-31-15-95 ~]$ python PA2-1.10.py
20/05/06 13:06:56 WARN NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Using Spark's default log4j profile: org/apache/spark/log4j-defaults.properties
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
Sucessfully Trained
[hadoop@ip-172-31-15-95 ~]$
```

Now we have to build our doker image using command

sudo docker build . -f DockerfileLocal.dat -t jalajsharma93/cloudcomputingpa2

this will create our image with name *cloudcomputingpa2*

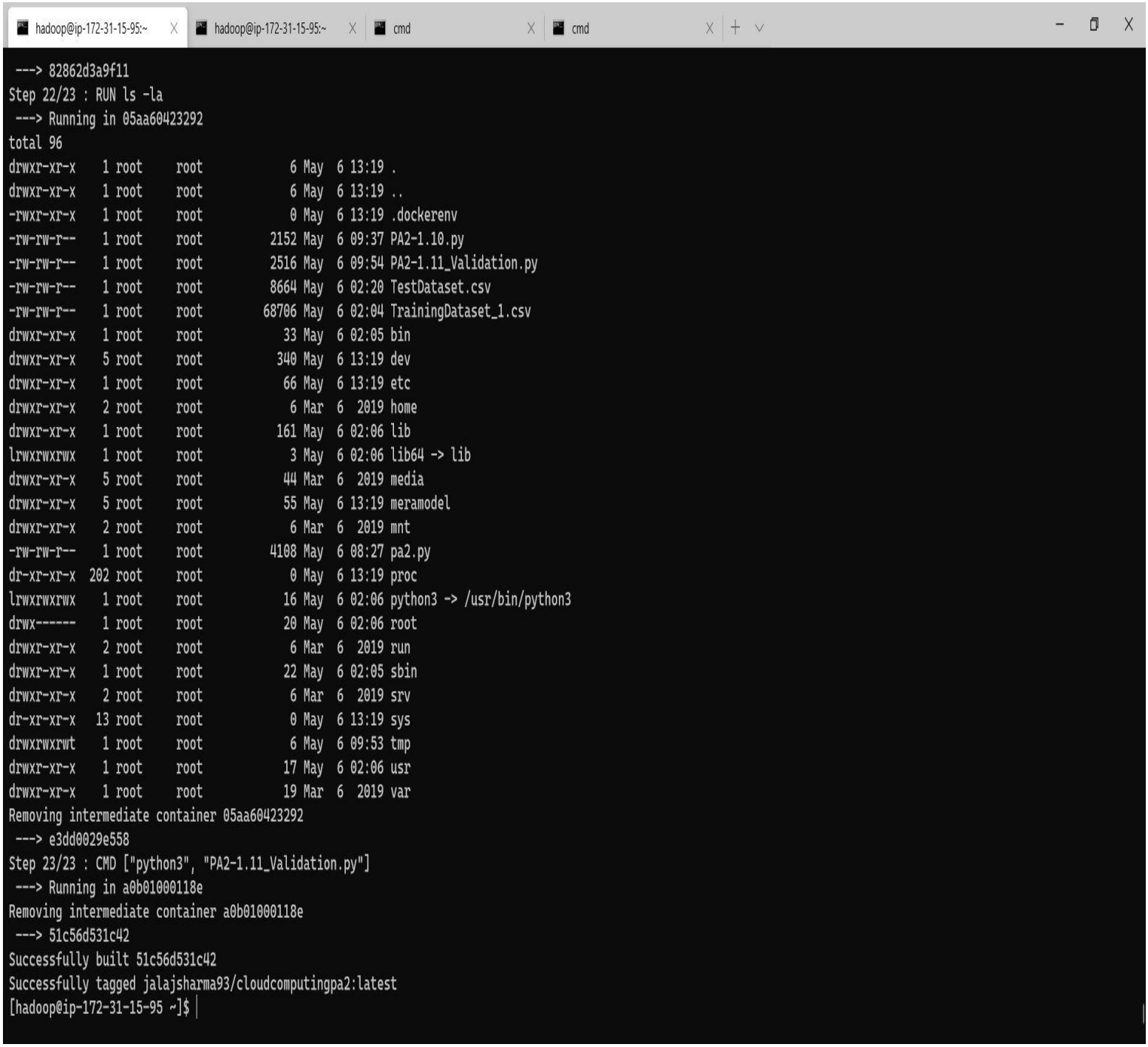
jalajsharma93 is the username for docker. So if you have different user name please edit it, in last cloudcomputingpa2 is repository name so you can edit it as you want.

Now we have to run our dockker image.

sudo docker run -t jalajsharma93/cloudcomputingpa2

above command will run it.

