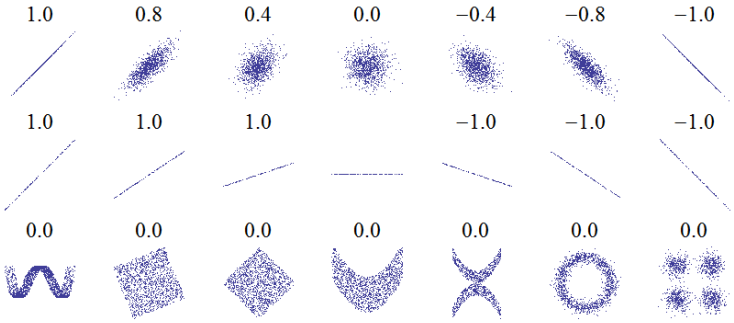
Lecture 1: Brief Review of Random Process

- probability
- random variable: probability distribution function, probability density function, distribution (uniform, Gaussian)
- mean, variance, standard deviation
- uncorrelated, independent
- unbiased estimator, mean square error

Correlation coefficient (ρ)

$$\rho = \frac{E[(X - m_X)(Y - m_Y)]}{\sqrt{\text{var}X}\sqrt{\text{var}Y}}$$



Homework #1

(1) Suppose X is a uniform distribution random variable on $[-2, 2]$.

- (a) draw the probability density function of X
- (b) Find the mean and variance of X .

(2) Suppose we want to estimate the true value x from two observation y_1 and y_2, where we know

$$\begin{aligned} y_1 &= x + v_1 \\ y_2 &= x + v_2. \end{aligned}$$

Assume that the measurement noise v_1 and v_2 are uncorrelated zero-mean Gaussian satisfying

$$\text{E}\{v_1^2\} = 1, \quad \text{E}\{v_2^2\} = 2.$$

Suppose we used an estimator $\hat{x} = \frac{1}{2}(y_1 + y_2)$. What is $\text{E}\{e^2\}$?

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