

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  
For this class, I will often use "MAT" files  
(generated by MATLAB software)*

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## List of acceptable numpy commands to use

|                    |                                                |                   |                      |                |
|--------------------|------------------------------------------------|-------------------|----------------------|----------------|
| <code>pi</code>    | <code>min</code>                               | <code>mean</code> | <code>reshape</code> | <code>T</code> |
| <code>e</code>     | <code>max</code>                               | <code>sum</code>  |                      |                |
| <code>power</code> | <code>where</code>                             | <code>std</code>  |                      |                |
| <code>sqrt</code>  | <code>array</code>                             |                   |                      |                |
| <code>shape</code> | Any command specifically introduced in your HW |                   |                      |                |

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

You also may not use any other libraries! (except `scipy.io.loadmat` and `matplotlib.pyplot`)