Bayesian Statistics

CAS-05-601A (10:30a - 12:00p and 12:00p - 01:30p)

Activity 5

```
# -*- coding: utf-8 -*-
"""
Created on Sat Mar  9 12:27:50 2024

@author: Dariel M. Militante
"""

import scipy.stats as sts
import numpy as np
import matplotlib.pyplot as plt

mu = np.linspace (1.65, 1.8, num = 50)
test= np.linspace (0,2)
uniform_dist = sts.uniform.pdf(mu) + 1 #sneaky advanced note: I'm using the uniform distribution for clarity,
```

```
#but we can also make the beta distribution look completely flat by tweaking alpha and beta:
uniform_dist= uniform_dist/uniform_dist.sum() #Normalizing the distribution to make the probability densities sum into 1
beta_dist = sts.beta.pdf(mu, 2, 5, loc = 1.65, scale = 0.2)
beta_dist = beta_dist/beta_dist.sum()
plt.plot(mu, beta_dist, label = 'Beta Dist')
plt.plot(mu, uniform_dist, label = 'Uniform Dist')
plt.xlabel("Value of $\mu$ in meters")
plt.ylabel("Probability density")
plt.legend()

def likelihood_func(datum, mu):
    likelihood_out = sts.norm.pdf(datum, mu, scale = 0.1) #Note that mu here is an array of values, so the output is also an array!
    return likelihood_out/likelihood_out.sum()

likelihood_out = likelihood_func(1.7, mu)
plt.plot(mu, likelihood_out)
plt.title("Likelihood of $\mu$ given observation 1.7m")
plt.ylabel("Probability Density/Likelihood")
```

```
plt.xlabel("Value of  $\mu$")
plt.show()


import scipy as sp


unnormalized_posterior = likelihood_out*uniform_dist
plt.plot(mu, unnormalized_posterior)
plt.xlabel("$\mu$ in meters")
plt.ylabel("Unnormalized Posterior")
plt.show()
```

Spyder

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C:\Users\daled\OneDrive\Pictures

C:\Users\daled\OneDrive\Pictures\untitled1.py

Militante_Activity3.py | untitled1.py*

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# -*- coding: utf-8 -*-
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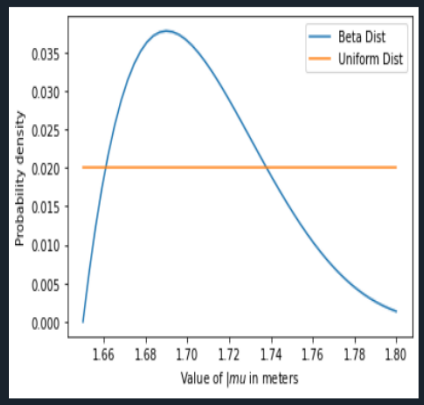

Help | Variable Explorer | Plots | Files

Console 1/A

```
File c:\users\daled\onedrive\pictures\untitled0.py:40
  plt.plot(mu, unnormalized_posterior)

NameError: name 'unnormalized_posterior' is not defined


In [13]: runfile('C:/Users/daled/OneDrive/Pictures/untitled0.py', wdir='C:/Users/
daled/OneDrive/Pictures')

In [14]: runfile('C:/Users/daled/OneDrive/Pictures/untitled1.py', wdir='C:/Users/
daled/OneDrive/Pictures')

In [15]:
```

IPython Console | History

Spyder: 5.5.1 internal (Python 3.8.10) Completions: internal LSP: Python Line 5, Col 29 UTF-8 CRLF RW Mem 88%

89°F Mostly cloudy

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ENG US

12:30 PM 3/9/2024

Spyder

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C:\Users\daled\OneDrive\Pictures

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Militante_Activity3.py | untitled1.py*

```
4
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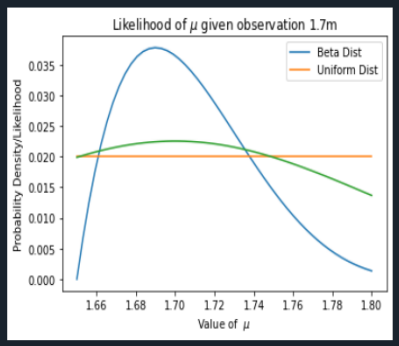
111 %



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Console 1/A

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Spyder: 5.5.1 | internal (Python 3.8.10) | Completions: internal | LSP: Python | Line 5, Col 29 | UTF-8 | CRLF | RW | Mem 88%

89°F
Air: Poor

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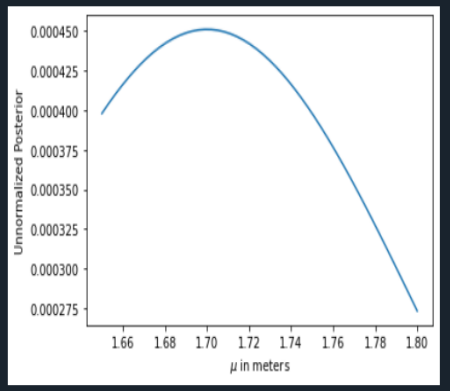

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IPython Console | Hist

Battery status: 83% remaining

Spyder: 5.5.1 internal (Python 3.8.10) Completions: internal LSP: Python Mem 88%

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Air: Poor

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3/9/2024