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 $((\phi_1, \ldots, \phi_k), (\psi_1, \ldots, \psi_\ell))$. 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

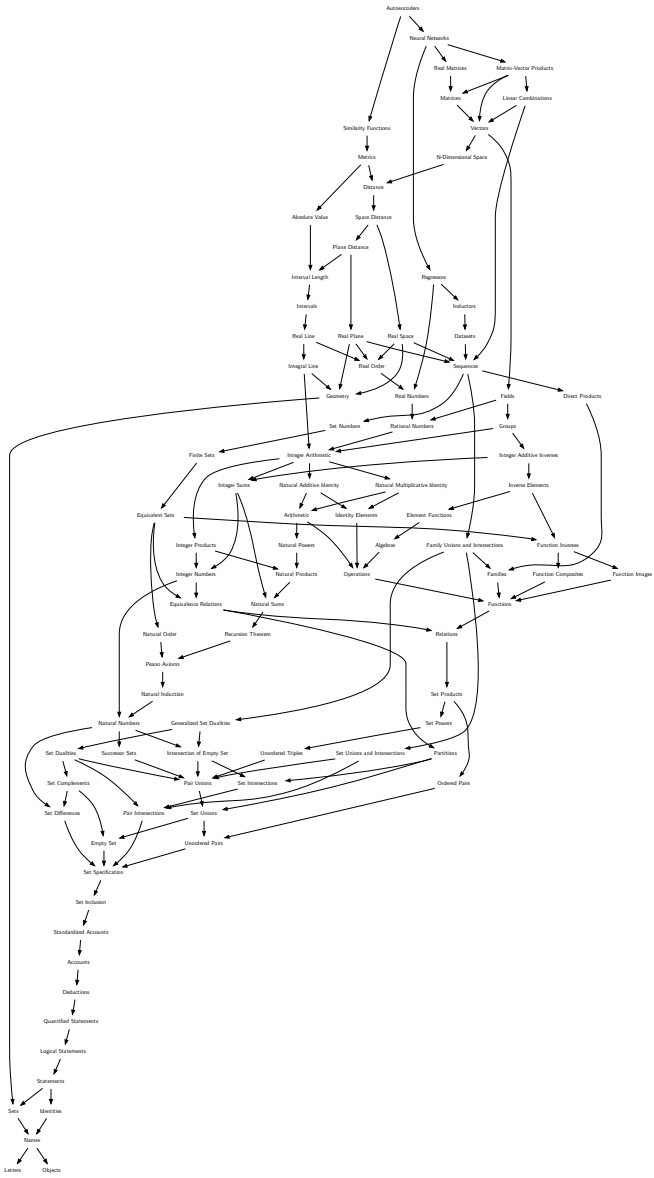
[1] Future editions will include. Future editions may also change the name of this sheet.

$\int_{\mathbf{R}^d} \ell(g(f(z)), z) dz$. 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
Neural Networks
Real Matrices
Matrix-Vector Products
Matrices
Linear Combinations
Vectors
Similarity Functions
Metrics
N-Dimensional Space
Distance
Absolute Value
Space Distance
Plane Distance
Interval Length
Regression
Intervals
Induction
Real Line
Real Plane
Real Space
Datasets
Integral Line
Real Order
Sequences
Geometry
Real Numbers
Fields
Direct Products
Set Numbers
Rational Numbers
Groups
Finite Sets
Integer Arithmetic
Integer Additive Inverses
Integer Sums
Natural Additive Identity
Natural Multiplicative Identity
Inverse Elements
Equivalent Sets
Arithmetic
Identity Elements
Element Functions
Integer Products
Natural Powers
Algebras
Family Unions and Intersections
Function Inverses
Integer Numbers
Natural Products
Operations
Families
Function Composites
Function Images
Equivalence Relations
Natural Sums
Functions
Natural Order
Recursion Theorem
Relations
Peano Axioms
Natural Induction
Set Products
Natural Numbers
Generalized Set Dualities
Set Powers
Set Dualities
Successor Sets
Intersection of Empty Set
Unordered Triples
Set Unions and Intersections
Partitions
Set Complements
Pair Unions
Set Intersections
Ordered Pairs
Set Differences
Pair Intersections
Set Unions
Empty Set
Unordered Pairs
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Sets
Identities
Names
Letters
Objects