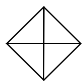


Why

[1]

Definition

A neural network ν commutes with a neural network μ if their associated predictors commute as functions.

An *autoencoder* (or *feedforward autoencoder*) is a pair of neural networks $((\phi_1, \dots, \phi_k), (\psi_1, \dots, \psi_\ell))$. If the networks commute and dom ϕ_1 = dom ψ_ℓ, we call the autoencoder *regular*. We call the predictor of the first network the *encoder* and the predictor the second network the *decoder*. We call the image of an input to the encoder an *embedding* (or *feature vector*, *representation*, *code*).

Compressive autoencoders

Let (ϕ, ψ) be regular and let $f : \mathsf{R}^d \to \mathsf{R}^k$ be the encoder and $g : \mathsf{R}^k \to \mathsf{R}^d$ be the decoder. If $k < d$, we call the autoencoder *compressive*. Otherwise, we call the autoencoder *noncompressive*. An autoencoder is *perfect* if $g \circ f$ is the identity function. Clearly, a compressive autoencoder can not be perfect.

Let us relax our notion of perfect by introducing a similarity function $\ell : \mathsf{R}^d \times \mathsf{R}^d \to \mathsf{R}$ (see Similarity Functions). An autoencoder is optimal with respect to ℓ if it minimizes

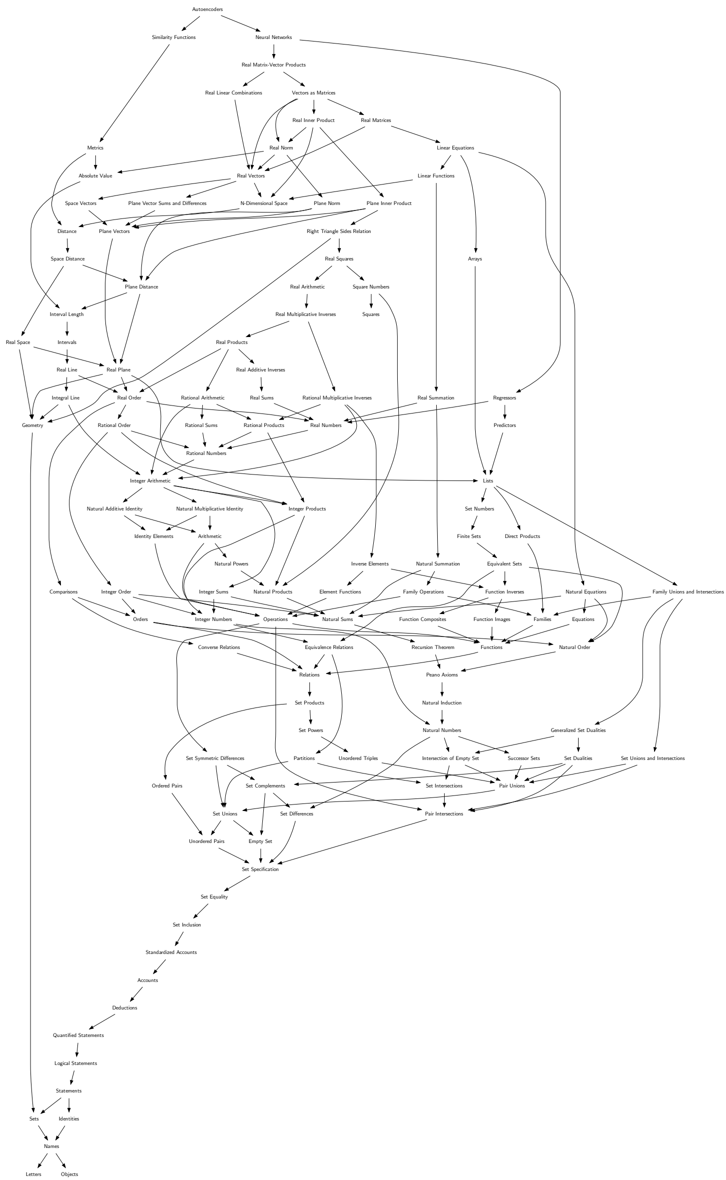
[1]Future editions will include. Future editions may also change the name of this sheet.

$\int_{\mathbf{R}^d} \ell(g(f(z)), z)dz$. This integral may diverge. Even if it converges for some autoencoders, there may not be an optimal autoencoder, or a unique one.

If we parameterize a family of autoencoders $\{x_\theta\}_{\theta\in\Theta}$ by a compact set Θ, ... [2]

It is natural to be interested in compressive autoencoders.

[2] Future editions will continue.


Autoencoders
Similarity Functions
Neural Networks
Real Matrix-Vector Products
Real Linear Combinations
Vectors as Matrices
Real Inner Product
Real Matrices
Metrics
Real Norm
Linear Equations
Absolute Value
Real Vectors
Linear Functions
Space Vectors
Plane Vector Sums and Differences
N-Dimensional Space
Plane Norm
Plane Inner Product
Distance
Plane Vectors
Right Triangle Sides Relation
Space Distance
Real Squares
Arrays
Plane Distance
Real Arithmetic
Square Numbers
Interval Length
Real Multiplicative Inverses
Squares
Real Space
Intervals
Real Products
Real Line
Real Plane
Real Additive Inverses
Integral Line
Real Order
Rational Arithmetic
Real Sums
Rational Multiplicative Inverses
Real Summation
Regressors
Geometry
Rational Order
Rational Sums
Rational Products
Real Numbers
Predictors
Rational Numbers
Integer Arithmetic
Lists
Natural Additive Identity
Natural Multiplicative Identity
Integer Products
Set Numbers
Identity Elements
Arithmetic
Finite Sets
Direct Products
Natural Powers
Inverse Elements
Natural Summation
Equivalent Sets
Comparisons
Integer Order
Integer Sums
Natural Products
Element Functions
Family Operations
Function Inverses
Natural Equations
Family Unions and Intersections
Orders
Integer Numbers
Operations
Natural Sums
Function Composites
Function Images
Families
Equations
Converse Relations
Equivalence Relations
Recursion Theorem
Functions
Natural Order
Relations
Peano Axioms
Set Products
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Natural Numbers
Generalized Set Dualities
Set Symmetric Differences
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Intersection of Empty Set
Successor Sets
Set Dualities
Set Unions and Intersections
Ordered Pairs
Set Complements
Set Intersections
Pair Unions
Set Unions
Set Differences
Pair Intersections
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Set Equality
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Deductions
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Logical Statements
Statements
Sets
Identities
Names
Letters
Objects