

Programming Supplement

Machine Learning – CISC 5800
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Python NumPy

Standard matrix of numbers in Python: list of lists

• `Mat=[[5, 10, 12], [3, -4, 12], [-6, 0, 0]]`

Matrix representation through numpy array:

- `import numpy as np`
- `npMat = np.array(Mat)`
- `# convert Mat to numpy array`

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NP-Array indexing

- Multi-dimensional indexing:


```
Mat=[[4,8,12],[6,3,0],[-2,-7,-12]]
npMat=np.array(Mat)
npMat[1,2] # result: 0 (2nd row, 3rd col)
npMat[2,0] # result: -2 (3rd row, 1st col)
```
- Last row/column can also be designated by index -1


```
npMat[0,-1] # result: 12
```
- Colon indicates counting up by increment


```
npMat[1,0:3] # result: [6, 3, 0]
```

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Vector/matrix functions

- ```
vec1=np.array([9, 3, 5, 7])
matrix2=np.array([[4.5, -3.2], [2.2, 0], [-4.4, -3]])
```
- mean `np.mean(vec1) -> 6`
  - min `np.min(vec1) -> 3`
  - max `np.max(vec1) -> ?`
  - std `np.std(vec1) -> 2.58`
  - length `leng(vec1) -> ?`
  - size `matrix2.shape -> [3, 2];`

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## Data: .mat files

Accessing variable `matVarX` in `file.mat`

```
import scipy.io
varIn = scipy.io.loadmat('file.mat')
matVarX=varIn['matVarX']
```

*Note: Python data typically saved in "Pickle" files  
csv text files are another popular format; so are h5 binaries  
For this class, I will often use "MAT" files  
(generated by MATLAB software)*

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## List of acceptable numpy commands to use

```
pi min mean sqrt reshape
e max sum array T
power where std shape append vstack
tolist dot matmul zeros ones
scipy.io.loadmat
matplotlib.pyplot: hist, show, scatter
```

Any command specifically introduced in your HW

For homework, you may not use any numpy commands outside this list