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 $\operatorname{dom} \phi_1 = \operatorname{dom} \psi_\ell$, 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 $f : \mathbf{R}^d \to \mathbf{R}^k$ be the encoder and $g : \mathbf{R}^k \to \mathbf{R}^d$ 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.

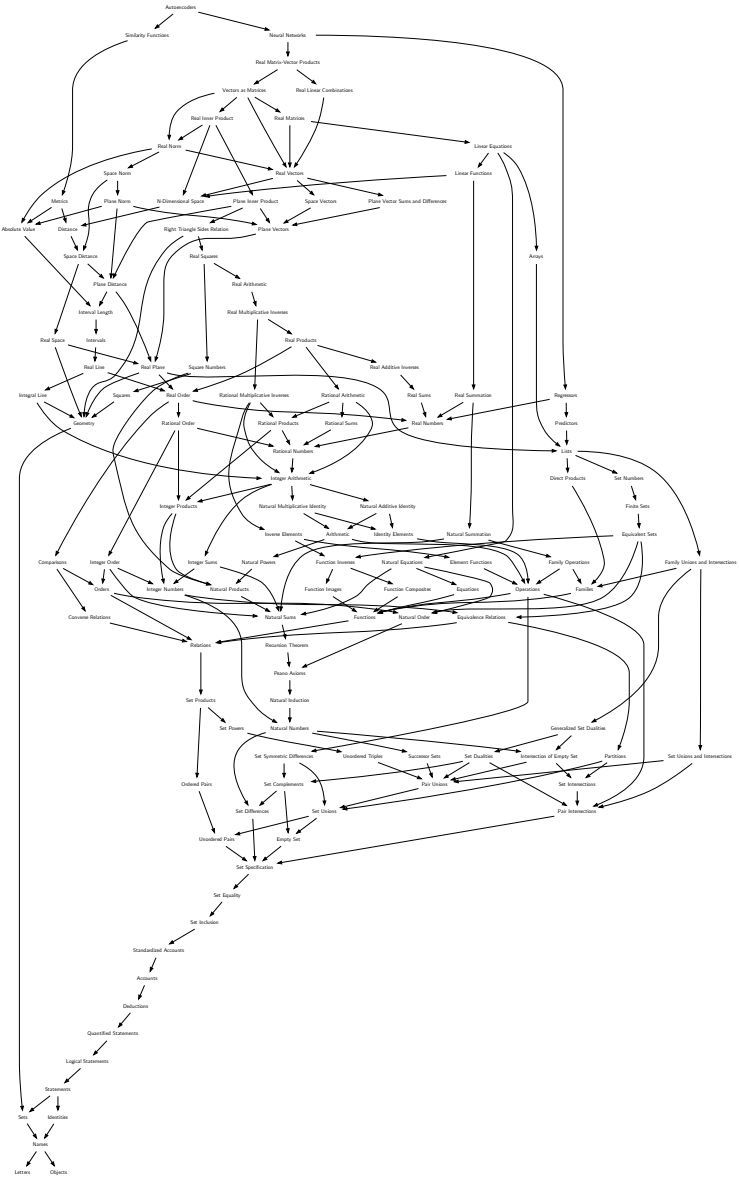
Let us relax our notion of perfect by introducing a similarity function $\ell : \mathbf{R}^d \times \mathbf{R}^d \to \mathbf{R}$ (see Similarity Functions). An autoencoder is optimal with respect to ℓ if it minimizes $\int_{\mathbf{R}^d} \ell(g(f(z)), z) dz$. This integral may diverge. Even if it converges 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.

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

[2] Future editions will continue.


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