This will give output.

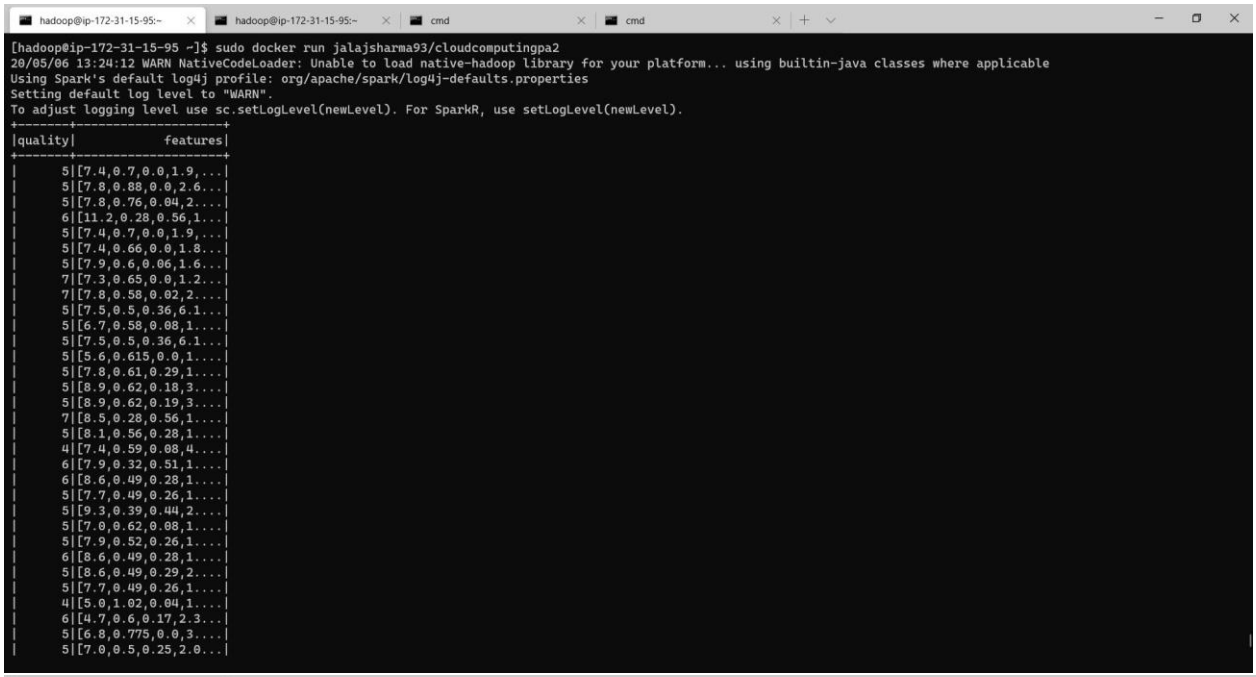


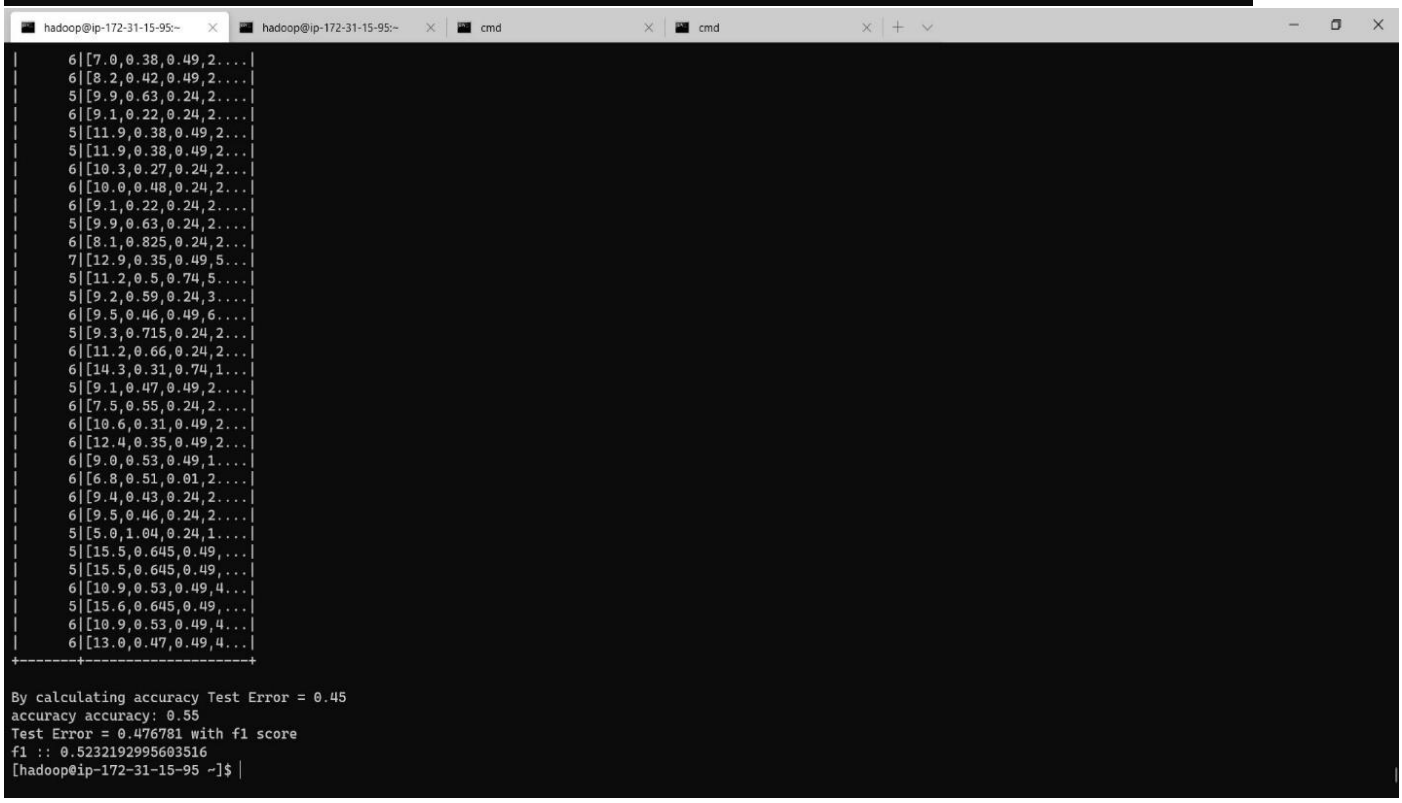
Running Output:

