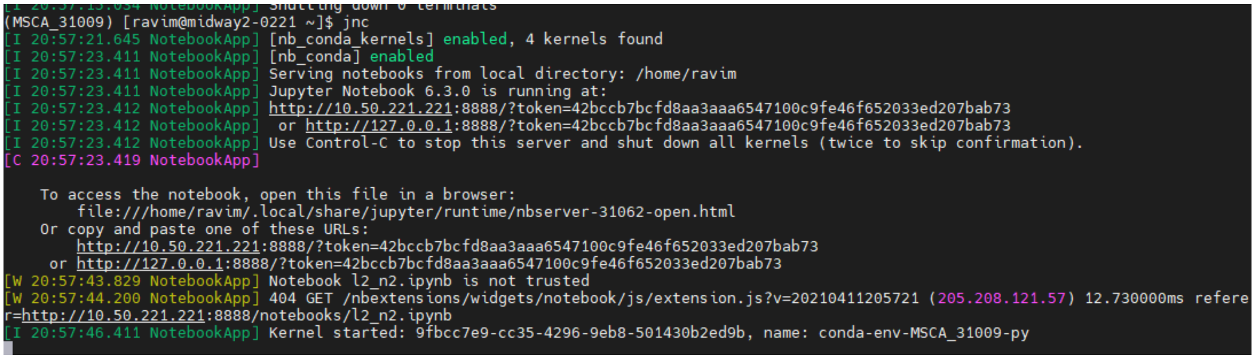
I met with prof. Igor Sunday and Thursday for some help.

Running Midway

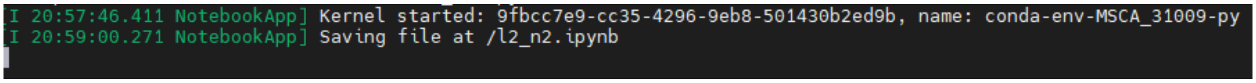
This is my mobax terminal showing my notebook started using jnc



```
[I 20:57:15.034 NotebookApp] Shutting down 0 terminals
(MSCA_31009) [ravim@midway2-0221 ~]$ jnc
[I 20:57:21.645 NotebookApp] [nb_conda_kernels] enabled, 4 kernels found
[I 20:57:23.411 NotebookApp] [nb_conda] enabled
[I 20:57:23.411 NotebookApp] Serving notebooks from local directory: /home/ravim
[I 20:57:23.411 NotebookApp] Jupyter Notebook 6.3.0 is running at:
[I 20:57:23.412 NotebookApp] http://10.50.221.221:8888/?token=42bccb7bcfd8aa3aaa6547100c9fe46f652033ed207bab73
[I 20:57:23.412 NotebookApp]  or http://127.0.0.1:8888/?token=42bccb7bcfd8aa3aaa6547100c9fe46f652033ed207bab73
[I 20:57:23.412 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 20:57:23.419 NotebookApp]

    To access the notebook, open this file in a browser:
        file:///home/ravim/.local/share/jupyter/runtime/nbserver-31062-open.html
    Or copy and paste one of these URLs:
        http://10.50.221.221:8888/?token=42bccb7bcfd8aa3aaa6547100c9fe46f652033ed207bab73
     or http://127.0.0.1:8888/?token=42bccb7bcfd8aa3aaa6547100c9fe46f652033ed207bab73
[W 20:57:43.829 NotebookApp] Notebook l2_n2.ipynb is not trusted
[W 20:57:44.200 NotebookApp] 404 GET /nbextensions/widgets/notebook/js/extension.js?v=20210411205721 (205.208.121.57) 12.730000ms refere
r=http://10.50.221.221:8888/notebooks/l2_n2.ipynb
[I 20:57:46.411 NotebookApp] Kernel started: 9fbcc7e9-cc35-4296-9eb8-501430b2ed9b, name: conda-env-MSCA_31009-py
```

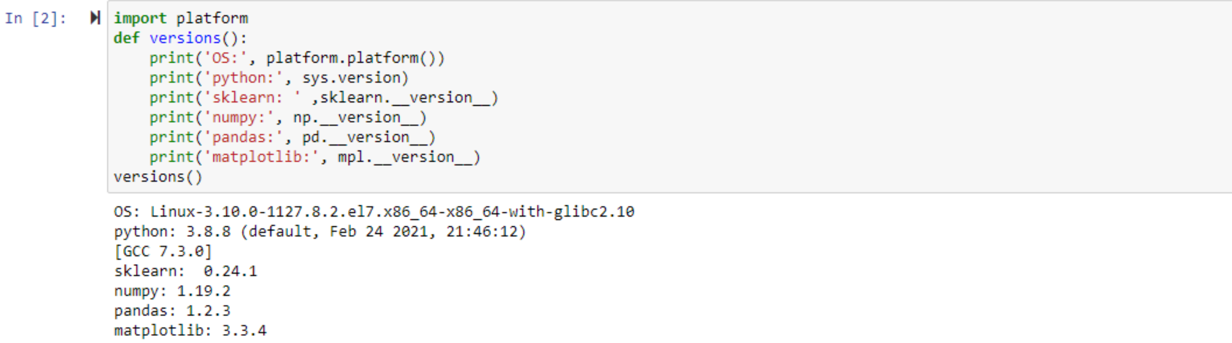
I ran everything in the compute node and just used the login node for downloading the iris dataset

Saving the notebook after running



```
[I 20:57:46.411 NotebookApp] Kernel started: 9fbcc7e9-cc35-4296-9eb8-501430b2ed9b, name: conda-env-MSCA_31009-py
[I 20:59:00.271 NotebookApp] Saving file at /l2_n2.ipynb
```

