Why

[1]

Definition

Let X and Y be sets. A *hidden memory chain* (*hidden markov chain*, *hidden memory model*, *hidden markov model*[2], *HMM*) with *hiddens* (or *latents*) Y and *observations* Y of *length* n is a joint distribution $p : X^n \times Y^n \to [0,1]$ satisfying

$$p(x,y) = f(x)g(y_1,x_1)\prod_{i=1}^{n} h(x_i,x_{i-1})g(y_i,x_i),$$

where $f : X \to [0,1]$ is a distribution, and g and h are functions satisfying $g(\cdot,\xi)$ and $h(\cdot,\xi)$ are distributions on Y and X, respectively, for all $\xi \in X$.

Proposition 1. *p so defined is a distribution. The function f is the distribition p_1. For all $i = 1,\ldots,n$, $p_{n+1|i} \equiv gg$. For all $i = 2,\ldots,n$, $p_{i|i-1} \equiv h$.*[3]

Clearly, $p_{1,\ldots,n}$ is a memory chain (see Memory Chains). For this reason, we continue to refer to h as the *conditional distribution*. We continute to refer to f as the *initial distribution*. We refer to h as the *observation distribution*.

[1] Future editions will include.

[2] This term is universal. We avoid it because of the Bourbaki project's policy on naming. The skeptical reader will note (as in Memory Chains) that our term and this term have the same initials.

[3] Future editions will define everything needed in this proposition in the proposition statement, as ooposed to saying "p so defined".

The word "hidden" refers to the situation in which we observe outcomes y, and we hypothesize that they were "generated by" unobserved outcomes x.

Hidden Memory Chains
Memory Chains
Conditional Distributions
Conditional Event Probability
Marginal Distributions
Event Probabilities
Joint Distributions
Probability Distributions
Intervals
Real Line
Real Order
Real Summation
Real Numbers
Integral Line
Rational Numbers
Integer Arithmetic
Sequences
Natural Multiplicative Identity
Natural Additive Identity
Set Numbers
Direct Products
Identity Elements
Arithmetic
Natural Summation
Finite Sets
Integer Products
Natural Powers
Family Operations
Equivalent Sets
Set Operations
Comparisons
Natural Products
Algebras
Integer Sums
Function Inverses
Family Unions and Intersections
Orders
Operations
Integer Numbers
Natural Sums
Families
Function Composites
Function Images
Converse Relations
Equivalence Relations
Natural Order
Recursion Theorem
Functions
Relations
Peano Axioms
Natural Induction
Set Products
Uncertain Outcomes
Set Powers
Natural Numbers
Generalized Set Dualities
Set Symmetric Differences
Unordered Triples
Successor Sets
Set Dualities
Set Unions and Intersections
Intersection of Empty Set
Partitions
Ordered Pairs
Set Complements
Pair Unions
Set Intersections
Set Differences
Set Unions
Pair Intersections
Unordered Pairs
Empty Set
Geometry
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Sets
Identities
Names
Letters
Objects