L2 : randomness and Bayesian inference

continuing math topics...

(3) randomness :

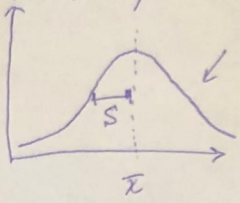
$x(t) = x_1(t) + x_2(t) + \cdots + x_n(t)$

↓ even more random!

random variables AND they are independent of each other, i.e uncorrelated

* Central limit theorem

P = probability



always Gaussian as $n \to \infty$

$\bar{x} = \bar{x}_1 + \bar{x}_2 + \cdots$ is the average

$S^2 = S_1^2 + S_2^2 + \cdots$ gives the standard deviation

(4) Bayesian inference

The statistics of "what if?"

example: coin toss { H T H T T H H H T H H T T H H H T T T T ... vs T T H H T T H H T T H H T T H H ...

will H happen if two Ts just happened?

Bayes' formula:

$P(A|B) = P(B|A) \cdot \frac{P(A)}{P(B)}$

$P(A|B)$: probability that A happens if B is true

$P(A)$: probability that A happens

Example of how to use IF = conditional probability

"Landa won 3 times out of 4 races against Hunt"

who do you bet on, what odds?

Let $P(B)$ be the chance Hunt wins.

$P(B) = 0.25$, so odds are 3:1 against Hunt and you bet on Landa!

WHAT IF Hunt drives better than Landa in rain. The 1 out of 4 times Hunt won, it rained. The forecast for race 5 is hard rain.

Now who do you favor?

Let A = "it rains" and B = "Hunt wins"

$P(B|A) = P(A|B) \cdot \frac{P(B)}{P(A)} = 1 \cdot \frac{0.25}{0.25} = 1$

↑ Hunt wins if it rains

↑ It rains if Hunt wins

$\Rightarrow$ BET on Hunt!

what if Hunt loses after all? Bayes can be updated:

$P(B|A) = 1 \cdot \frac{0.2}{0.4} = 0.5$

The odds are still even.

* The "Monty Hall" problem is a famous example in this topic.