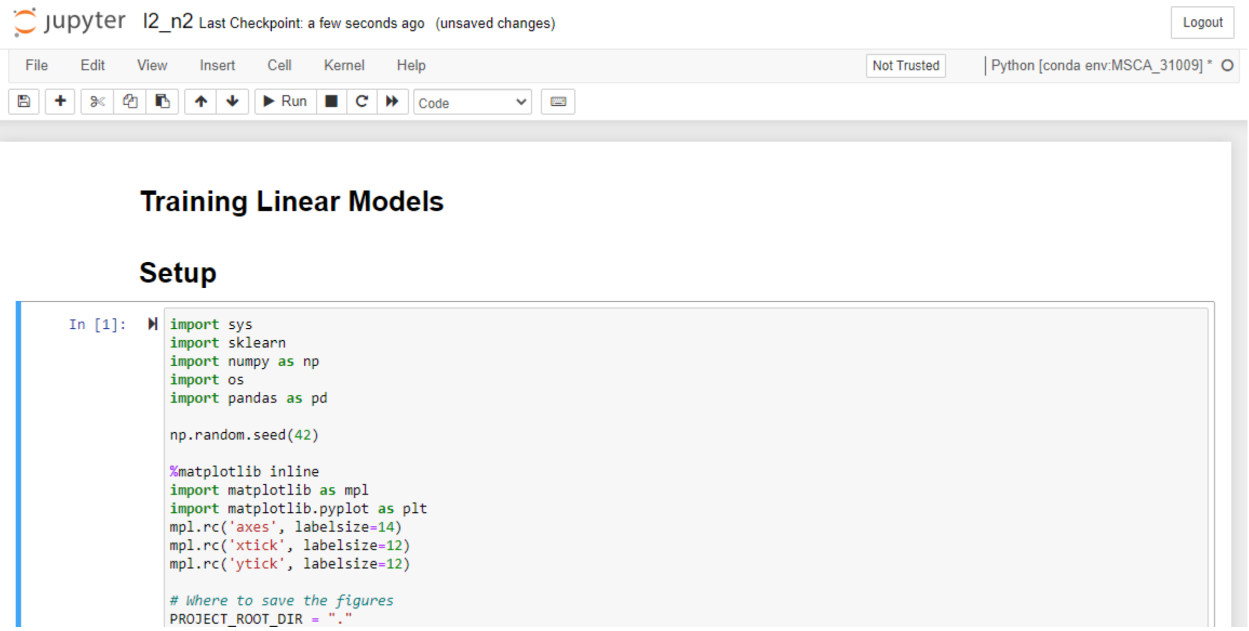
Here is a screenshot of the notebook running in Linux OS and info about the path



```
In [2]:
import platform
def versions():
    print('OS:', platform.platform())
    print('python:', sys.version)
    print('sklearn: ' ,sklearn.__version__)
    print('numpy:', np.__version__)
    print('pandas:', pd.__version__)
    print('matplotlib:', mpl.__version__)
versions()
```

```
OS: Linux-3.10.0-1127.8.2.el7.x86_64-x86_64-with-glibc2.10
python: 3.8.8 (default, Feb 24 2021, 21:46:12)
[GCC 7.3.0]
sklearn:  0.24.1
numpy: 1.19.2
pandas: 1.2.3
matplotlib: 3.3.4
```

I have attached some screenshots showing the run of the notebook

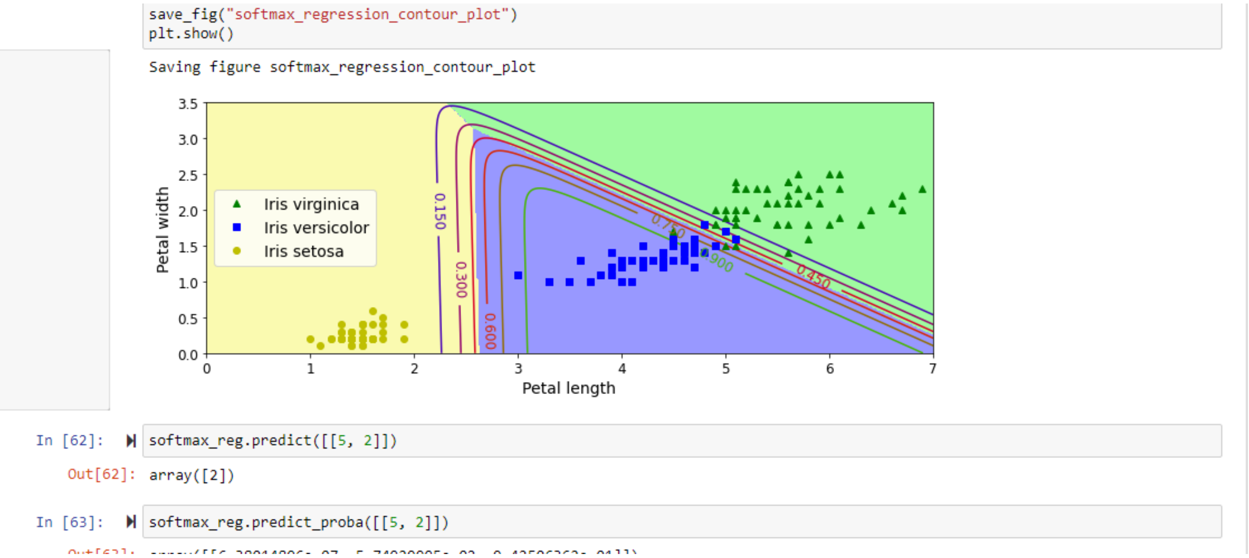

jupyter
l2_n2 Last Checkpoint: a few seconds ago (unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Help
Not Trusted
Python [conda env:MSCA_31009] *
Run
Code

## Training Linear Models

## Setup

In [1]:

```
import sys
import sklearn
import numpy as np
import os
import pandas as pd

np.random.seed(42)

%matplotlib inline
import matplotlib as mpl
import matplotlib.pyplot as plt
mpl.rc('axes', labelsize=14)
mpl.rc('xtick', labelsize=12)
mpl.rc('ytick', labelsize=12)

# Where to save the figures
PROJECT_ROOT_DIR = "."
```



```
save_fig("softmax_regression_contour_plot")
plt.show()
```

```
Saving figure softmax_regression_contour_plot
```

In [62]:

```
softmax_reg.predict([[5, 2]])
```

Out[62]:

```
array([2])
```

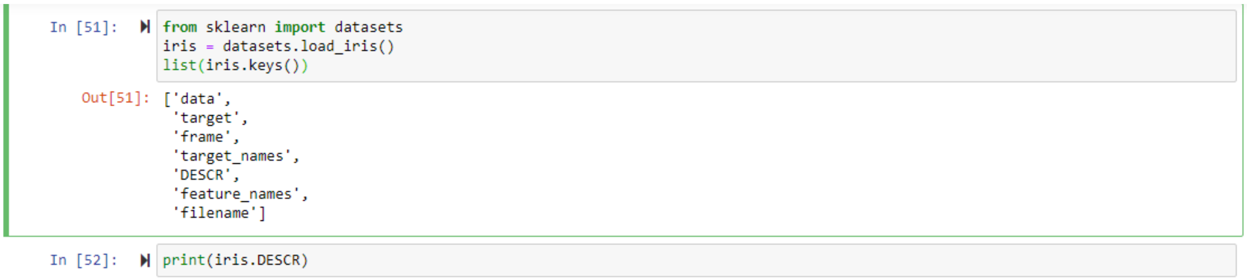
In [63]:

```
softmax_reg.predict_proba([[5, 2]])
```

Out[63]:

```
array([[6.38014896e-07, 5.74929995e-02, 9.42506362e-01]])
```

Iris data set run in login mode



In [51]:

```
from sklearn import datasets
iris = datasets.load_iris()
list(iris.keys())
```

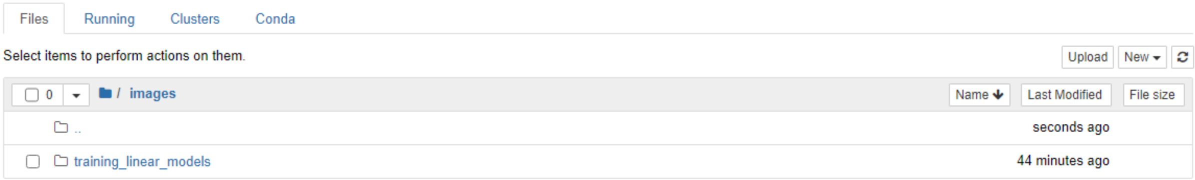
Out[51]:

```
['data',
 'target',
 'frame',
 'target_names',
 'DESCR',
 'feature_names',
 'filename']
```

In [52]:

```
print(iris.DESCR)
```

Here is the saved images directory



Select items to perform actions on them.

