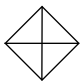


Why

We want a notion of "uncertainty" for a real-valued (continuous) random variable.

Definition

The *relative entropy* of a probability density function is the integral of the density against the negative log of the density.

Notation

Let $f : \mathsf{R}^n \to \mathsf{R}$ be a probability density function. The differential entropy of f is

$$-\int f \log f$$

We denote the differential entropy of f by $h(f)$.

Example

Let $x : \Omega \to \mathsf{R}$ be uniform on $[0, 1/2]$. Then $h(x) = \log 1/2 < 0$.

Problems

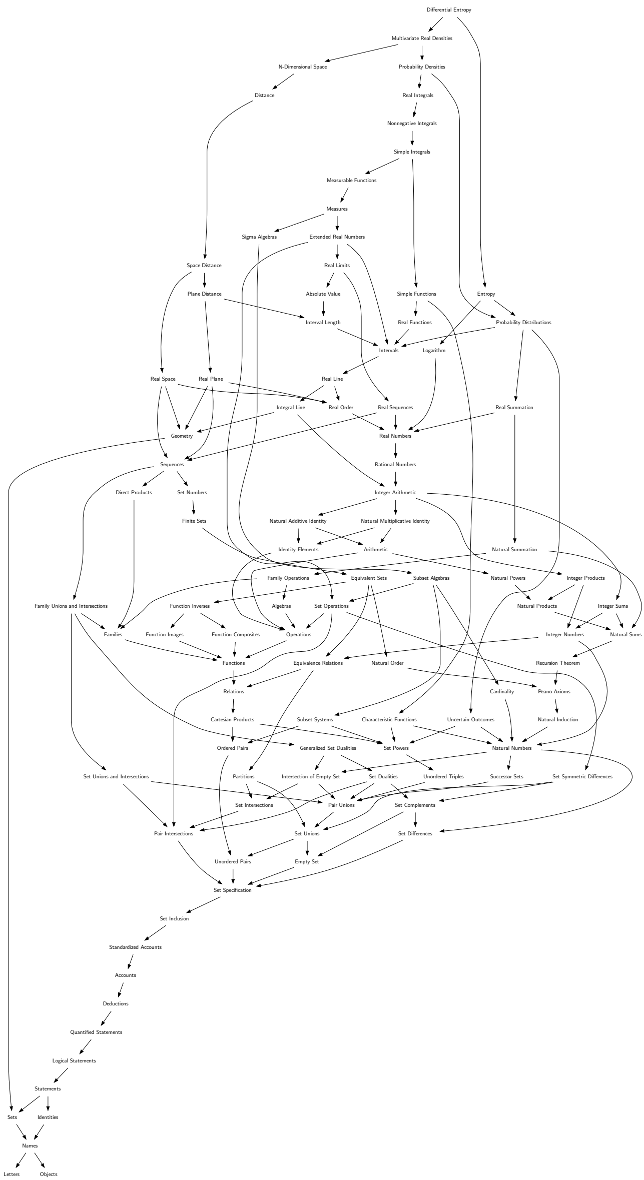
We have $h(ax) = h(x) + \log |a|$. In generaly $h(Ax) = h(x) + \log |A|$.

Differences still meaningful

Even though the value of the differential entropy is not necessarily a good analogy to discrete entropy, differences still are.

In particular, the following holds

$$I(X;Y) = H(Y) - H(Y \mid X) = H(X) = H(X \mid Y)$$


Differential Entropy
Multivariate Real Densities
N-Dimensional Space
Probability Densities
Distance
Real Integrals
Nonnegative Integrals
Simple Integrals
Measurable Functions
Measures
Sigma Algebras
Extended Real Numbers
Space Distance
Real Limits
Plane Distance
Absolute Value
Simple Functions
Entropy
Interval Length
Real Functions
Probability Distributions
Intervals
Logarithm
Real Space
Real Plane
Real Line
Integral Line
Real Order
Real Sequences
Real Summation
Geometry
Real Numbers
Sequences
Rational Numbers
Direct Products
Set Numbers
Integer Arithmetic
Finite Sets
Natural Additive Identity
Natural Multiplicative Identity
Identity Elements
Arithmetic
Natural Summation
Family Operations
Equivalent Sets
Subset Algebras
Natural Powers
Integer Products
Family Unions and Intersections
Function Inverses
Algebras
Set Operations
Natural Products
Integer Sums
Families
Function Images
Function Composites
Operations
Integer Numbers
Natural Sums
Functions
Equivalence Relations
Natural Order
Recursion Theorem
Relations
Cardinality
Peano Axioms
Cartesian Products
Subset Systems
Characteristic Functions
Uncertain Outcomes
Natural Induction
Ordered Pairs
Generalized Set Dualities
Set Powers
Natural Numbers
Set Unions and Intersections
Partitions
Intersection of Empty Set
Set Dualities
Unordered Triples
Successor Sets
Set Symmetric Differences
Set Intersections
Pair Unions
Set Complements
Pair Intersections
Set Unions
Set Differences
Unordered Pairs
Empty Set
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Sets
Identities
Names
Letters
Objects