15-494/694: Cognitive Robotics

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Lecture 10: matplotlib

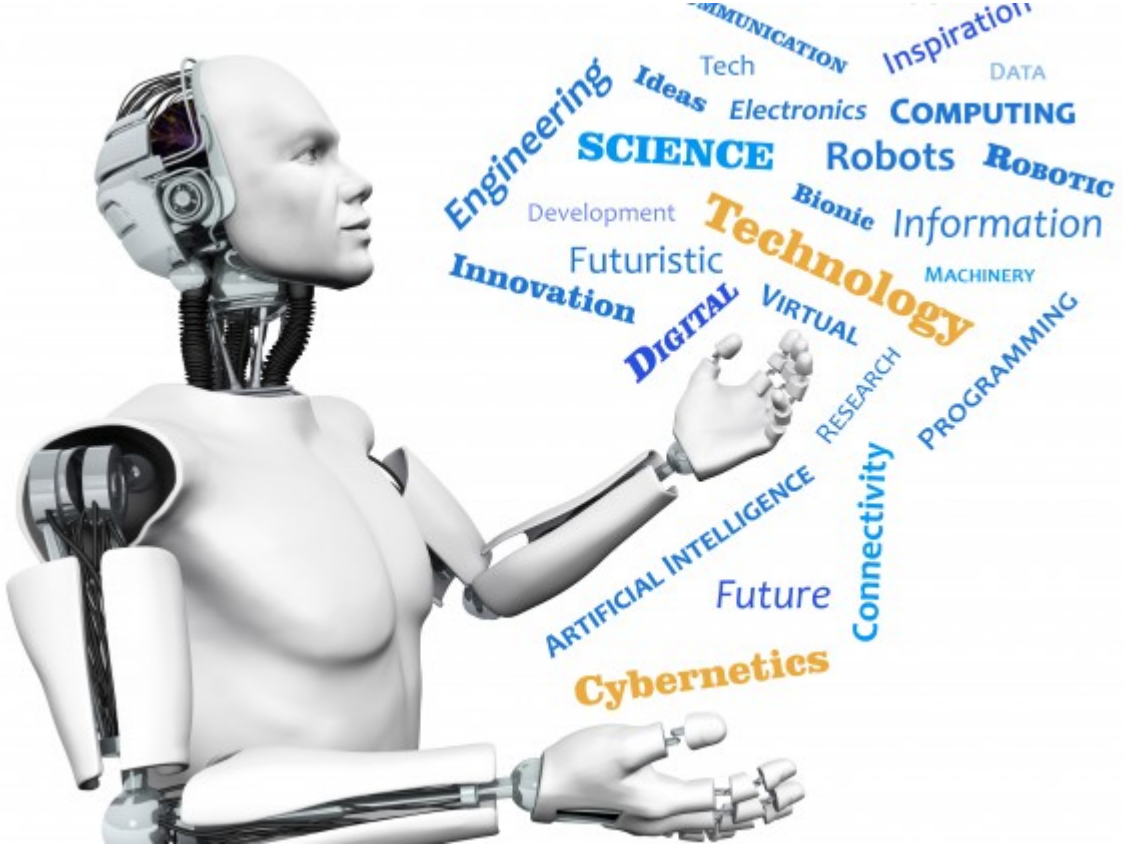


Image from http://www.futuristgerd.com/2015/09/10

Intro to matplotlib

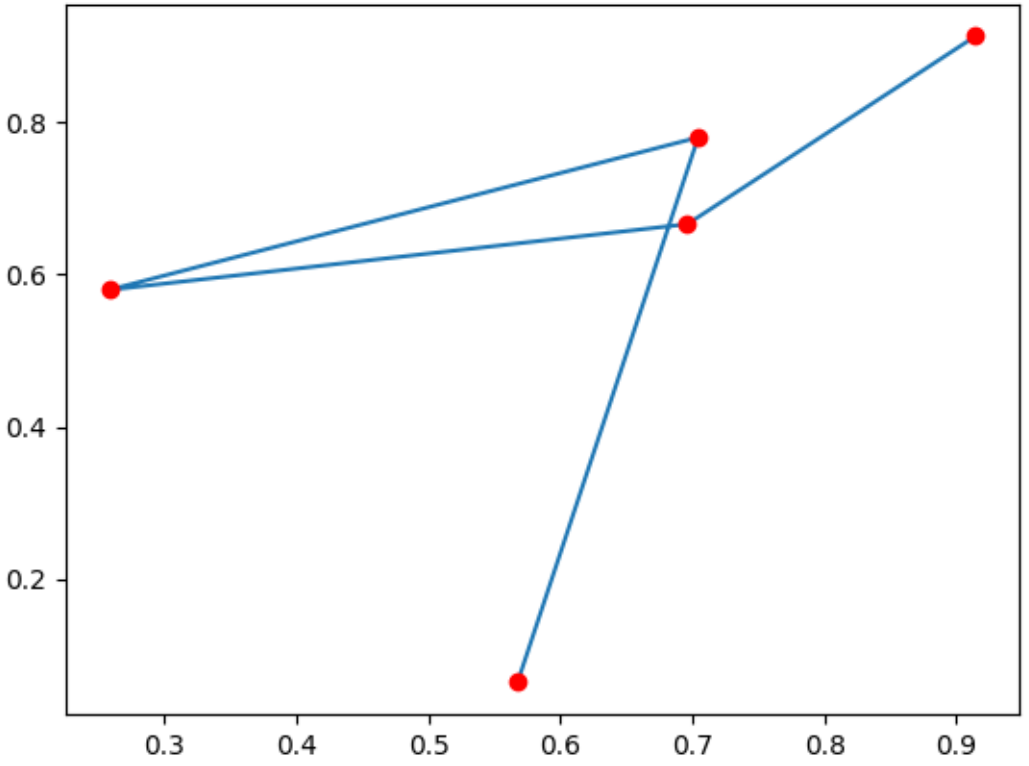
- matplotlib is “MATLAB (subset) in Python”
- Relies on **numpy** for vectors, math
- Relies on **tkinter** for display graphics
- Usage:

```
import matplotlib.pyplot as plt
```

Sample Program

```
import numpy as np

import matplotlib.pyplot as plt

fig = plt.figure()

ax = fig.add_subplot(111)

rand = np.random.random

xvals = rand(5); yvals = rand(5)

ax.plot(xvals, yvals)

ax.plot(xvals, yvals, 'ro',
        linestyle='None')

plt.pause(0.01)
```

Plotting Points



PlotDrive (1)

```
from aim_fsm import *

class PlotDrive(StateMachineProgram):


    class SetupPlot(StateNode):
        def start(self,event=None):
            super().start()
            self.parent.fig = plt.figure()
            self.parent.ax = ax = self.parent.fig.add_subplot(111)
            ax.set_xlim(-5,5)
            ax.set_ylim(23,29)
            ax.plot([-5,5],[25,25],'g--')
            ax.plot([0,0],[23,29],'r--')
            ax.set_xlabel('Drift')
            ax.set_ylabel('Travel Distance')
            self.parent.old_pose = self.robot.pose
```

PlotDrive (2)

```
class AddPoint(StateNode):
    def start(self,event=None):
        super().start()
        fwd = self.robot.pose.x - self.parent.old_pose.x
        drift = wrap_angle(self.robot.pose.theta -
                                self.parent.old_pose.theta) * 180/pi
        print('fwd=',fwd,'drift=',drift)
        self.parent.ax.plot(drift,fwd,'bo',linestyle='None')
        self.parent.old_pose = self.robot.pose



class ShowPlot(StateNode):
    def start(self,event=None):
        super().start()
        plt.pause(0.01)
```

PlotDrive (3)

```
$setup{

    self.SetupPlot() =N=> loop

    loop: Iterate(range(5))
    loop =D=> Forward(25) =T(5)=> self.AddPoint() =Next=> loop
    loop =C=> show

    show: self.ShowPlot()

}
```