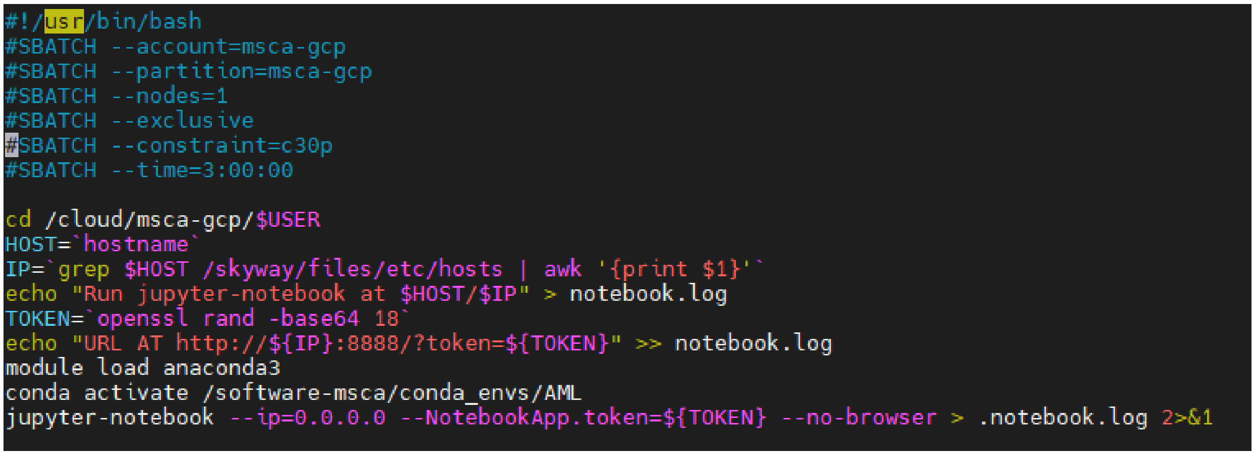
/ images

.. seconds ago

training_linear_models 44 minutes ago

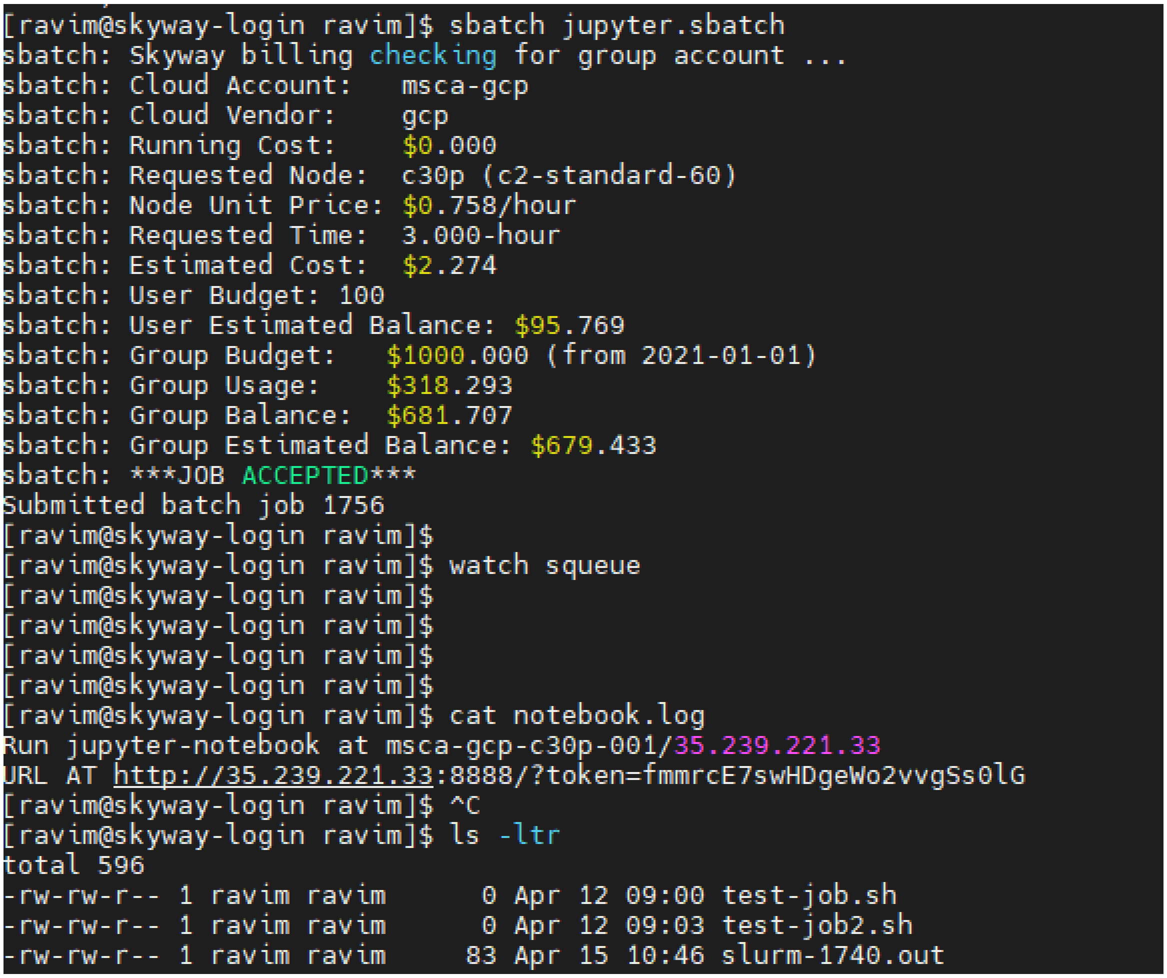
Running Skyway with Jupyter

Here is a screenshot of my batch file



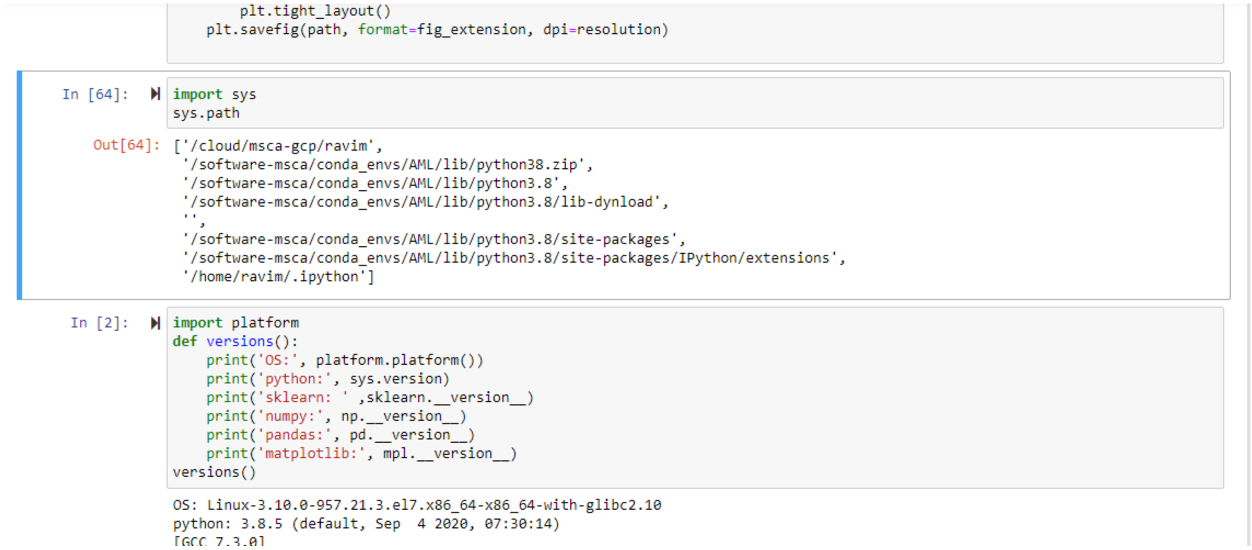
```
#!/usr/bin/bash
#SBATCH --account=msca-gcp
#SBATCH --partition=msca-gcp
#SBATCH --nodes=1
#SBATCH --exclusive
#SBATCH --constraint=c30p
#SBATCH --time=3:00:00

cd /cloud/msca-gcp/$USER
HOST=`hostname`
IP=`grep $HOST /skyway/files/etc/hosts | awk '{print $1}'`
echo "Run jupyter-notebook at $HOST/$IP" > notebook.log
TOKEN=`openssl rand -base64 18`
echo "URL AT http://${IP}:8888/?token=${TOKEN}" >> notebook.log
module load anaconda3
conda activate /software-msca/conda_envs/AML
jupyter-notebook --ip=0.0.0.0 --NotebookApp.token=${TOKEN} --no-browser > .notebook.log 2>&1
```

Batch submission



```
[ravim@skyway-login ravim]$ sbatch jupyter.sbatch
sbatch: Skyway billing checking for group account ...
sbatch: Cloud Account:   msca-gcp
sbatch: Cloud Vendor:    gcp
sbatch: Running Cost:    $0.000
sbatch: Requested Node:  c30p (c2-standard-60)
sbatch: Node Unit Price: $0.758/hour
sbatch: Requested Time:  3.000-hour
sbatch: Estimated Cost:  $2.274
sbatch: User Budget: 100
sbatch: User Estimated Balance: $95.769
sbatch: Group Budget:   $1000.000 (from 2021-01-01)
