

CS 133 - Introduction to Computational and Data Science

Instructor: Renzhi Cao
Computer Science Department
Pacific Lutheran University
Spring 2017



Linear Algebra

- In the previous class, we learned how to visualize data.
- Today we are going to learn linear algebra

Exercise

Read the file data.txt and store its contents in a list

1. First element should go in list l1
2. Second element should go in list l2
3. Create a line plot that includes both lines.
4. Create a bar chart for each list
5. Create a bar chart with the decile
6. Create a scatter plot

Check the website

Linear algebra and statistics

- Reading (Data Science from Scratch):
 - Read chapter 5: Statistics
 - Read chapter 6: Probability

Linear Algebra

- Branch of Mathematics that deals with Vector Spaces.
- Vector Space? What is a Vector?
- Formal: “a quantity having direction as well as magnitude, especially as determining the position of one point in space relative to another.”
- Informal: Point in a finite-dimensional space. They can be added together and multiplied by scalars (numbers)
- Example: A vector in a 3-d space: Age, Height, Weight
- A vector in a 4-d space: Exam1, Exam2, Exam3, Exam4
- They “can” be represented with lists in Python
- List = [70, 70, 170]

Vectors in Python

Not very practical to use lists!

- Cannot perform operations as vectors!

```
import numpy as np
```

```
a = np.array([1,2,3], float)
```

```
b = np.array([5,2,6],float) OR      b = np.array([5,2,6])
```

```
print a +b
```

```
print a * 5
```

Matrices in Python

2-d Vectors

Python does not have 2-d arrays!

We can use vectors to represent them

```
friendship = np.array([[0,0,1],[1,0,1],[1,0,0]])
```

```
friendship2 = np.array([[0,0,1],[1,0,1],[1,0,0]])
```

```
Test =friendship + friendship2
```

Details about Numpy

<http://www.engr.ucsb.edu/~shell/che210d/numpy.pdf>

Also on the course website as a pdf file

Exercises on Numpy

- Explore Numpy document with your partner.
- Read the data.txt and load the first column as list 1, and the second column as list2
- Use Numpy to calculate the mean, min, max of all data for each list. Write function to do that.
- Use Numpy to do a vector add, subtract, and multiply of this two lists.

Extra practices:

<http://codingbat.com/python>