PlotDrive

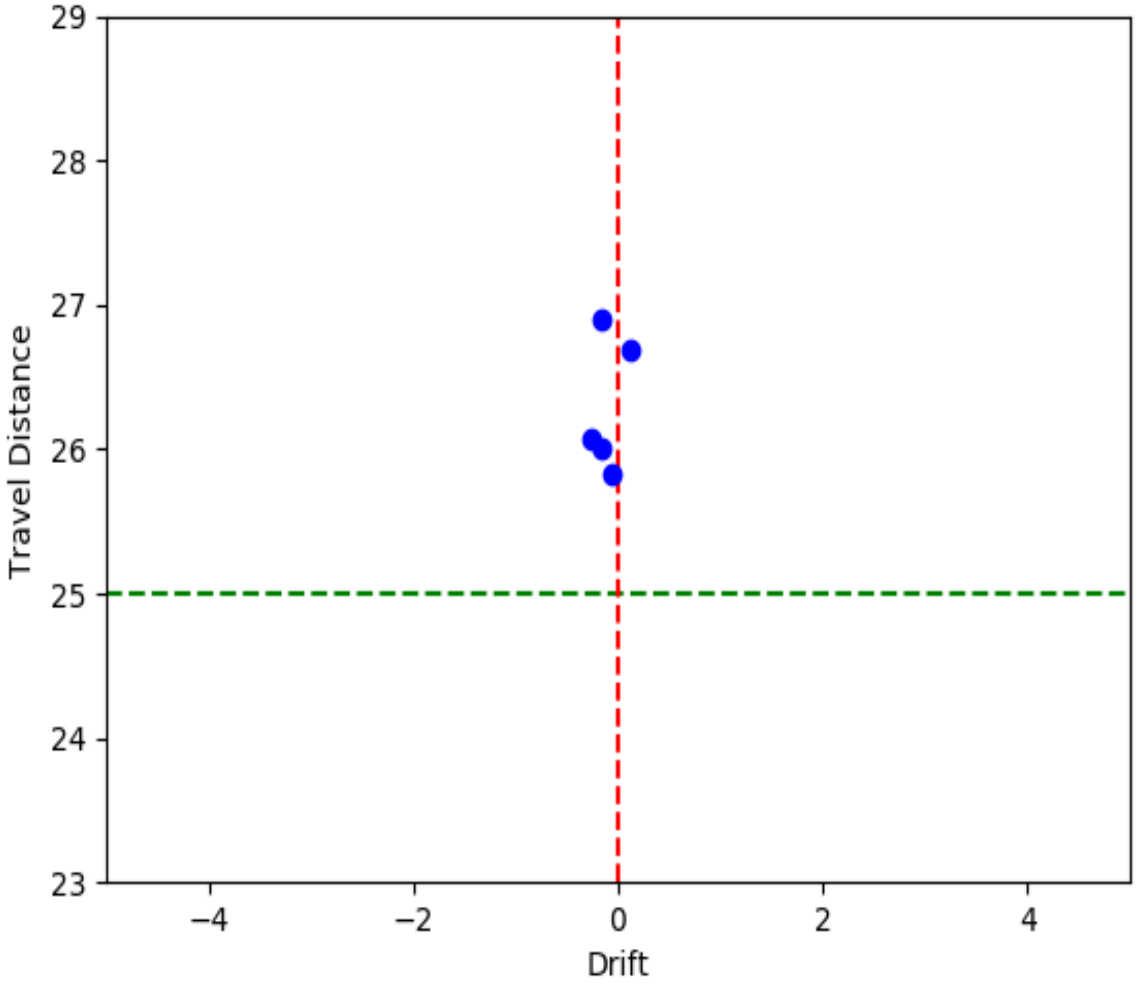
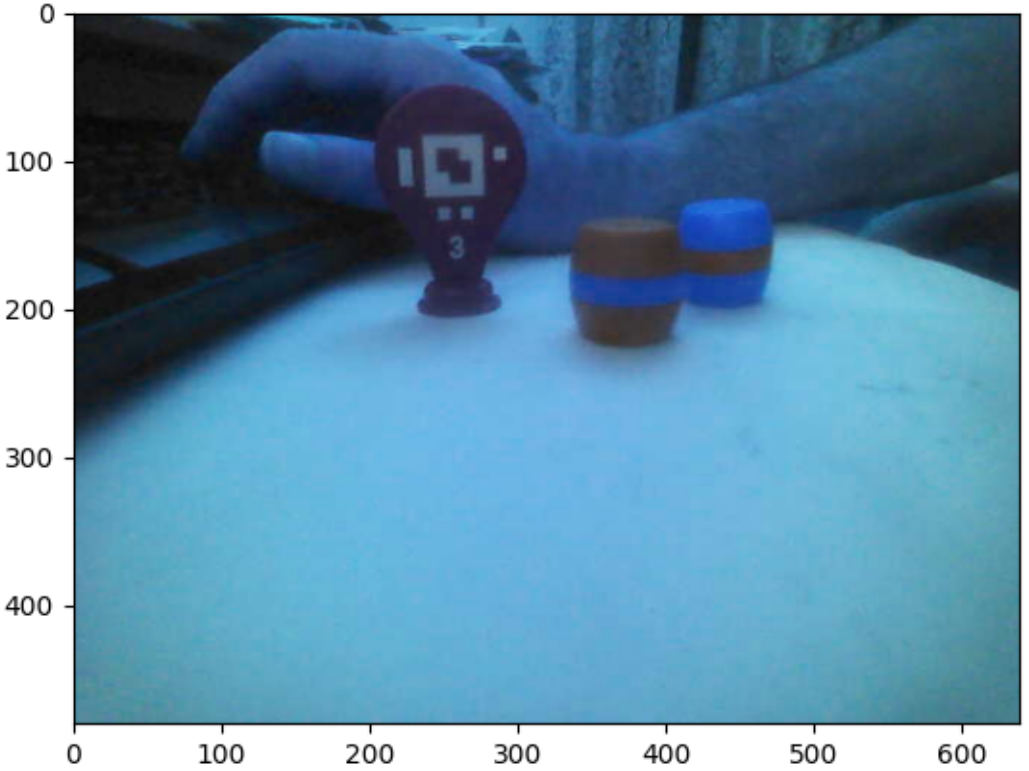


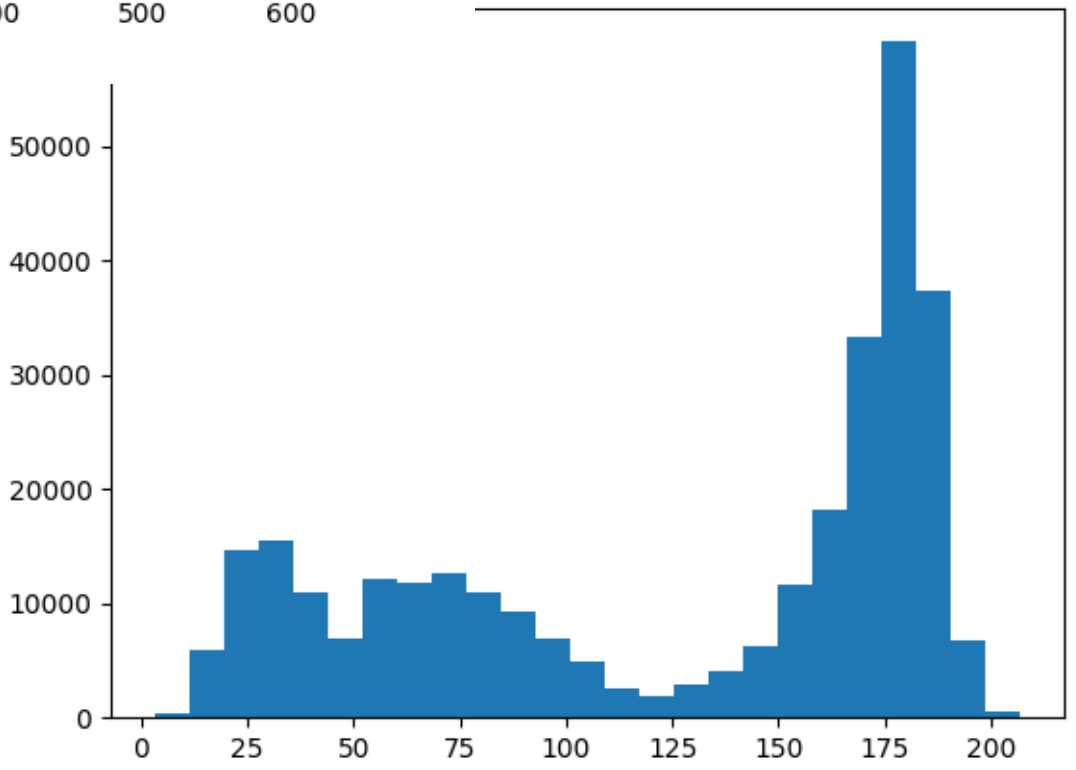
Image Display

```
rimg = robot.camera_image

img = np.array(rimg)

plt.imshow(img)
```

Intensity Histogram

```
pixels = tuple(img[:,:,1].flat)

plt.hist(pixels, bins=25)

plt.pause(0.01)
```


0
100
200
300
400
0
100
200
300
400
500
600


50000
40000
30000
20000
10000
0
0
25
50
75
100
125
150
175
200