AMS 131

4 Aug 17

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this time: conditional probability

next time: discrete & continuous random variables

read for next time: DS pp. 55 [redacted]-166

free app: KamScanner

if $p = P(A)$ then the odds in favor of A are $o = \frac{p}{1-p}$

$\leftrightarrow \quad p = \frac{o}{1+o}$

simulation (Monte Carlo) approach to approximating probabilities

Buffon (1720)

William Gosset (1905)

Metropolis & Ulam (1942) (1949)

pseudo-random numbers $\leftarrow$ von Neumann (1942)

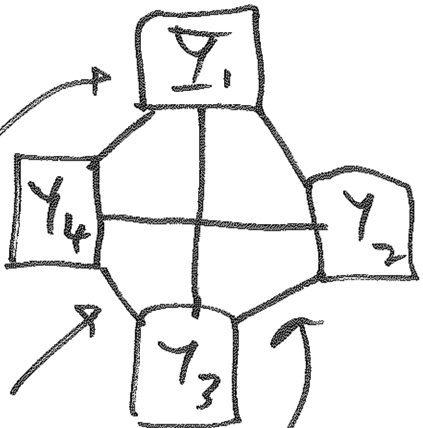
Feynman

Alan Turing (1940)

m = # of simulation replications

as $m \to \infty$ $\quad \hat{p}$ (Monte Carlo estimate) $\longrightarrow p$

(graph theory)



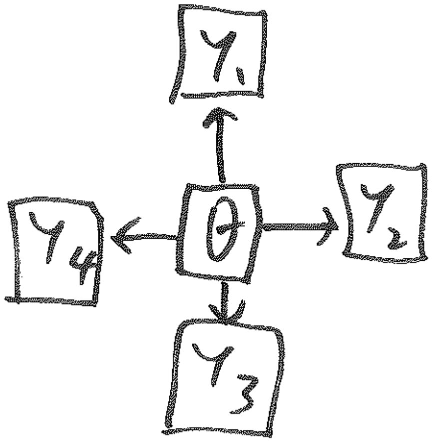
nodes

edge

$\boxed{Y_i \text{: dependent}}$

4 nodes

6 edges



5 nodes

4 edges

$x — y$

x & y are dependent

$x \rightarrow y$

x causes y

n nodes ← # data points

$\binom{n}{2}$ edges $= \dfrac{n(n-1)}{2}$

$= O(n^2)$

this is of order n^2

= Big "oh" of n^2

$(n+1)$ nodes

n edges $= O(n)$

now Y_i are conditionally independent given θ

$O(n^2)$ / in this model, the past and the future are conditionally independent given the truth (θ)

$$P(B_i \mid A) \overset{(\text{def})}{=} \frac{P(B_i \text{ and } A)}{P(A)}$$

$$P(A \mid B_i) \overset{(\text{def})}{=} \frac{P(A \text{ and } B_i)}{P(B_i)}$$

$$P(B_i \text{ and } A) = P(A)\,P(B_i \mid A)$$

mult by $P(A)$

$$\|\qquad\qquad\|$$

mult. by $P(B_i)$

$$P(A \text{ and } B_i) = P(B_i)\,P(A \mid B_i)$$

$$\therefore \quad P(A)\,P(B_i \mid A) = P(B_i)\,P(A \mid B_i)$$

$$\therefore \quad P(B_i \mid A) = \frac{P(B_i)\,P(A \mid B_i)}{P(A)}$$