Why

[1]

Definition

A sequence of functions $(g_1, \ldots, g_\ell)$ is *composable* if g_i is composible with g_{i-1} for $i = 2, \ldots, \ell$. In this case we write $g_\ell \circ g_{\ell-1} \circ \cdots \circ g_2 \circ g_1$. For example, we write $g_3 \circ g_2 \circ g_1$ for (g_1, g_2, g_3).

A *neural network* (or *feedforward neural network*) from $\mathbf{R}^n$ to $\mathbf{R}^m$ is a sequence of composable functions $(g_1, \ldots, g_\ell)$, $\operatorname{dom} g_1 = \mathbf{R}^n$, $\operatorname{ran} g_\ell \subset \mathbf{R}^m$, satisfying

$$g_i(\xi) = h_i(A_i\xi + b_i)$$

for some conforming matrices A_i, vectors b_i and functions h_i.

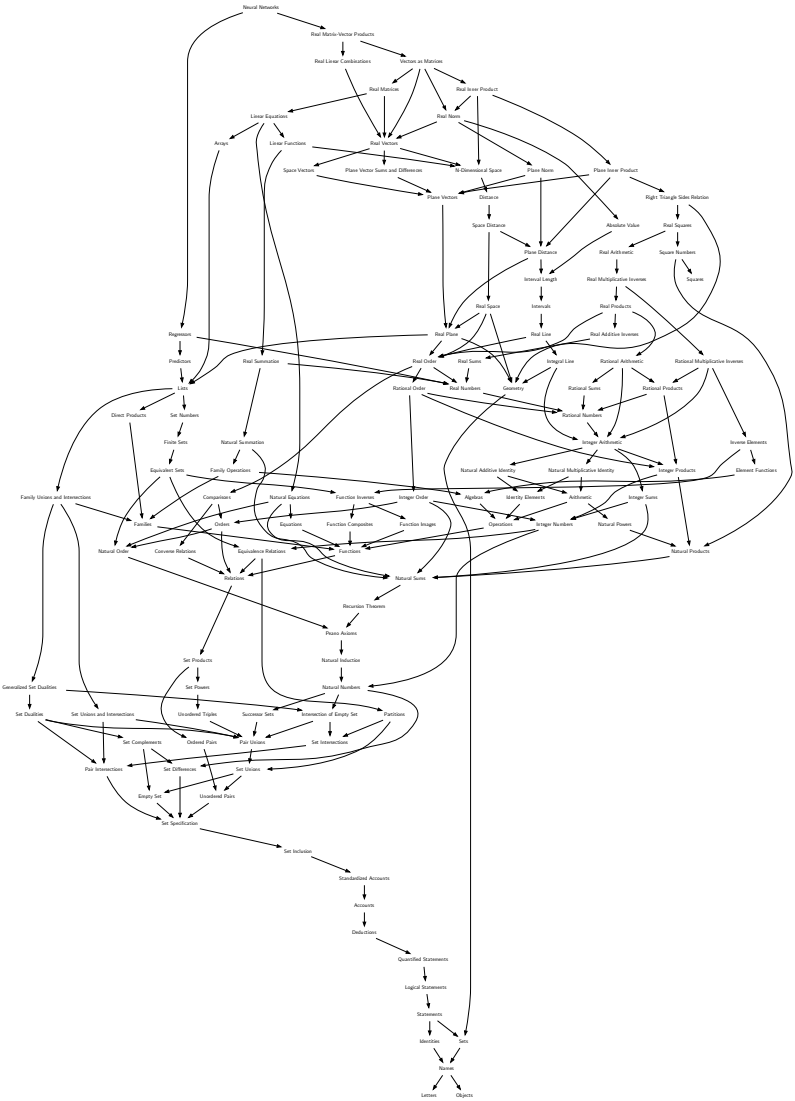
The ith *layer* of the neural network is the ith function g_i. The ith *activation* of the neural network is the function h_i. A *neural network* is called *deep* if its number of layers is larger than 3.

We call the composition of the layers of the neural network the *network predictor* (or just *predictor*). We also call it *the function* of the network.[2]

[1] Future editions will include. Future editions may change the name of this sheet to *computation networks*, or may add prerequisite sheet on computation graphs.

[2] Many authorities refer to a neural network as a function. Strictly speaking that is true for us, as well, since a sequence is a function. But the meaning of the common use is in reference to the *network predictor*.

A *multi-layer perceptron* (*MLP*) is a neural network with 2 layers (1 *hidden layer*) and for which A_i and b_i have unrestricted nonzero entries.


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