Box-Muller Transform

Definition:

Given two independent random variables U_1 and U_2 that are uniformly distributed in the interval $(0, 1]$, the Box-Muller transform produces two independent standard normal (Gaussian) variables Z_0 and Z_1 as follows:

$$Z_0 = \sqrt{-2 \ln U_1} \cos(2\pi U_2)$$

$$Z_1 = \sqrt{-2 \ln U_1} \sin(2\pi U_2)$$

where:

- Z_0, Z_1 are standard normally distributed (mean = 0, variance = 1),
- U_1, U_2 are independent and uniformly distributed on $(0, 1]$.