sbatch: Group Usage:    $318.293
sbatch: Group Balance:  $681.707
sbatch: Group Estimated Balance: $679.433
sbatch: ***JOB ACCEPTED***
Submitted batch job 1756
[ravim@skyway-login ravim]$
[ravim@skyway-login ravim]$ watch squeue
[ravim@skyway-login ravim]$
[ravim@skyway-login ravim]$
[ravim@skyway-login ravim]$
[ravim@skyway-login ravim]$
[ravim@skyway-login ravim]$ cat notebook.log
Run jupyter-notebook at msca-gcp-c30p-001/35.239.221.33
URL AT http://35.239.221.33:8888/?token=fmmrcE7swHDgeWo2vvgSs0lG
[ravim@skyway-login ravim]$ ^C
[ravim@skyway-login ravim]$ ls -ltr
total 596
-rw-rw-r-- 1 ravim ravim      0 Apr 12 09:00 test-job.sh
-rw-rw-r-- 1 ravim ravim      0 Apr 12 09:03 test-job2.sh
-rw-rw-r-- 1 ravim ravim     83 Apr 15 10:46 slurm-1740.out
```

Here is a screenshot of my jupyter notebook



```
        plt.tight_layout()
    plt.savefig(path, format=fig_extension, dpi=resolution)
```

In [64]:

```
import sys
sys.path
```

Out[64]:

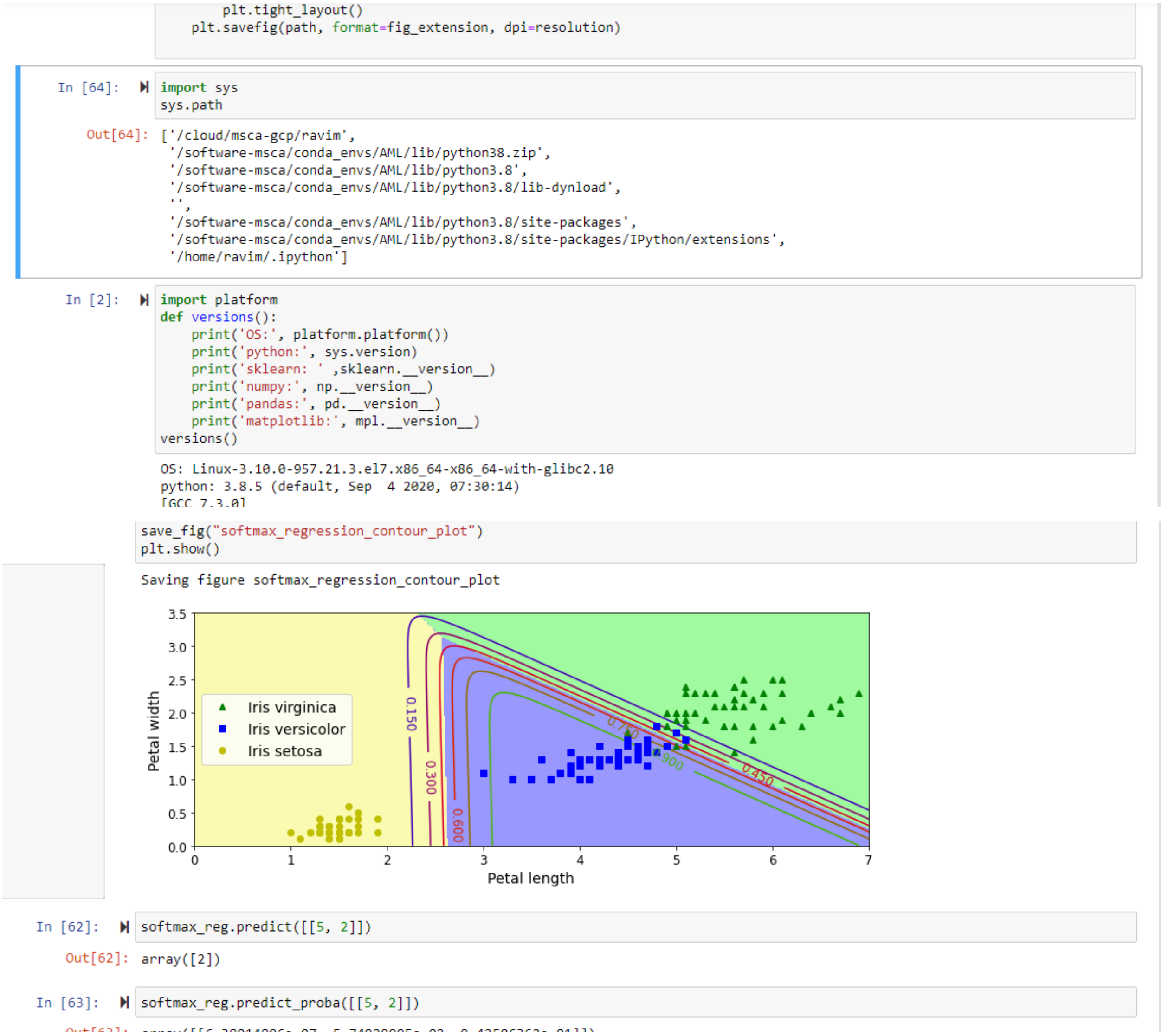
```
['/cloud/msca-gcp/ravim',
 '/software-msca/conda_envs/AML/lib/python38.zip',
 '/software-msca/conda_envs/AML/lib/python3.8',
 '/software-msca/conda_envs/AML/lib/python3.8/lib-dynload',
 '',
 '/software-msca/conda_envs/AML/lib/python3.8/site-packages',
 '/software-msca/conda_envs/AML/lib/python3.8/site-packages/IPython/extensions',
 '/home/ravim/.ipython']
```

