



Empirical Distribution

1 Why

A natural distribution to associate with a dataset is to assign to each outcome a probability which reflects the number of times it appears in the dataset.

2 Definition

The *empirical distribution* of a dataset is the distribution which associates to each outcome a probability which is the proportion of its appearance in the dataset. The proportions are nonnegative and sum to one, so the function so described is indeed a probability distribution.

2.1 Notation

Let A be a non-empty set. Let (a^1, \dots, a^n) be a data set in A . Let $q : A \rightarrow \mathbf{R}$ be defined by

$$q(a) = \frac{1}{n} \left| \{k \in \{1, \dots, n\} \mid a^k = a\} \right|$$

Then q is the empirical distribution of (a^1, \dots, a^n) . In other words, to give the probability of outcome a , we count the number of times it appeared in the dataset of size n , and then divide by n .



