

sampleFromGaussianWinkler

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from Probabilistic Robotics p.124; cite Winkler (1995: p293)

```
%latex
Winkler: $$\frac{1}{2}\sum_{i=1}^{12}\mathrm{rand}(-\sigma,\ \sigma)$$
Herleitung dan...\\
Ausgangslage: $$\var\left(\frac{\sum_{i=1}^n x_i}{\sum_{i=1}^n x_i}\right) = \frac{(b-a)^2}{12n}$$$
für $b-a = 2\sigma$ : $$\var\left(\frac{\sum_{i=1}^n x_i}{\sum_{i=1}^n x_i}\right) = \frac{4\sigma^2}{12n} \ \mathrm{Rrightarrow} \ \frac{1}{3}\sigma^2$$$
\\
$$\frac{1}{2}\sum_{i=1}^{12}x_i\cdot \var\left(\frac{\sum_{i=1}^n x_i}{\sum_{i=1}^n x_i}\right) = \sigma^2 \ \mathrm{xrightarrow{n = 12}} \ \frac{1}{4}\cdot \var\left(\frac{\sum_{i=1}^{12}x_i}{\sum_{i=1}^{12}x_i}\right) = \sigma^2 \ \mathrm{Rrightarrow}$$$
\\
$$\var\left(\frac{1}{2}\sum_{i=1}^{12}x_i\right) = \sigma^2$$$
```

Winkler:

$$\frac{1}{2} \sum_{i=1}^{12} rand(-\sigma, \sigma)$$

Herleitung dan...

Ausgangslage:

$$var\left(\frac{\sum_{i=1}^n x_i}{n}\right) = \frac{(b-a)^2}{12n}$$

für $b - a = 2\sigma$:

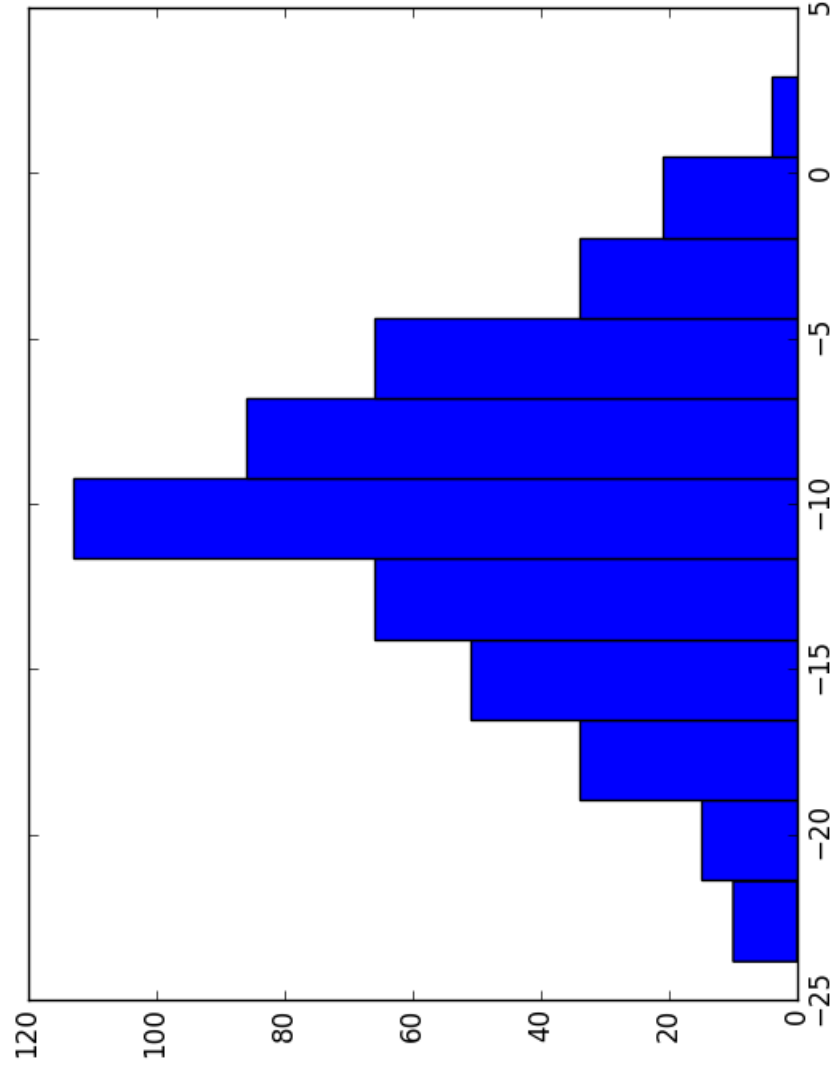
$$var\left(\frac{\sum_{i=1}^n x_i}{n}\right) = \frac{4\sigma^2}{12n} \uparrow \frac{12n}{4} \cdot var\left(\frac{\sum_{i=1}^n x_i}{n}\right) = \sigma^2 \uparrow$$

$$\frac{12n}{4n^2} \cdot var \left(\sum_{i=1}^n x_i \right) \xrightarrow{n=12} \frac{1}{4} \cdot var \left(\sum_{i=1}^{12} x_i \right) = \sigma^2 \uparrow \uparrow$$

$$var\left(\frac{1}{2}\sum_{i=1}^{12}x_i\right)=\sigma^2$$

```
class sampleFromGaussian:
    """A Class for sampling from a gaussian normal distribution"""
    def sample(self, mu, sigma):
        tmp = [(random() * 2.0 * sigma - sigma) for x in range(12)]
        return 0.5 * sum(tmp) + mu
```

```
import matplotlib.pyplot as plt
n = 500
sampler = sampleFromGaussian()
sampleSet = []
for _ in range(n):
    sampleSet.append(sampler.sample(mu = -10.0, sigma = 5))
#print std(sampleSet)
#print variance(sampleSet)
plt.hist(sampleSet, bins=11) #this is the histogram
plt.savefig('Histogram.png') #matplotlib has a bug, these lines force the plot to actually be drawn
plt.close()
```



```
setX = []
setY = []
for _ in range(n):
    setX.append(sampler.sample(mu = -10.0, sigma = 5))
    setY.append(sampler.sample(mu = -10.0, sigma = 5))

plt.plot(setX, setY, 'bo')
plt.axes().set_aspect('equal', 'datalim')
plt.savefig('Histogram.png') #matplotlib has a bug, these lines force the plot to actually be drawn
```

```
|plt.close()
```