In [2]:

```
import platform
def versions():
    print('OS:', platform.platform())
    print('python:', sys.version)
    print('sklearn: ' ,sklearn.__version__)
    print('numpy:', np.__version__)
    print('pandas:', pd.__version__)
    print('matplotlib:', mpl.__version__)
versions()
```

```
OS: Linux-3.10.0-957.21.3.el7.x86_64-x86_64-with-glibc2.10
python: 3.8.5 (default, Sep  4 2020, 07:30:14)
[GCC 7.3.0]
```

Here is a screen shot of the AML kernel running



```
        plt.tight_layout()
    plt.savefig(path, format=fig_extension, dpi=resolution)
```

```
In [64]:  import sys
          sys.path

Out[64]: ['/cloud/msca-gcp/ravim',
          '/software-msca/conda_envs/AML/lib/python38.zip',
          '/software-msca/conda_envs/AML/lib/python3.8',
          '/software-msca/conda_envs/AML/lib/python3.8/lib-dynload',
          '',
          '/software-msca/conda_envs/AML/lib/python3.8/site-packages',
          '/software-msca/conda_envs/AML/lib/python3.8/site-packages/IPython/extensions',
          '/home/ravim/.ipython']
```

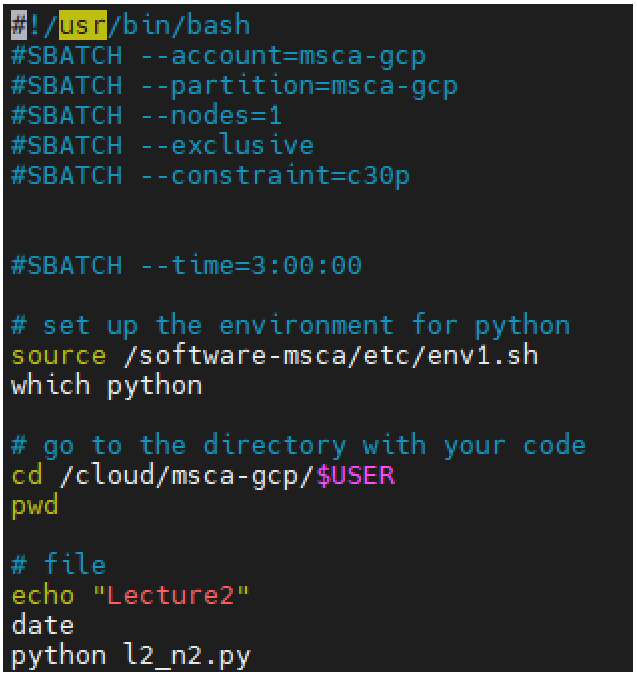
```
In [2]:  import platform
         def versions():
             print('OS:', platform.platform())
             print('python:', sys.version)
             print('sklearn: ' ,sklearn.__version__)
             print('numpy:', np.__version__)
             print('pandas:', pd.__version__)
             print('matplotlib:', mpl.__version__)
         versions()

         OS: Linux-3.10.0-957.21.3.el7.x86_64-x86_64-with-glibc2.10
         python: 3.8.5 (default, Sep  4 2020, 07:30:14)
         [GCC 7.3.0]
```

```
save_fig("softmax_regression_contour_plot")
plt.show()

Saving figure softmax_regression_contour_plot
```

```
In [62]:  softmax_reg.predict([[5, 2]])

Out[62]: array([2])

In [63]:  softmax_reg.predict_proba([[5, 2]])

Out[63]: array([[6.38014896e-07, 5.74929995e-02, 9.42506362e-01]])
```

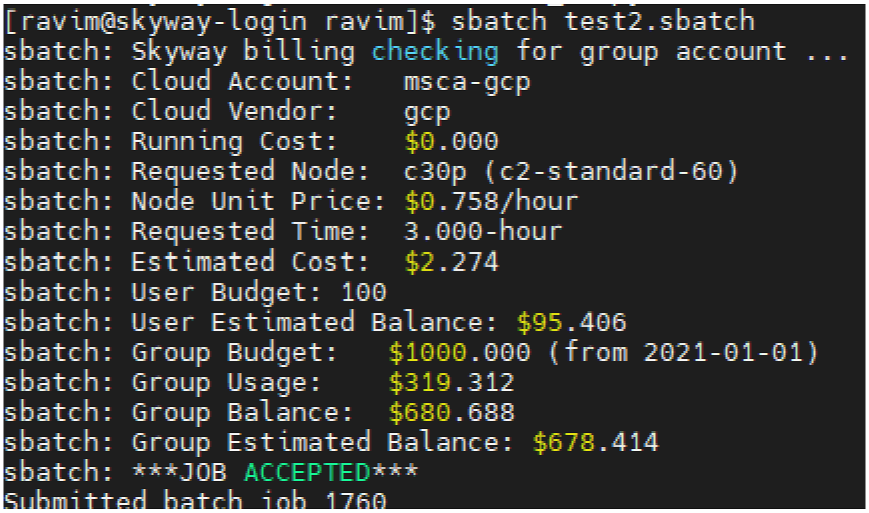
Running Skyway python file

My batch file



```
#!/usr/bin/bash
#SBATCH --account=msca-gcp
#SBATCH --partition=msca-gcp
#SBATCH --nodes=1
#SBATCH --exclusive
#SBATCH --constraint=c30p


#SBATCH --time=3:00:00

# set up the environment for python
source /software-msca/etc/env1.sh
which python

# go to the directory with your code
cd /cloud/msca-gcp/$USER
pwd

# file
echo "Lecture2"
date
python l2_n2.py
```

