

```
In [22]: import scipy.stats as sps
import numpy as np(0,1)
import matplotlib.pyplot as plt
%matplotlib inline
```

```
In [23]: X = sps.norm.rvs(size = 100, loc = 0, scale = 1)
```

В модели $N(\theta, 1)$ найти оценку theta по макс правдоподобию

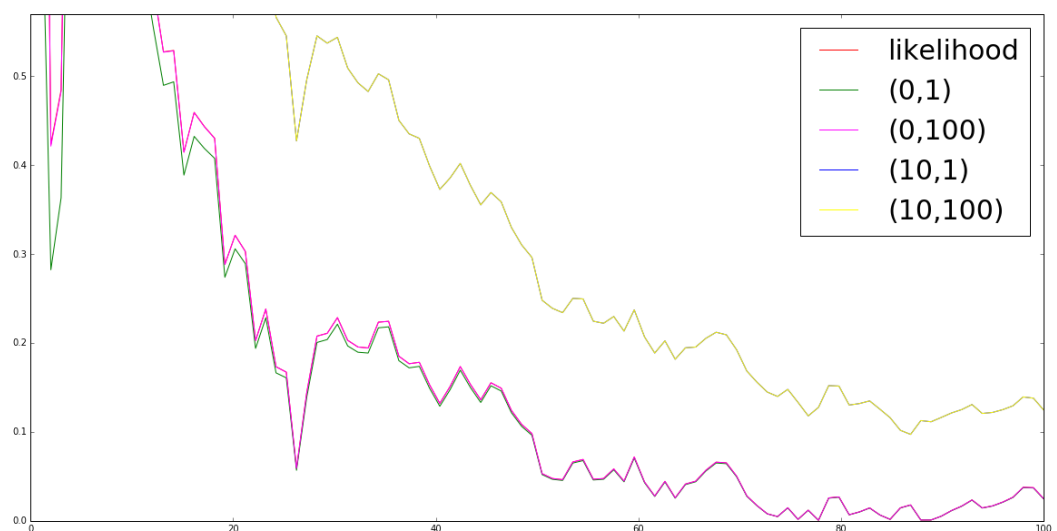
```
In [24]: est = np.array([np.array(X[:i]).mean() for i in range(1,101)])
```

Теперь байесовские оценки

```
In [25]: def make_est(a,sigma_squared) :
return np.array( [ (X[:n].sum() + (a/sigma_squared))/(n+(1/sigma_squared)) for n in range(1,101)] )
```

```
In [26]: est1 = make_est(0,1)
est2 = make_est(0,100)
est3 = make_est(10,1)
est4 = make_est(10,100)
```

```
In [27]: x = np.linspace(1,101,100)
plt.figure(figsize=(20,10))
plt.xlim(0, 100)
plt.ylim(0, 0.57)
plt.plot(x, abs(est), color = "red", label = 'likelihood')
plt.plot(x, abs(est1), color = "green", label = '(0,1)')
plt.plot(x, abs(est2), color = "magenta", label = '(0,100)')
plt.plot(x, abs(est3), color = "blue", label = '(10,1)')
plt.plot(x, abs(est4), color = "yellow", label = '(10,100)')
plt.legend(fontsize=30)
plt.show()
```



Для параметров (10,100) оценка плохая, их лучше не использовать как параметры априорного распределения, а вот, к примеру, розовый график - самое то.

