James Dolan (1)

5/5/19

$X \in$

Finite set X "sample space"

$x_1, \dots, x_n \in X$

$p = \frac{1}{n}(\delta(x_1) + \dots \delta(x_n))$

$X_n = X^n/n!$ n-element multisets in X.

$\widetilde{Nat}^\times$: objects are $n \in \mathbb{N}^+$

morphisms $n \to m$ iff $m = kn$.

(Subsets of X possibility monad is set of possibility distributions)

$X \in \widetilde{FinSet}$

Multisubset of X

Multisubsets

Slice category $FinSet/X$

objects $\{\cdot \to X\}$

morphisms $\begin{array}{ccc} \cdot & \xrightarrow{f} & \cdot \\ & a \searrow \quad \swarrow b & \\ & X & \end{array}$

($\mathbb{N}$-vector space over X. $\mathbb{N}[x] = \{\sum x_i\}$)

Functor X_- : $\widetilde{Nat}^\times \to$ Fi-MultiSet

$n \mapsto X_n$

$k : n \to m \mapsto X_n \xrightarrow{\text{copy}} X_{nk}$

probability measures on X:

"$PX = \operatorname{colim}_{n \in Nat} X_n$"

$PX = \operatorname{colim} X_-$

Spans

$FinSet/X/Y \cong FinSet/X \times Y \cong FinSet/Y/X$

transpose

Grp Finite Groupoids (Baez Dolan, Feynman diagrams)

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(2) 5/5/19

Idempotent adjunction

Macquarie Uni PhD student
Hardy Hully ??

Free abstract convex sets on a set X
is an algebra for probability Bloch sphere monad.
is a non-free algebra for this monad
Classical statistics are free algebras.

Analogy between probability dist and presheaves.

Probability monad → (surjective) → Possibility distribution monad

forget $\{a_i\}$ remember $\{0\}\{>0\}$

Probability monad ↓ algebras: convex sets

Possibility distribution monad ↓ algebras: sup semilattices without bottom

unit ball of a Banach space has a zero & negatives

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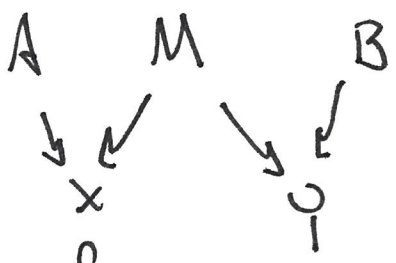
take X a ~~[illegible]~~ groupoid



Inverse of copy is division

take X with involution f

∞ fixed points

colimit of $X \circlearrowleft f$

is dividing by 2.

~~[illegible]~~

If f does have fixed points

take homotopy colimit

this is a genuine groupoid

the fixed points gain an involution

these become "half a point"

Groupoid cardinality

Analogy between

probability distributions

~

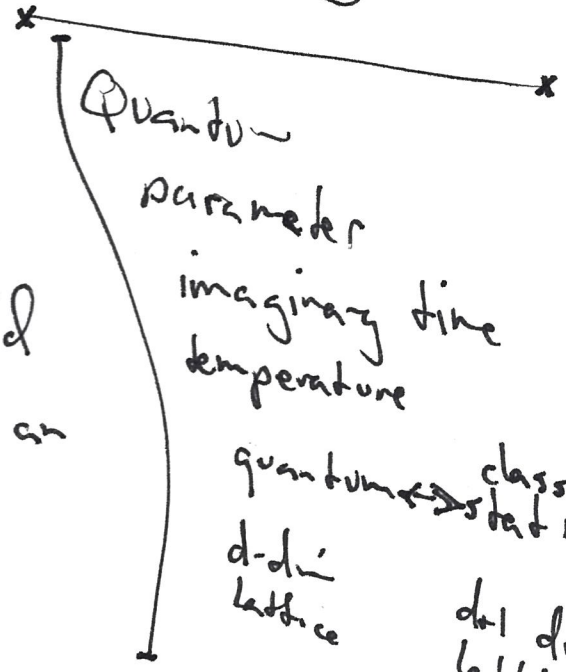
presheaves

Frequentist uses "random variables" $\leadsto$ multisubsets

Bayesian uses probability distributions.

colimit

categorification



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5/5/19

binomial coefficient

$\binom{n}{m}$

computational complexity

Entropy "work"

1) $W(a,b,c) = W(a,b) + W(a+b,c)$

$= W(b,c) + W(a,b+c)$

2) $W(ka, kb) = k\, W(a,b)$

Linear algebra over a ring (min, sum)

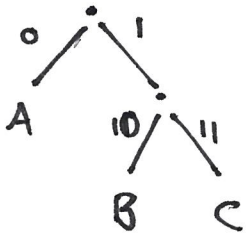
addition ↑ ↑ conjunction

Huffman encoding

compressing text files with measurable letter frequencies

$\{A, B, C\}$

$p = \frac{1}{2}\ \frac{1}{4}\ \frac{1}{4}$



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corpos:

{ABA,
BCAA,
CAA,
BC},

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online versus batch

dynamic versus static