Why

We want to estimate a random vector $x : \Omega \to \mathbf{R}^d$ from a random vector $y : \Omega \to \mathbf{R}^n$.

Definition

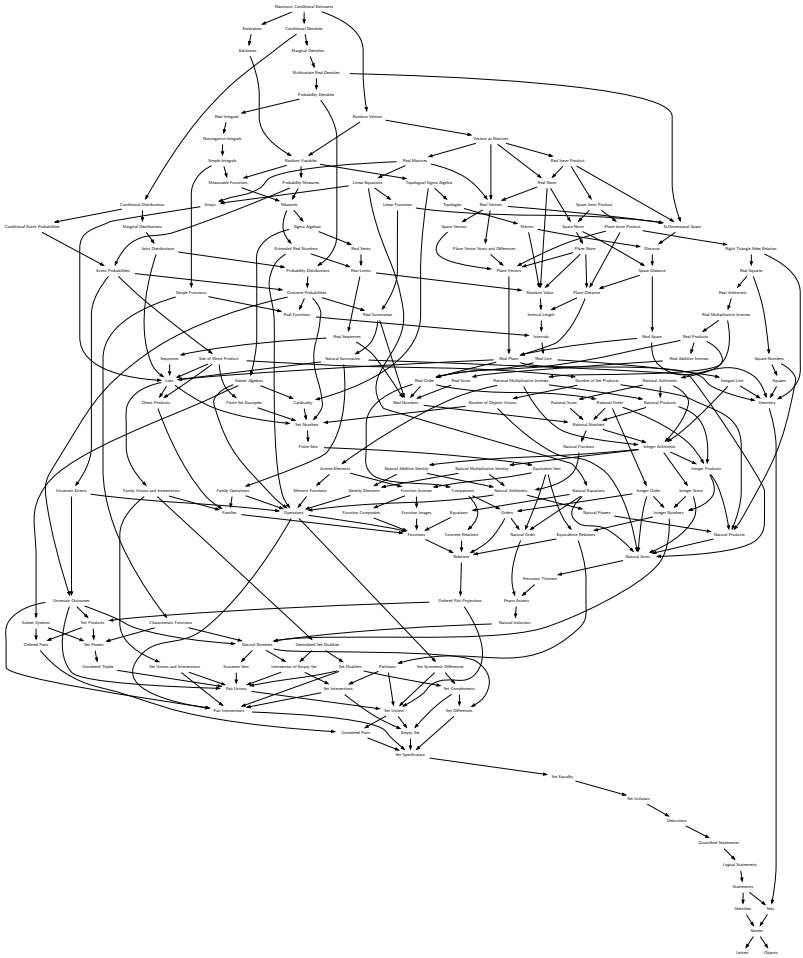
Denote by $g : \mathbf{R}^d \times \mathbf{R}^n \to \mathbf{R}$ the joint density for (x, y).[1] Denote the conditional density for x given y by $g_{x|y} : \mathbf{R}^d \times \mathbf{R}^n \to \mathbf{R}$. In this setting, $g_{x|y}$ is called the *posterior density*, g_x is called the *prior density*, and $g_{y|x}$ is called the *likelihood density* and g_y is called the *marginal likelihood density*.

As usual (and assuming $g_y > 0$), the posterior is related to the likelihood, prior and marginal likelihood by

$$g_{x|y} \equiv \frac{g_x g_{y|x}}{g_y}.$$

A *maximum conditional estimate* for $x : \Omega \to \mathbf{R}^n$ given that y has taken the value $\gamma \in \mathbf{R}^n$ is a maximizer $\xi \in \mathbf{R}^d$ of $g_{x|y}(\xi, \gamma)$. It is also called the *maximum a posteriori estimate* or *MAP estimate*. The maximum conditional estimate is natural, in part, because it also maximizes the joint density, since $g(\xi, \gamma) = g_y(\gamma) g_{x|y}(\xi, \gamma)$ for all $\xi \in \mathbf{R}^d$ and $\gamma \in \mathbf{R}^n$.

[1] Future editions will comment on the existence of such a density.


Maximum Conditional Estimators
Estimators
Conditional Densities
Estimators
Marginal Densities
Multivariate Real Densities
Probability Densities
Real Integrals
Nonnegative Integrals
Random Vectors
Vectors as Matrices
Simple Integrals
Random Variables
Real Matrices
Real Inner Product
Measurable Functions
Probability Measures
Linear Functionals
Topological Vector Algebra
Real Norm
Conditional Distributions
Arrays
Measures
Linear Functions
Topologies
Real Metrics
Space Inner Product
Conditional Event Probabilities
Marginal Distributions
Sigma Algebra
Space Metrics
Metrics
Space Norms
Place Inner Product
Bi-Dimensional Space
Right Triangle-Sides Relation
Joint Distributions
Extended Real Numbers
Real Sets
Place Vector Sums and Differences
Place Norm
Distances
Event Probabilities
Probability Distributions
Real Limits
Place Vectors
Space Distance
Real Squares
Simple Functions
Measure Probabilities
Measure Sums
Place Distances
Real Arithmetic
Real Functions
Real Summations
Interval Length
Real Multiplication Inverses
Real Sequences
Intervals
Real Sums
Real Products
Sequences
Set of Street Product
Natural Summations
Real Plus
Real Less
Real Addition Inverses
Square Numbers
Sets
Subset Algebra
Real Order
Real Sums
Rational Multiplication Inverses
Number of Set Products
Rational Additions
Integral Line
Squares
Direct Products
Finite Set Examples
Cardinality
Real Subtractions
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Rational Order
Rational Products
Intervals
Set Numbers
Rational Numbers
Finite Sets
Natural Numbers
Integer Additions
Inverse Elements
Natural Addition Identity
Natural Multiplication Identity
Equivalent Sets
Integer Products
Universe Sets
Family Unions and Intersections
Family Equivalence
Element Functions
Identity Elements
Compositions
Natural Additions
Natural Equations
Integer Order
Integer Sums
Equalities
Elements
Function Compositions
Function Images
Equations
Orders
Natural Powers
Integer Numbers
Functions
Converse Relations
Natural Order
Equivalence Relations
Natural Products
Subsets
Natural Sums
Finite Unions
Ordered Pair Projections
Power Sums
Universe Elements
Subset Systems
Set Products
Characteristic Functions
Natural Subtractions
Ordered Pairs
Set Pairs
Natural Numbers
Generalized Set Duality
Unordered Triples
Set Sums and Intersections
Successor Sets
Intersection of Empty Set
Set Dualities
Partitions
Set Symmetric Differences
Pair Unions
Set Intersections
Set Complements
Set Intersections
Set Unions
Set Differences
Unordered Pairs
Empty Set
Set Specification
Set Equality
Set Inclusion
Definitions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Numbers
Integers
Digits