HW2&3_question6_MAP

March 25, 2021

[2]:
```
import numpy as np
from scipy.stats import beta
from matplotlib import pyplot as plt
%matplotlib inline
```

[3]:
```
# set alpha and beta, the parameter of beta distribution
a = b = 5
# sample of coin tossing, H=1 and T=0
sample_arr = np.asarray([1,1,0,0,1,1,1])
# result of MLE estimation (max likelihood)
print('Probability of MLE:',sum(sample_arr)/sample_arr.size)
```

```
Probability of MLE: 0.7142857142857143
```

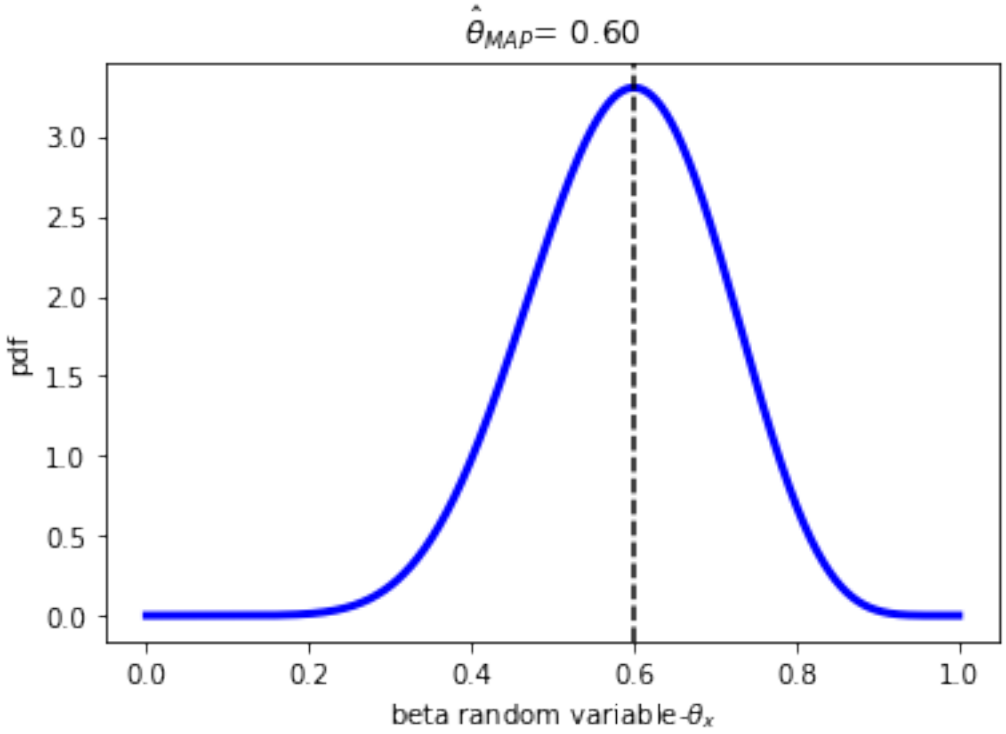
[4]:
```
# create beta random variable
beta_X = np.linspace(0,1,1000)
# set alpha and beta in formula of MAP we did
a_alpha = a+sum(sample_arr)
b_beta = b+(sample_arr.size-sum(sample_arr))
# calculate pdf of beta ditribution
y_pdf = beta.pdf(x=beta_X, a=a_alpha, b=b_beta)

# calculate MAP
map_answer = (a_alpha-1)/(a_alpha+b_beta-2)

# draw beta distribution
print('picture in second page (a little big)')
plt.plot(beta_X, y_pdf,color='b',linewidth=3)
plt.axvline(x=map_answer, linestyle="--", color='k')
plt.title('$\hat{\\theta}_{MAP}$= %.2f' % map_answer)
plt.xlabel('beta random variable-$\\theta_x$')
plt.ylabel('pdf')
```

```
picture in second page (a little big)
```

[4]:
```
Text(0, 0.5, 'pdf')
```


$\hat{\theta}_{MAP}$= 0.60
3.0
2.5
2.0
1.5
1.0
0.5
0.0
pdf
0.0
0.2
0.4
0.6
0.8
1.0
beta random variable-θ_x