Batch submission

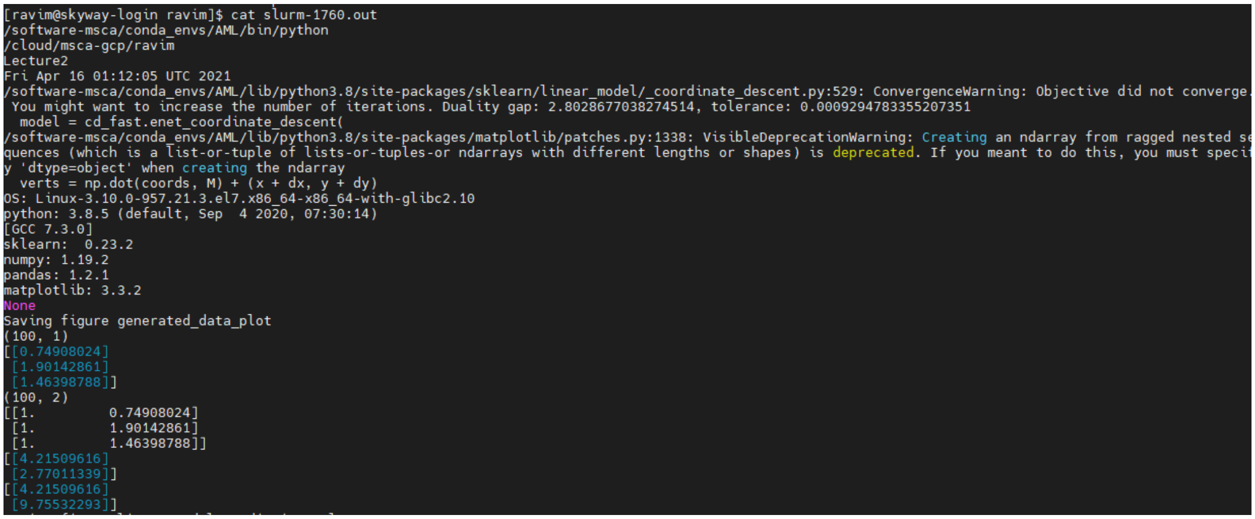


```
[ravim@skyway-login ravim]$ sbatch test2.sbatch
sbatch: Skyway billing checking for group account ...
sbatch: Cloud Account:   msca-gcp
sbatch: Cloud Vendor:    gcp
sbatch: Running Cost:    $0.000
sbatch: Requested Node:  c30p (c2-standard-60)
sbatch: Node Unit Price: $0.758/hour
sbatch: Requested Time:  3.000-hour
sbatch: Estimated Cost:  $2.274
sbatch: User Budget: 100
sbatch: User Estimated Balance: $95.406
sbatch: Group Budget:    $1000.000 (from 2021-01-01)
sbatch: Group Usage:     $319.312
sbatch: Group Balance:   $680.688
sbatch: Group Estimated Balance: $678.414
sbatch: ***JOB ACCEPTED***
Submitted batch job 1760
```

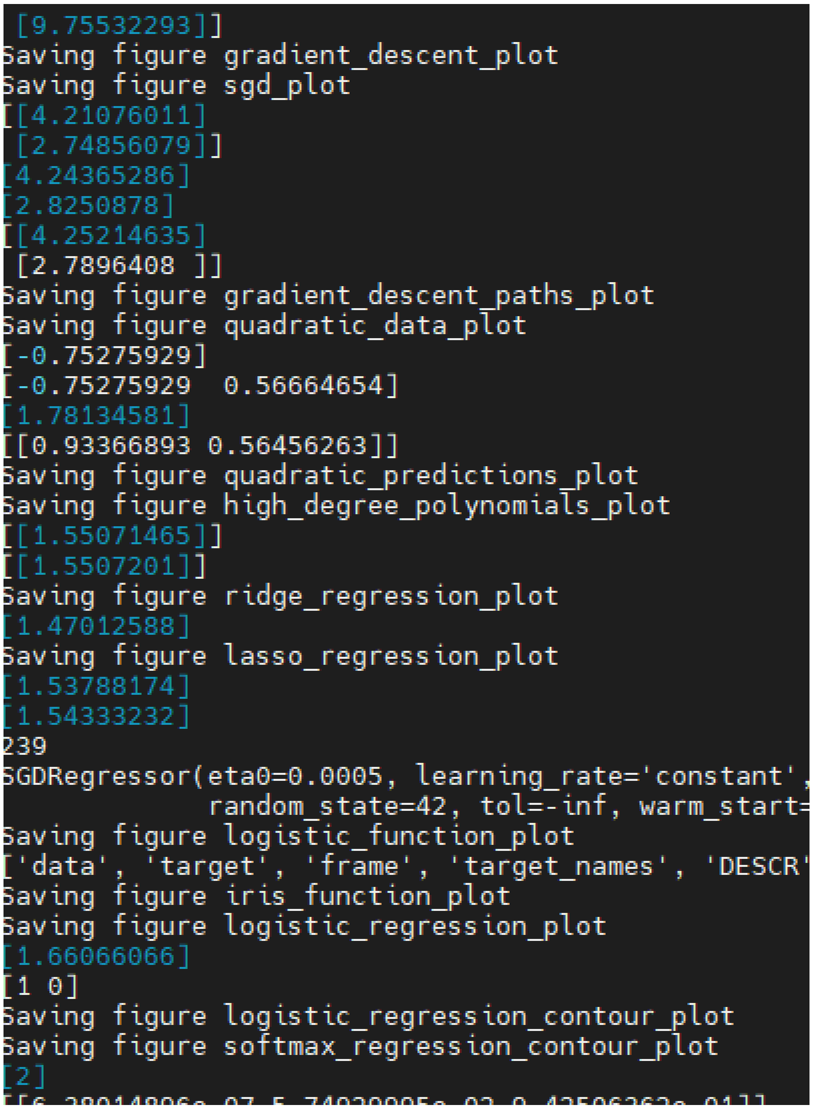
Running the python file:

- Removed matlab line and used:
    - import matplotlib as mpl
    - mpl.use('Agg')
- Removed the plt.show lines and saved the figures
- Added print statement instead of just outputting as you would on jupyter notebook

