# Sampling from High Dimensional Distributions

## A Gradient Based Approach

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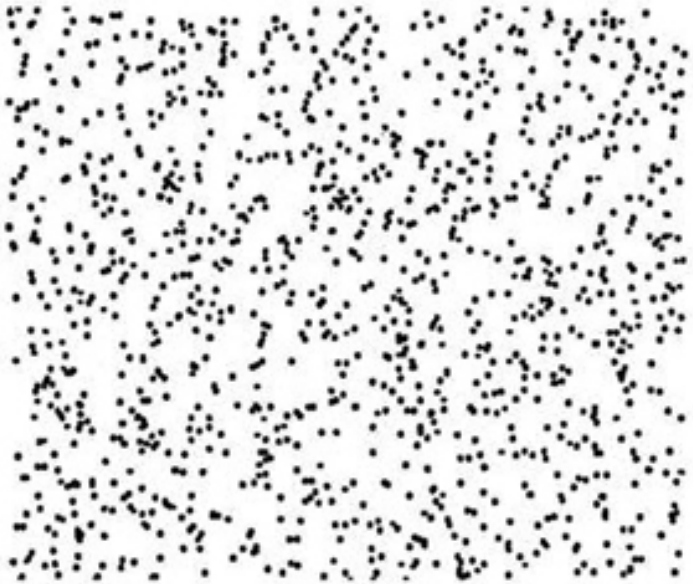
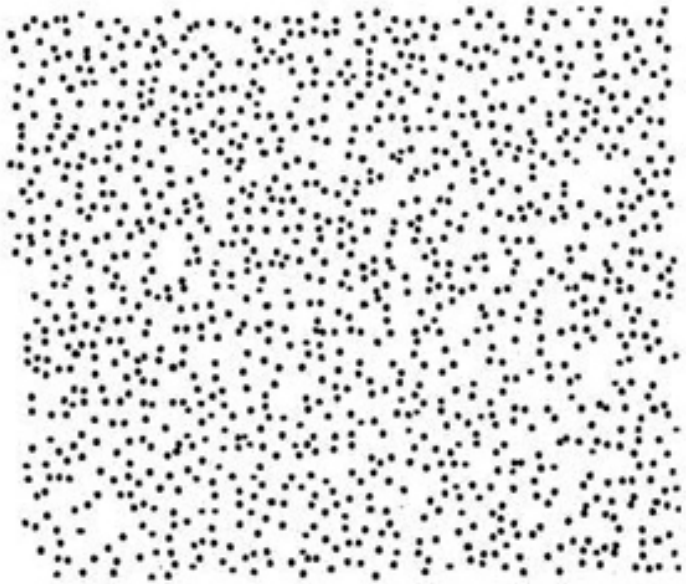
# 1 Introduction

- Randomness
- Sampling Methods

# What is random?







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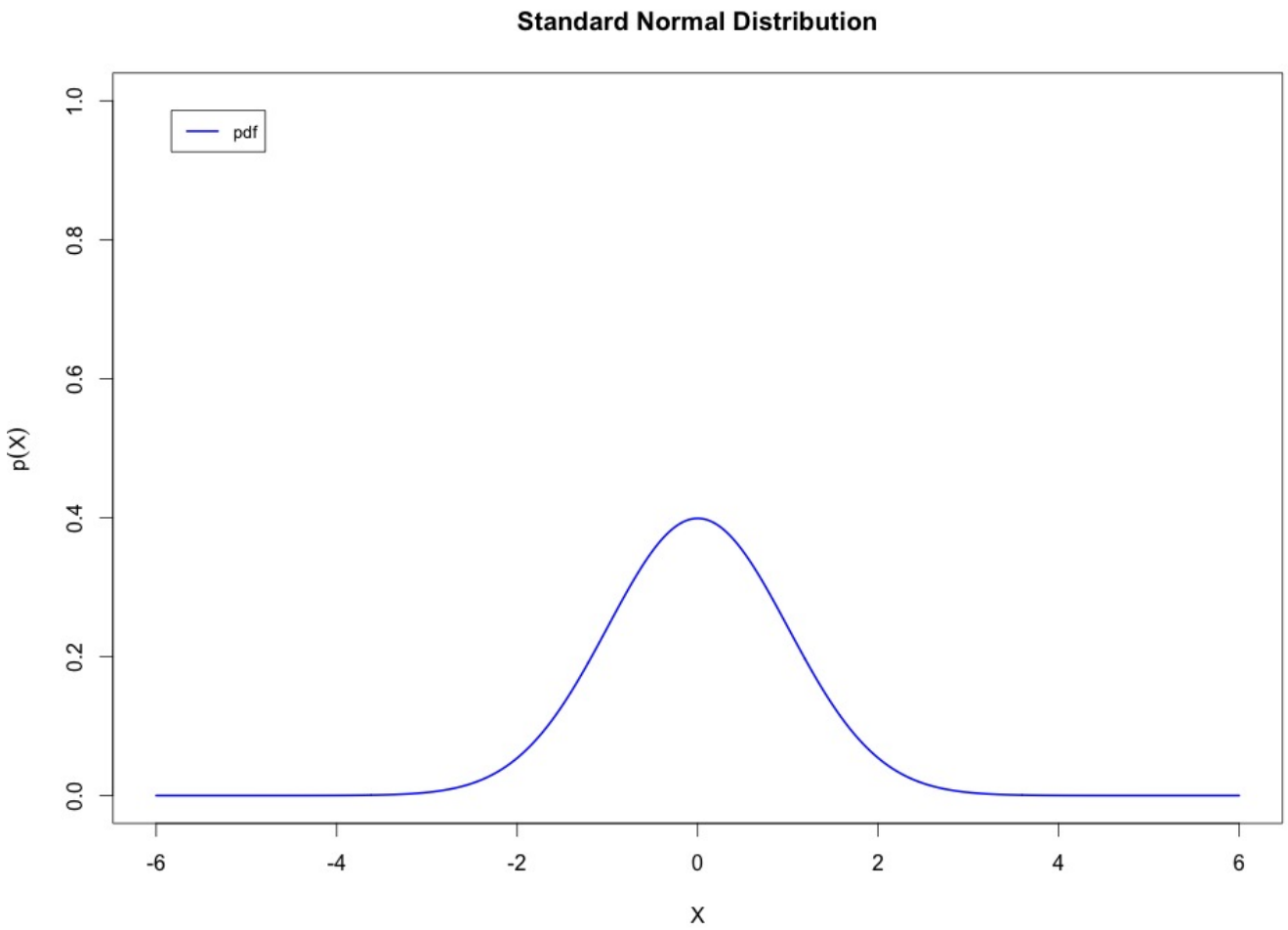
- Inverse transform sampling:
  - Cumulative distribution function: $z = h(x) = \int_{-\infty}^{x} p(\hat{x})\, d\hat{x}$
  - Idea: transform the uniform random variables using the inverse of the indefinite integral of the desired distribution.

$$x = h^{-1}(z) = h^{-1}\left( \int_{-\infty}^{x} p(\hat{x})\, d\hat{x} \right)$$

# Inverse Transform Example





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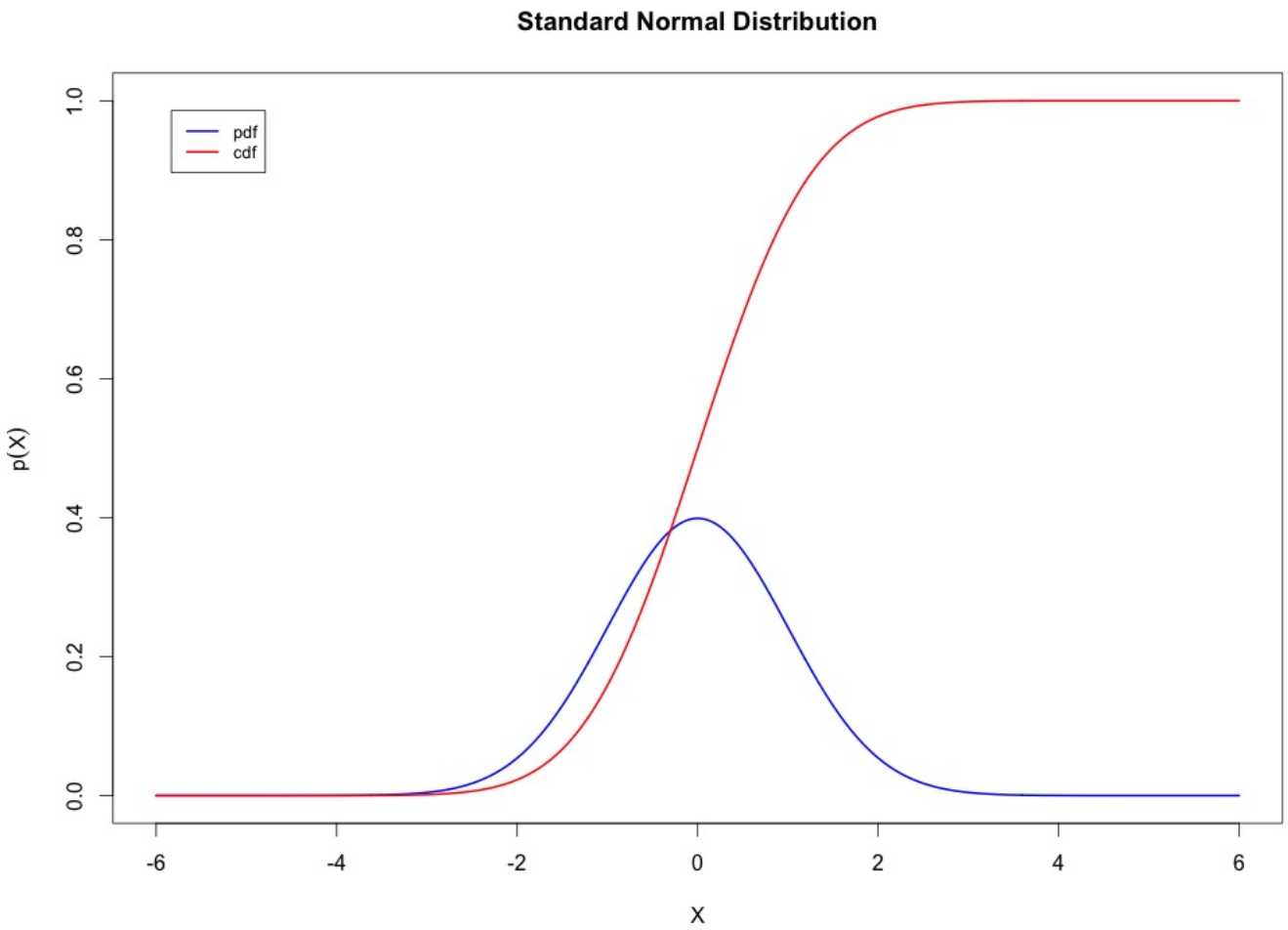

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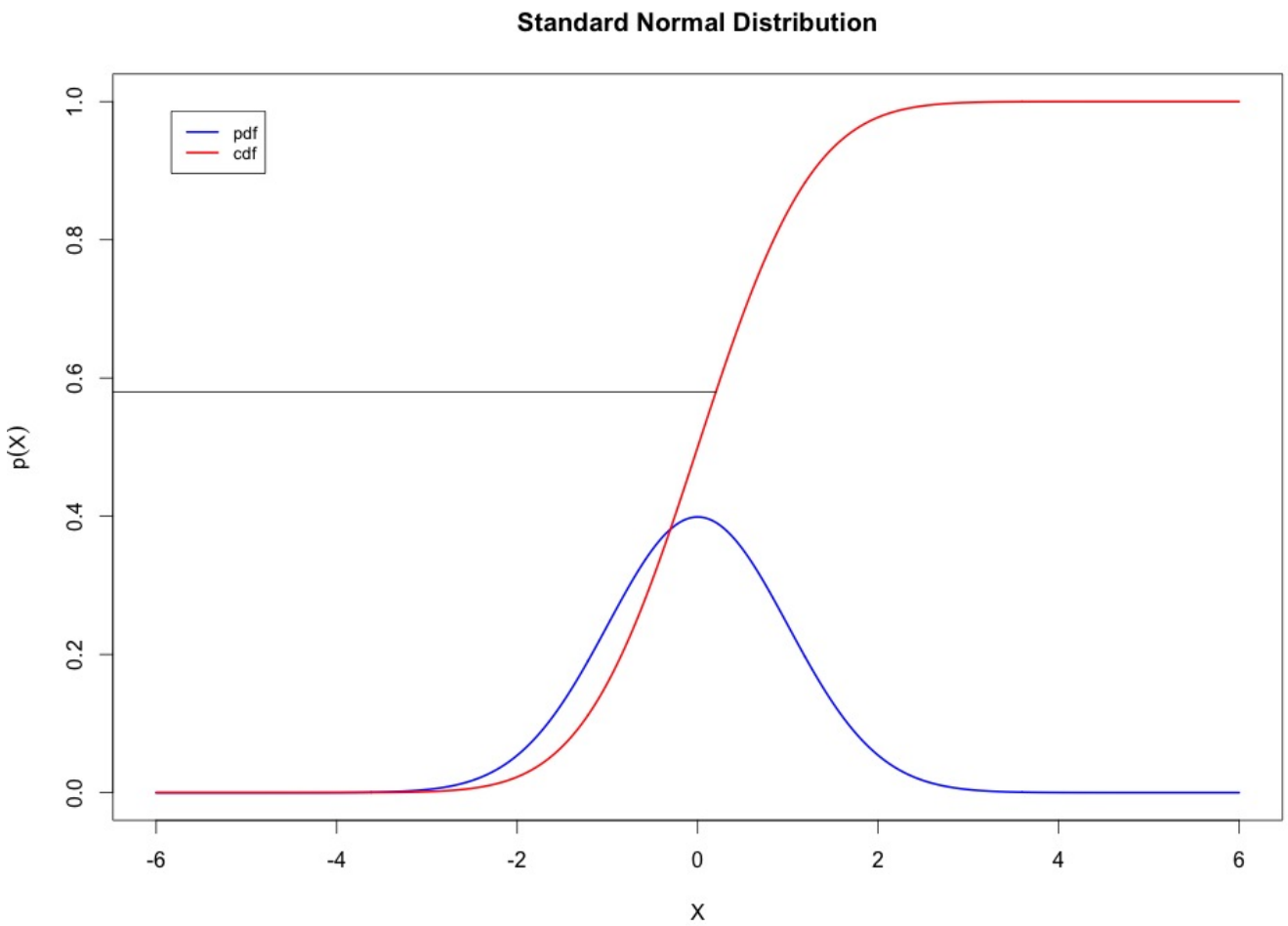

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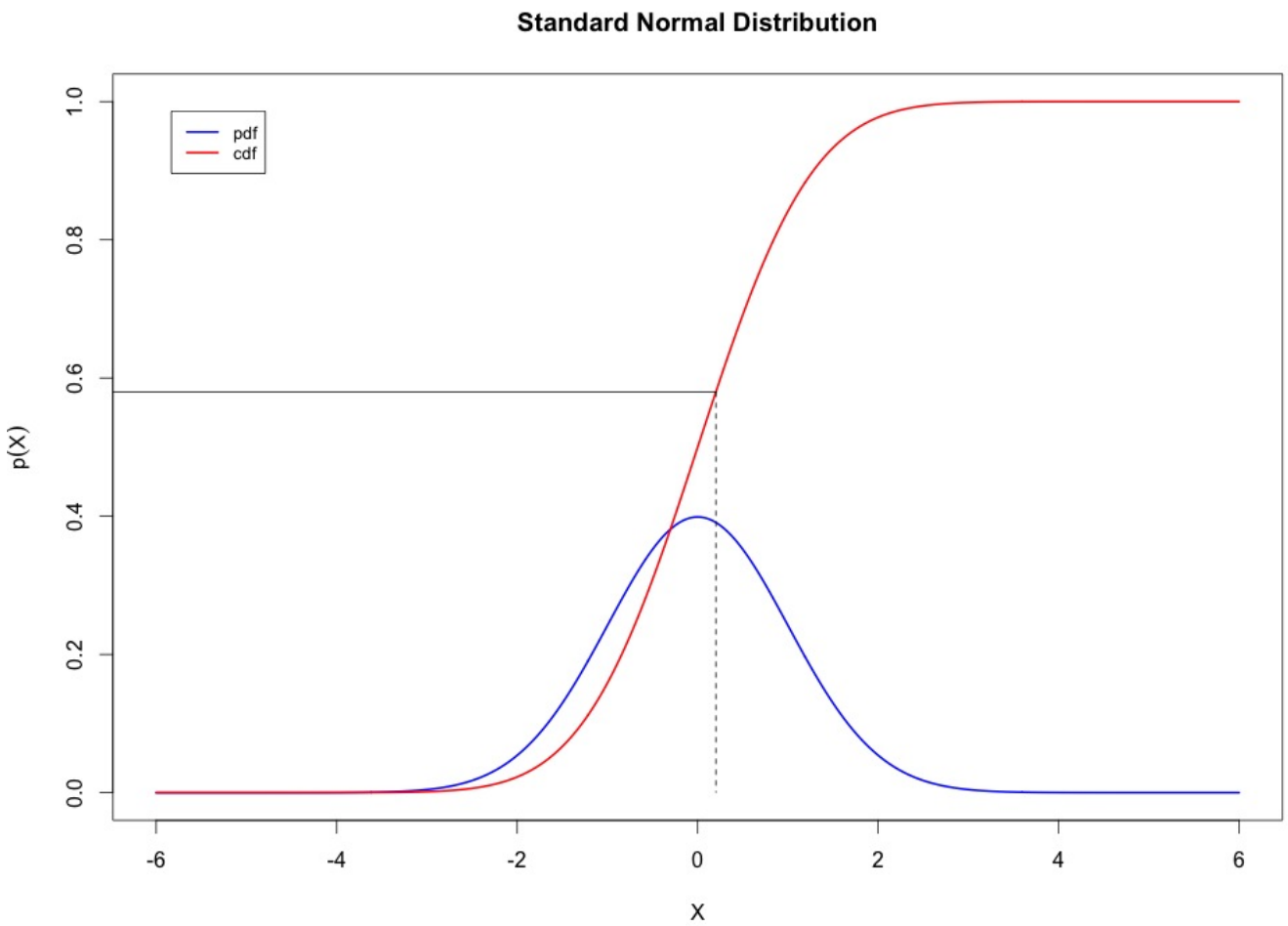

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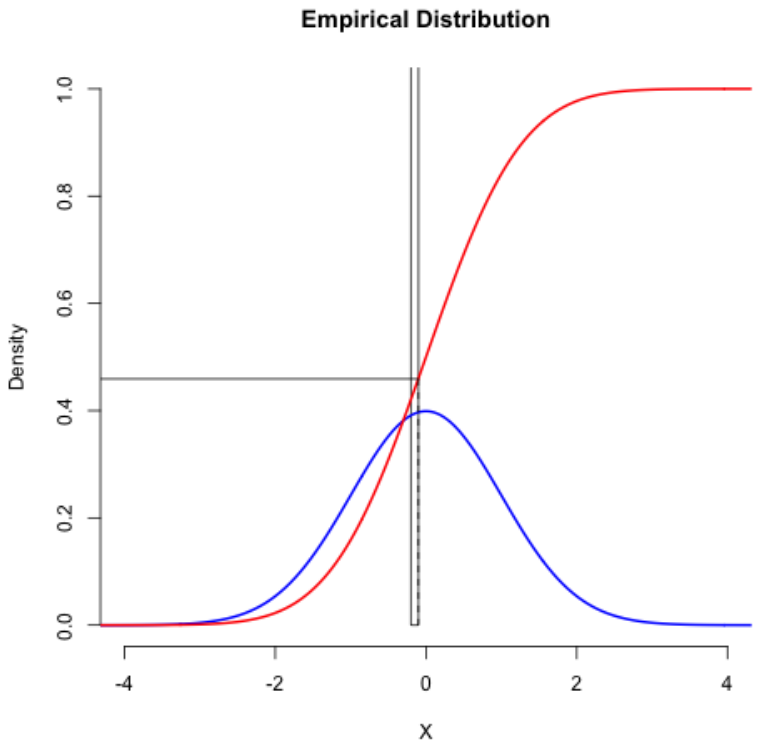

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  - Gibbs Sampling
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  - Hamiltonian Monte Carlo