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 $q : A \rightarrow \mathbf{R}$ be a distribution. Let $p : A \rightarrow \mathbf{R}$ be a distribution. Then $p : A \rightarrow \mathbf{R}$ 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 $p : A^n \rightarrow \mathbf{R}$ where $\mid A \mid = k$, 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.

Distribution Approximators

Approximators

Similarity Functions

Metrics

Distance

Space Distance

Absolute Value

Plane Distance

Empirical Distribution

Interval Length

Probability Distributions

Real Space

Intervals

Real Plane

Real Line

Integral Line

Real Order

Real Optimizers

Real Summation

Geometry

Rational Order

Real Numbers

Rational Numbers

Optimizers

Lists

Integer Arithmetic

Direct Products

Set Numbers

Integer Products

Natural Additive Identity

Natural Multiplicative Identity

Finite Sets

Arithmetic

Identity Elements

Natural Summation

Equivalent Sets

Natural Powers

Integer Sums

Integer Order

Comparisons

Family Operations

Function Inverses

Family Unions and Intersections

Natural Products

Integer Numbers

Orders

Operations

Families

Function Composites

Function Images

Natural Sums

Natural Order

Converse Relations

Functions

Equivalence Relations

Recursion Theorem

Relations

Peano Axioms

Ordered Pair Projections

Natural Induction

Set Products

Uncertain Outcomes

Natural Numbers

Set Powers

Generalized Set Dualities

Set Symmetric Differences

Set Duality

Successor Sets

Unordered Triples

Intersection of Empty Set

Partitions

Set Unions and Intersections

Set Complements

Pair Unions

Ordered Pairs

Set Intersections

Set Differences

Set Unions

Pair Intersections

Empty Set

Unordered Pairs

Set Specification

Set Equality

Set Inclusion

Deductions

Quantified Statements

Logical Statements

Statements

Sets

Identities

Names

Letters

Objects