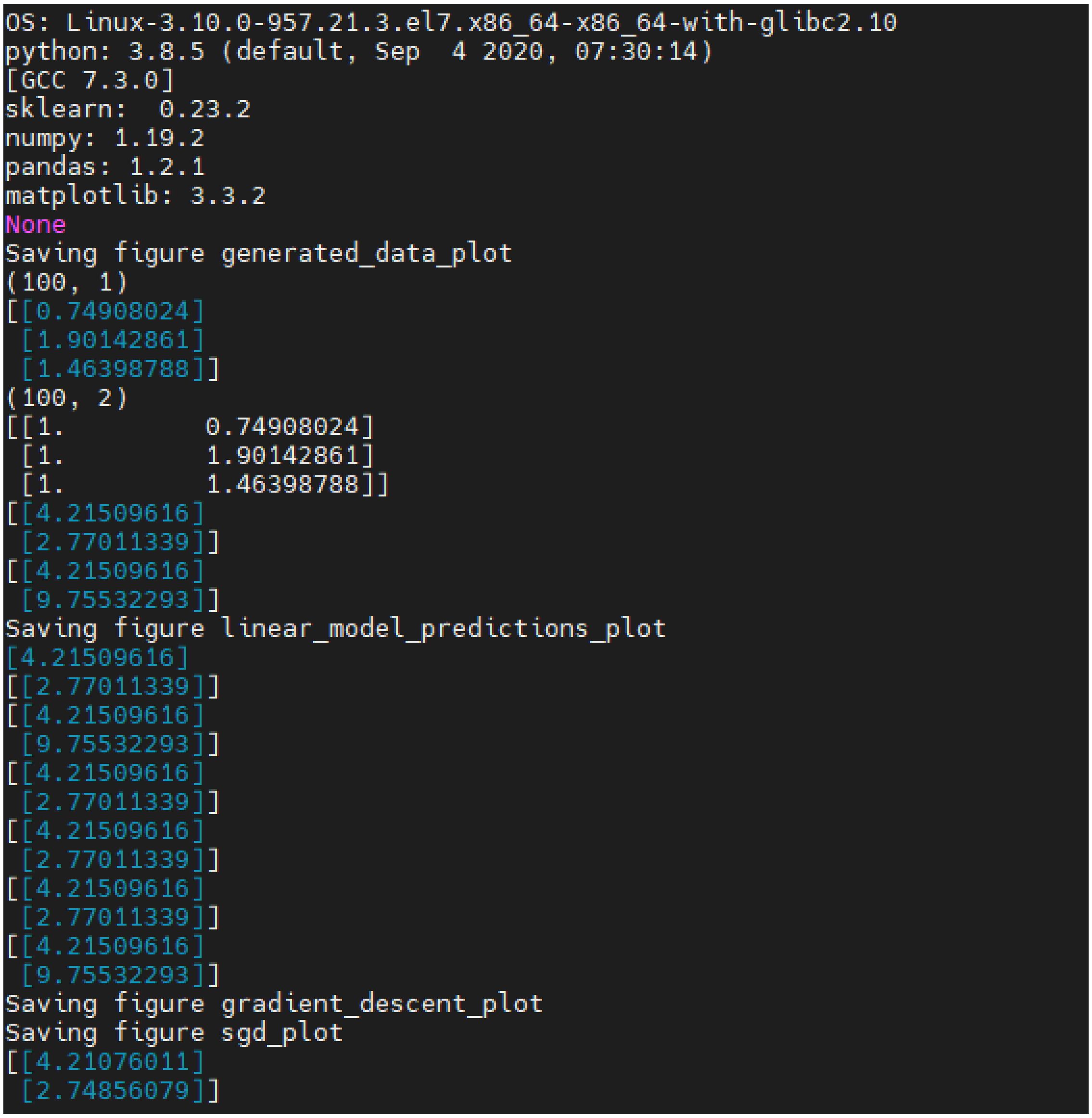
Here is a screenshot of my output: the results can be found in **slurm-1760.out**



```
[ravim@skyway-login ravim]$ cat slurm-1760.out
/software-msca/conda_envs/AML/bin/python
/cloud/msca-gcp/ravim
Lecture2
Fri Apr 16 01:12:05 UTC 2021
/software-msca/conda_envs/AML/lib/python3.8/site-packages/sklearn/linear_model/_coordinate_descent.py:529: ConvergenceWarning: Objective did not converge.
 You might want to increase the number of iterations. Duality gap: 2.8028677038274514, tolerance: 0.0009294783355207351
  model = cd_fast.enet_coordinate_descent(
/software-msca/conda_envs/AML/lib/python3.8/site-packages/matplotlib/patches.py:1338: VisibleDeprecationWarning: Creating an ndarray from ragged nested se
quences (which is a list-or-tuple of lists-or-tuples-or ndarrays with different lengths or shapes) is deprecated. If you meant to do this, you must speci
y 'dtype=object' when creating the ndarray
  verts = np.dot(coords, M) + (x + dx, y + dy)
OS: Linux-3.10.0-957.21.3.el7.x86_64-x86_64-with-glibc2.10
python: 3.8.5 (default, Sep  4 2020, 07:30:14)
[GCC 7.3.0]
sklearn:  0.23.2
numpy: 1.19.2
pandas: 1.2.1
matplotlib: 3.3.2
None
Saving figure generated_data_plot
(100, 1)
[[0.74908024]
 [1.90142861]
 [1.46398788]]
(100, 2)
[[1.         0.74908024]
 [1.         1.90142861]
 [1.         1.46398788]]
[[4.21509616]
 [2.77011339]]
[[4.21509616]
 [9.75532293]]
```