Showing only some commands please run code for full output

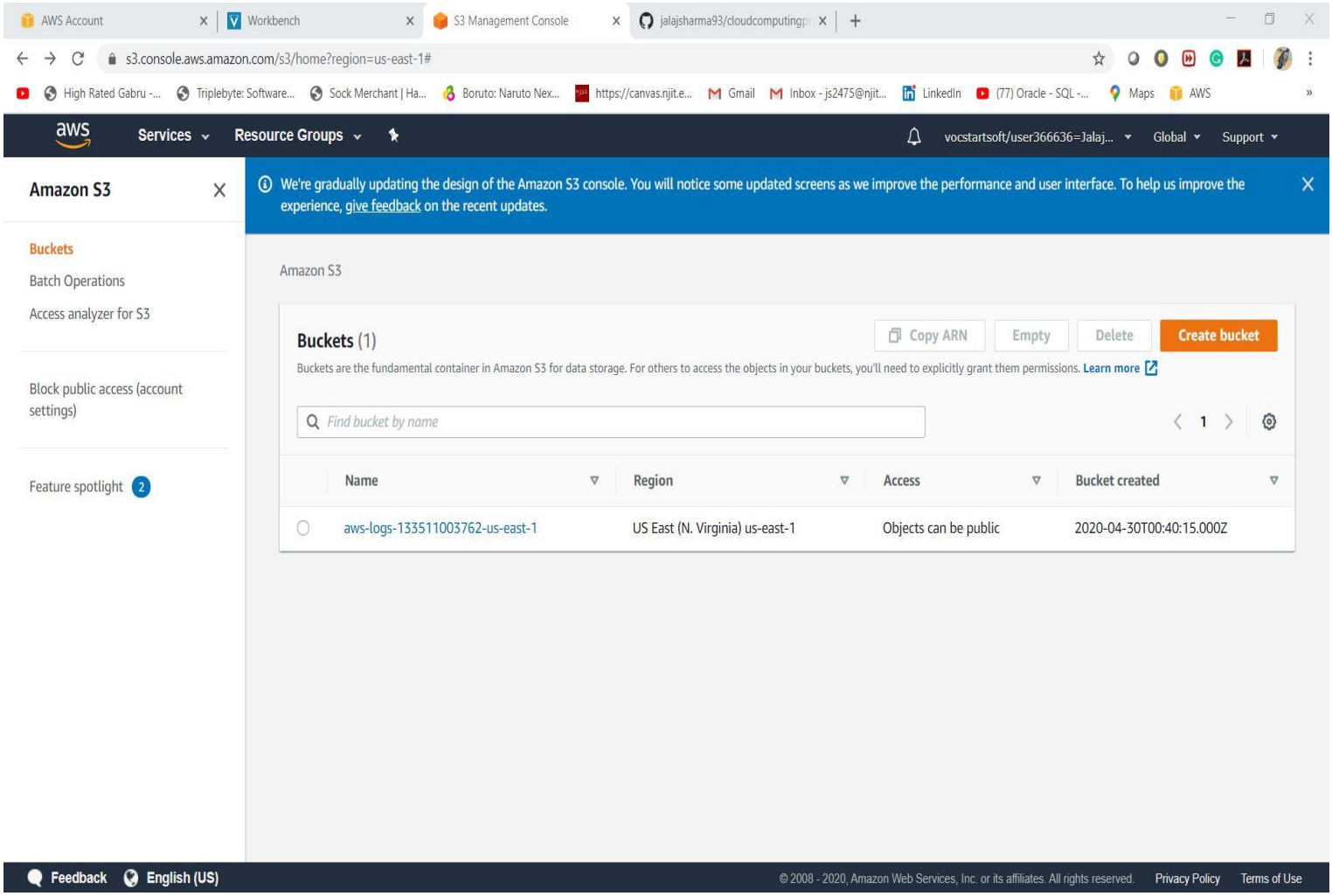
Please comment if you don't need features and quality. And accuracy.

As it mentioned in the code **PA2-1.11_Validation.py**





The final output is ranging between 53 to 65% in term of accuracy percentage or in score .54 to .65 for accuracy and same for f1 score



Logs for training can be found here.

Now we can push our build file to Docker,

Run commad

Sudo docker login -u <username>

//it will ask for password please type it.

And then

Sudo docker push.

It will push file to docker.

Now we are ready to upload everything in git hub.

For that please look for command on git hub docs or git hub have nice user interface please look upload and download it from there.

Commands might help

 # cloudcomputingproject2

We have several steps to follow which includes sub commands also

a)Set up EMR with 3 slave and 1 Master --- Required by professor

b)uploads all the file to EMR

c)Install python, pyspark, docker with all dependencies required to run pyspark

d)Create dokerFile, start docker, build, run and push to dockehub

Setting up EMR cluster

please check document with extention.pdf or word dockehub

#copy file to cluster

Scp -i A.key * hadopp@<address from ec2 instance connect> :/home/hadoop/

Scp -i <key.pem with path> <directory or file with path> hadopp@<address from ec2 instance connect> :/home/Hadoop/

#Connect to EMR cluster

ssh -i A.key hadoop@<address from ec2 instance>

Installing python

sudo pip install --upgrade pip

sudo apt install python3-pip

#installing pyspark, docker and dependencies

sudo pip install --upgrade pip

sudo pip install wheel

sudo pip install pyspark --no-cache-dir

sudo pip install findspark

sudo pip install numpy

sudo yum install -y docker

sudo service docker start

sudo docker build . -f Dockerfile -t jalajsharma93/cloudcomputingpa2

sudo docker run -t cloudcomputingpa2

##for Pushing file to docker

sudo docker login -u <user_name>

<type password it will ask for it>

sudo docker push

For more please check docker file it will give you brief idea what to install because it has them all in one place

References.

1) https://medium.com/@dhiraj.p.rai/logistic-regression-in-spark-ml-8a95b5f5434c
2) https://medium.com/@dhiraj.p.rai/logistic-regression-in-spark-ml-8a95b5f5434c
3) https://spark.apache.org/docs/latest/mllib-dimensionality-reduction
4) https://datascience.stackexchange.com/questions/9424/spark-mllib-multiclass-logistic-regression-how-to-get-the-probabilities-of-all/11444
5) https://towardsdatascience.com/predict-customer-churn-using-pyspark-machine-learning-519e866449b5
6) https://spark.apache.org/docs/latest/ml-classification-regression.html#random-forest-classifier
7) https://spark.apache.org/docs/2.2.0/mllib-evaluation-metrics.html
8) https://stackoverflow.com/questions/43835504/error-attributeerror-py4jerror-object-has-no-attribute-message-building-de
9) https://mapr.com/blog/churn-prediction-pyspark-using-mllib-and-ml-packages/
10) https://runawayhorse001.github.io/LearningApacheSpark/pyspark.pdf
11) https://stackoverflow.com/questions/30063907/using-docker-compose-how-to-execute-multiple-commands
12) https://mlinproduction.com/docker-for-ml-part-4/
13) https://medium.com/@thiagolcmelo/submitting-a-python-job-to-apache-spark-on-docker-b2bd19593a06
14) https://docs.docker.com/engine/reference/commandline/run/