В модели $N(0, \theta)$ найти оценку theta по макс правдоподобию

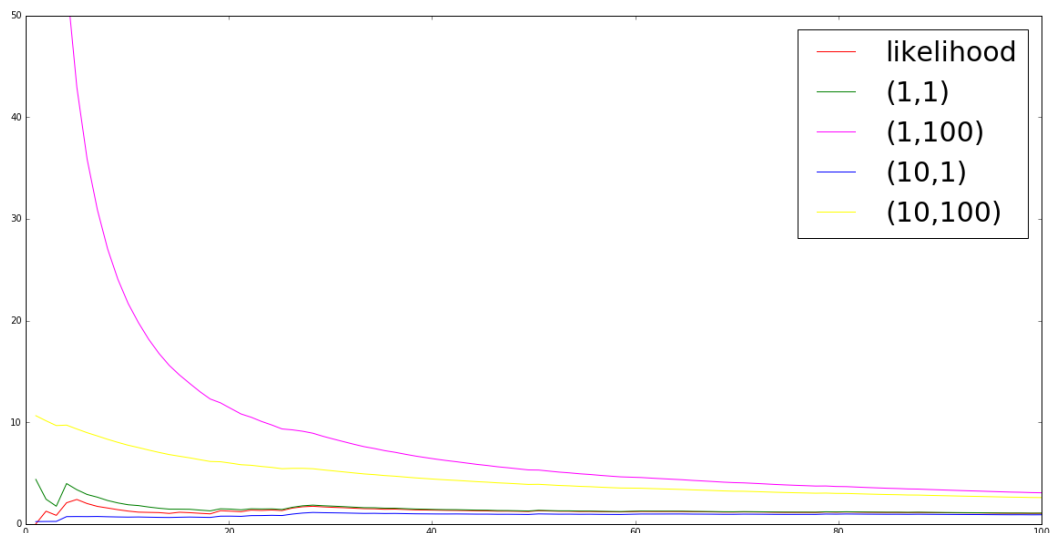
```
In [28]: est = np.array([np.array(X[:i]).var() for i in range(1,101)])
```

Теперь Байесовские оценки

```
In [29]: def make_est(alpha, beta) :
          return np.array( [ (beta + ((X[:n]**2).sum())/2))/(alpha + (n/2.) - 1)
                           for n in range (1,101)] )
```

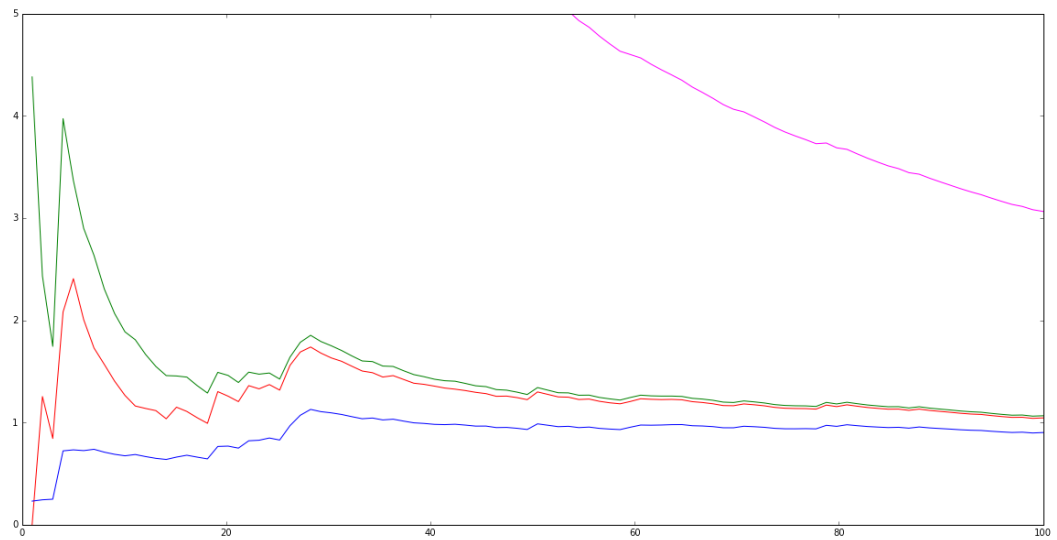
```
In [30]: est1 = make_est(1,1)
          est2 = make_est(1,100)
          est3 = make_est(10,1)
          est4 = make_est(10,100)
```

```
In [31]: x = np.linspace(1,101,100)
          plt.figure(figsize=(20,10))
          plt.xlim(0,100)
          plt.ylim(0,50)
          plt.plot(x, abs(est), color = "red", label = 'likelihood')
          plt.plot(x, abs(est1), color = "green", label = '(1,1)')
          plt.plot(x, abs(est2), color = "magenta", label = '(1,100)')
          plt.plot(x, abs(est3), color = "blue", label = '(10,1)')
          plt.plot(x, abs(est4), color = "yellow", label = '(10,100)')
          plt.legend(fontsize=30)
          plt.show()
```



другой масштаб

```
In [32]: x = np.linspace(1,101,100)
plt.figure(figsize=(20,10))
plt.xlim(0, 100)
plt.ylim(0, 5)
plt.plot(x, abs(est), color = "red")
plt.plot(x, abs(est1), color = "green")
plt.plot(x, abs(est2), color = "magenta")
plt.plot(x, abs(est3), color = "blue")
plt.show()
```



In []: