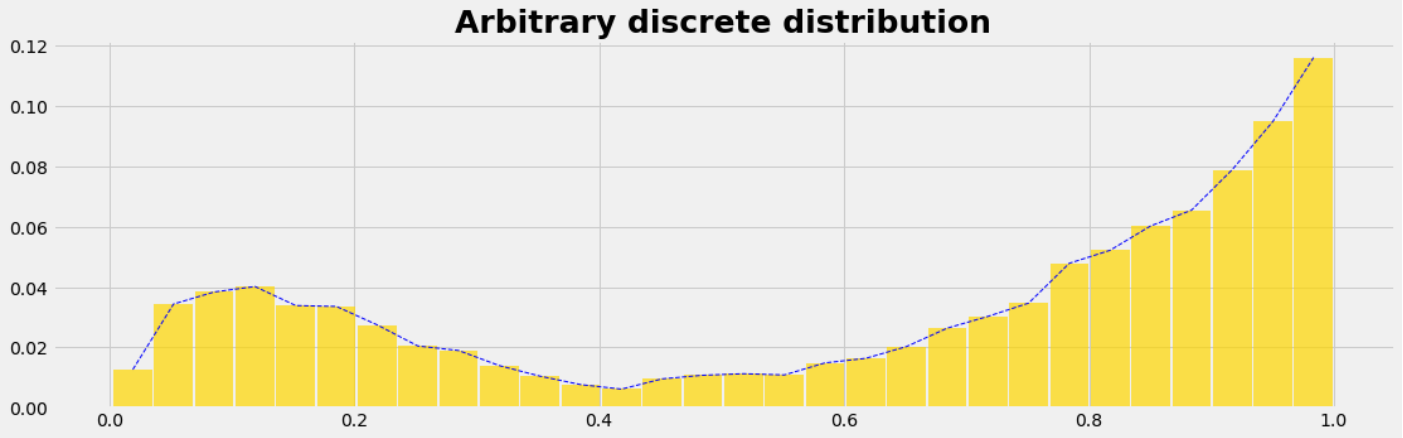
Sampling

In the practical use of statistics, we don't have an infinite amount of data. An enormous amount of data is needed to accurately estimate the true distribution non-parametrically. We need to take small **samples** of data, from which we can make inferences about the population from. We often describe this sample as **empirical,** originating or based on observation.

We model the quantity of interest as a random variable that follows some arbitrary probability distribution. In the case of discrete random variables, the probability distribution is characterized by **probability mass functions (PMFs)**. Continuous random variables are represented by **probability density functions (PDF)**. The area under the PMF and PDF curve is always equal to 1.

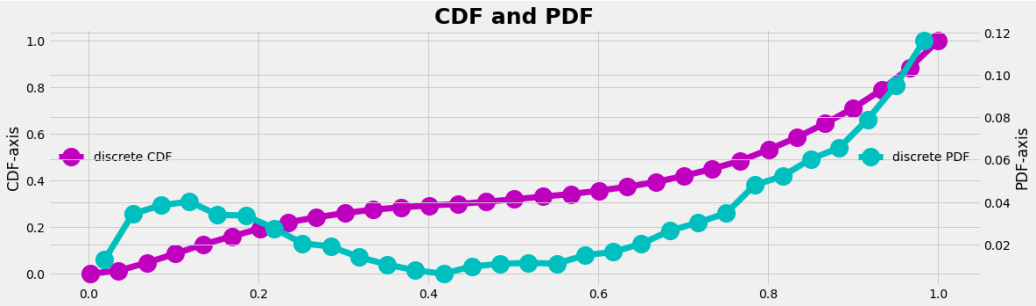


Let's assume we have a dataset we wish to use as a sampling engine. We'll assume the data:

- is Empirical
- is Discrete (given by data points)
- has an unknown function defining the distribution

If we want a random number generator that returns data with the same distribution of our empirical distribution we can do so in 3 steps:

1. Define a **cumulative density function (CDF)** for our empirical distribution (the cumulative sum from the PDF, ranging from [0,1] on the y-axis)
2. Create a uniform random generator that gives data in the interval [0,1]
3. Identify which element of the CDF the random number fits best and count the 'hit' (which is the x-axis transformation)



References

How to randomly sample your empirical arbitrary distribution

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