

## DISTRIBUTION APPROXIMATORS

# Why

We have a distribution to approximate. It is, for some reason, unsuitable to our needs and we want to replace it with one more suitable.

#### Definition

A distribution approximator is an approximator of a probability distribution. It is also a distribution. The criterion of approximation is any similarity function on distributions over the same space.

## Notation

Let A be a non-empty set and  $q: A \to \mathbf{R}$  be a distribution. Let  $p: A \to \mathbf{R}$  be a distribution. Then  $p: A \to \mathbf{R}$  is a distribution approximator of q.

# Reasons for approximation

Infeasible to represent. If there are many outcomes, many numbers are required to specify the distribution. If  $p: A^n \to \mathbb{R}$  where |A| = k, then there are  $k^n$  outcomes; take, for example, k = 2 and n = 100. So we might want to find a distribution which requires fewer numbers to express. In other words, we want a different distribution, selected from the set of those which is easier to express, which is close to the original.

Unreasonable from common sense. The distribution may be unreasonable as a result of our common sense. For example, it may give zero probability to an outcome which we know to be possible, and would like to model with non-zero probability. This may happen when working with an empirical distribution: a particular outcome does not appear in the dataset, however, our common sense suggests is possible. In this case, we want to find a different distribution, selected from the set of those which is more reasonable based on common sense, which is close to the original.