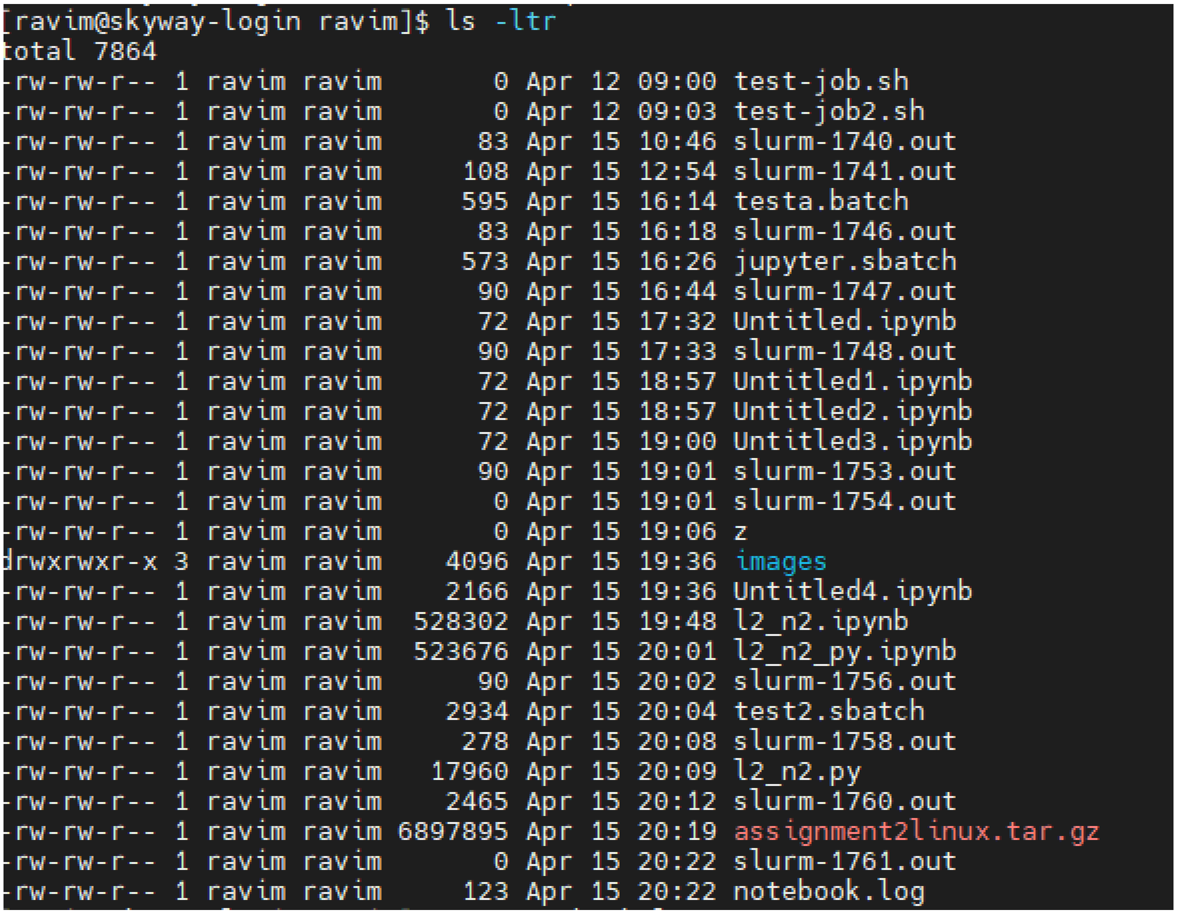


```
 [9.75532293]]
Saving figure gradient_descent_plot
Saving figure sgd_plot
[[4.21076011]
 [2.74856079]]
[4.24365286]
[2.8250878]
[[4.25214635]
 [2.7896408 ]]
Saving figure gradient_descent_paths_plot
Saving figure quadratic_data_plot
[-0.75275929]
[-0.75275929  0.56664654]
[1.78134581]
[[0.93366893 0.56456263]]
Saving figure quadratic_predictions_plot
Saving figure high_degree_polynomials_plot
[[1.55071465]]
[[1.5507201]]
Saving figure ridge_regression_plot
[1.47012588]
Saving figure lasso_regression_plot
[1.53788174]
[1.54333232]
239
SGDRegressor(eta0=0.0005, learning_rate='constant',
             random_state=42, tol=-inf, warm_start=
Saving figure logistic_function_plot
['data', 'target', 'frame', 'target_names', 'DESCR'
Saving figure iris_function_plot
Saving figure logistic_regression_plot
[1.66066066]
[1 0]
Saving figure logistic_regression_contour_plot
Saving figure softmax_regression_contour_plot
[2]
[[6.38014896e-07 5.74929995e-02 9.42506362e-01]]
```



```
OS: Linux-3.10.0-957.21.3.el7.x86_64-x86_64-with-glibc2.10
python: 3.8.5 (default, Sep  4 2020, 07:30:14)
[GCC 7.3.0]
sklearn:  0.23.2
numpy: 1.19.2
pandas: 1.2.1
matplotlib: 3.3.2
None
Saving figure generated_data_plot
(100, 1)
[[0.74908024]
 [1.90142861]
 [1.46398788]]
(100, 2)
[[1.         0.74908024]
 [1.         1.90142861]
 [1.         1.46398788]]
[[4.21509616]
 [2.77011339]]
[[4.21509616]
 [9.75532293]]
Saving figure linear_model_predictions_plot
[4.21509616]
[[2.77011339]]
[[4.21509616]
 [9.75532293]]
[[4.21509616]
 [2.77011339]]
[[4.21509616]
 [2.77011339]]
[[4.21509616]
 [2.77011339]]
[[4.21509616]
 [9.75532293]]
Saving figure gradient_descent_plot
Saving figure sgd_plot
[[4.21076011]
 [2.74856079]]
```

Now I save it as tar file and you can see below my files in the cloud and the tar zip file is in red color



```
[ravim@skyway-login ravim]$ ls -ltr
total 7864
-rw-rw-r-- 1 ravim ravim       0 Apr 12 09:00 test-job.sh
-rw-rw-r-- 1 ravim ravim       0 Apr 12 09:03 test-job2.sh
-rw-rw-r-- 1 ravim ravim      83 Apr 15 10:46 slurm-1740.out
-rw-rw-r-- 1 ravim ravim     108 Apr 15 12:54 slurm-1741.out
-rw-rw-r-- 1 ravim ravim     595 Apr 15 16:14 testa.batch
-rw-rw-r-- 1 ravim ravim      83 Apr 15 16:18 slurm-1746.out
-rw-rw-r-- 1 ravim ravim     573 Apr 15 16:26 jupyter.sbatch
-rw-rw-r-- 1 ravim ravim      90 Apr 15 16:44 slurm-1747.out
-rw-rw-r-- 1 ravim ravim      72 Apr 15 17:32 Untitled.ipynb
-rw-rw-r-- 1 ravim ravim      90 Apr 15 17:33 slurm-1748.out
-rw-rw-r-- 1 ravim ravim      72 Apr 15 18:57 Untitled1.ipynb
-rw-rw-r-- 1 ravim ravim      72 Apr 15 18:57 Untitled2.ipynb
-rw-rw-r-- 1 ravim ravim      72 Apr 15 19:00 Untitled3.ipynb
-rw-rw-r-- 1 ravim ravim      90 Apr 15 19:01 slurm-1753.out
-rw-rw-r-- 1 ravim ravim       0 Apr 15 19:01 slurm-1754.out
-rw-rw-r-- 1 ravim ravim       0 Apr 15 19:06 z
drwxrwxr-x 3 ravim ravim    4096 Apr 15 19:36 images
-rw-rw-r-- 1 ravim ravim    2166 Apr 15 19:36 Untitled4.ipynb
-rw-rw-r-- 1 ravim ravim  528302 Apr 15 19:48 l2_n2.ipynb
-rw-rw-r-- 1 ravim ravim  523676 Apr 15 20:01 l2_n2_py.ipynb
-rw-rw-r-- 1 ravim ravim      90 Apr 15 20:02 slurm-1756.out
-rw-rw-r-- 1 ravim ravim    2934 Apr 15 20:04 test2.sbatch
-rw-rw-r-- 1 ravim ravim     278 Apr 15 20:08 slurm-1758.out
-rw-rw-r-- 1 ravim ravim   17960 Apr 15 20:09 l2_n2.py
-rw-rw-r-- 1 ravim ravim    2465 Apr 15 20:12 slurm-1760.out
-rw-rw-r-- 1 ravim ravim 6897895 Apr 15 20:19 assignment2linux.tar.gz
-rw-rw-r-- 1 ravim ravim       0 Apr 15 20:22 slurm-1761.out
-rw-rw-r-- 1 ravim ravim     123 Apr 15 20:22 notebook.log
```

The slurm-1760.out contin the python output
And images are saved in the images directory