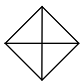


Why

We generalize the normal density to d-dimensional space.

Definition

Let $f : \mathsf{R}^d \to \mathsf{R}$ be a density such that

$$f(x) = \frac{1}{\sqrt{(2\pi)^d \,\mathbf{det}\, \Sigma}} \exp\left(-\frac{1}{2}(x-\mu)^\top \Sigma^{-1}(x-\mu)\right)$$

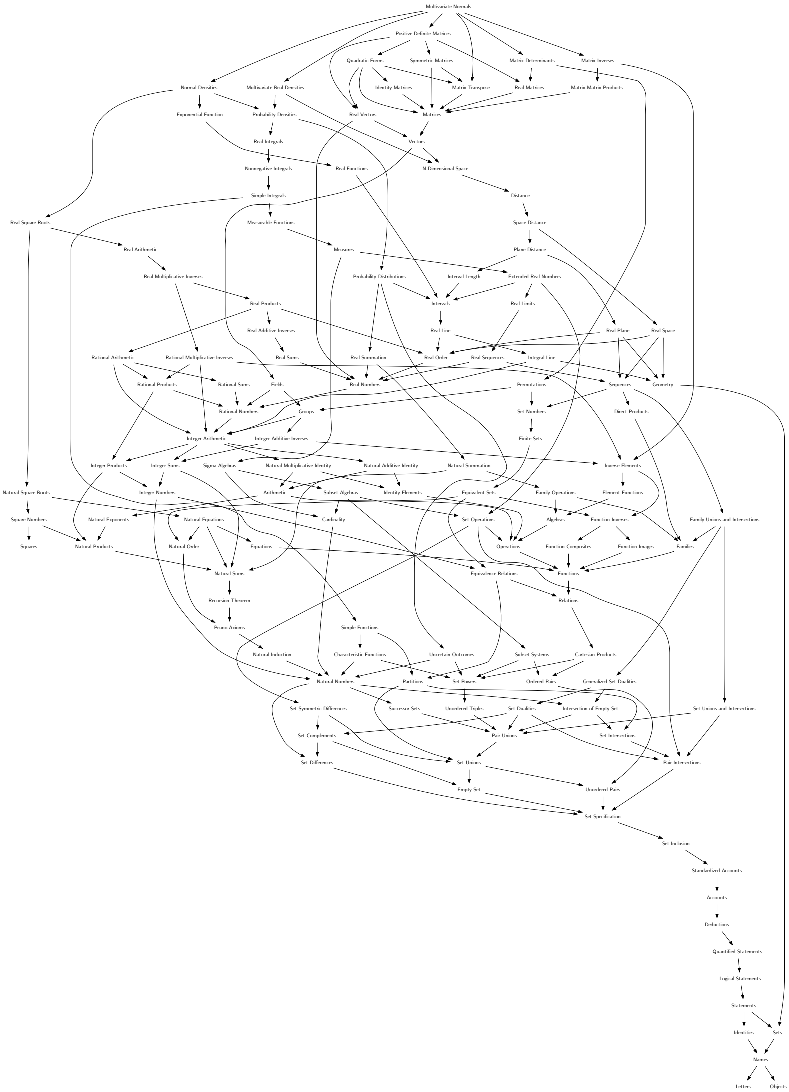
where $\mu \in \mathsf{R}^d$, $\Sigma \in \mathsf{S}^d$, and $\Sigma \succ 0$. We call f a *multivariate normal density*. A multivariate normal density with $d = 1$ is a normal density, so we refer to multivariate normal densities as *normal densities* without ambiguity. We frequently use the word normal as a substantive, and refer to *normals* when we mean multivariate normal densities. Many people call a multivariate normal distribution a *multivariate gaussian distribution* and speak of *gaussians* instead of normals.[1]

We call μ the *mean* and Σ the *covariance matrix*. We call Σ^{-1} the *precision matrix*.

Maximum

The maximum of a normal density is its mean, $\mu \in \mathsf{R}^d$.

[1]We avoid this usage in accordance with the project's policy on historical names.


Multivariate Normals
Positive Definite Matrices
Quadratic Forms
Symmetric Matrices
Matrix Determinants
Matrix Inverses
Normal Densities
Multivariate Real Densities
Identity Matrices
Matrix Transpose
Real Matrices
Matrix-Matrix Products
Exponential Function
Probability Densities
Real Vectors
Matrices
Real Integrals
Vectors
Nonnegative Integrals
Real Functions
N-Dimensional Space
Simple Integrals
Distance
Real Square Roots
Measurable Functions
Space Distance
Real Arithmetic
Measures
Plane Distance
Real Multiplicative Inverses
Probability Distributions
Interval Length
Extended Real Numbers
Real Products
Intervals
Real Limits
Real Additive Inverses
Real Line
Real Plane
Real Space
Rational Arithmetic
Rational Multiplicative Inverses
Real Sums
Real Summation
Real Order
Real Sequences
Integral Line
Rational Products
Rational Sums
Fields
Real Numbers
Permutations
Sequences
Geometry
Rational Numbers
Groups
Set Numbers
Direct Products
Integer Arithmetic
Integer Additive Inverses
Finite Sets
Integer Products
Integer Sums
Sigma Algebras
Natural Multiplicative Identity
Natural Additive Identity
Natural Summation
Inverse Elements
Natural Square Roots
Integer Numbers
Arithmetic
Subset Algebras
Identity Elements
Equivalent Sets
Family Operations
Element Functions
Square Numbers
Natural Exponents
Natural Equations
Cardinality
Set Operations
Algebras
Function Inverses
Family Unions and Intersections
Squares
Natural Products
Natural Order
Equations
Operations
Function Composites
Function Images
Families
Natural Sums
Equivalence Relations
Functions
Recursion Theorem
Relations
Peano Axioms
Simple Functions
Natural Induction
Characteristic Functions
Uncertain Outcomes
Subset Systems
Cartesian Products
Natural Numbers
Partitions
Set Powers
Ordered Pairs
Generalized Set Dualities
Set Symmetric Differences
Successor Sets
Unordered Triples
Set Dualities
Intersection of Empty Set
Set Unions and Intersections
Set Complements
Pair Unions
Set Intersections
Set Differences
Set Unions
Pair Intersections
Empty Set
Unordered Pairs
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects