Conditional probability

Thursday, 27 January 2022 12:35

$A = \{1, 2, 3\}. \to 1/2$

$B = \{2, 4, 6\} \to 1/3.$

$P(B) = 1.$

$P(A)$

Since 2 is the only Number from A in B

required Prob: $\frac{\#(A \cap B)}{\# B} = \frac{1}{3}$

M equally likely outcomes.

A & B are two events.

If we are given information That "B has happened"

What is the prob that A has

happened in the light of new knowledge?

$$\# A = k$$

$$\# B = n.$$

$$\# (A \cap B) = i$$

out of these n, $\#(A \cap B) = i$ outcomes belong to A.

$$P(A \cap B) = i/m.$$

$$P(B) = n/m.$$

$$P(A|B) = i/n.$$

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

$$P(A \cap B) = P(B) \cdot P(A|B)$$

$P(A \cap B) = P(B)\, P(\ldots)$

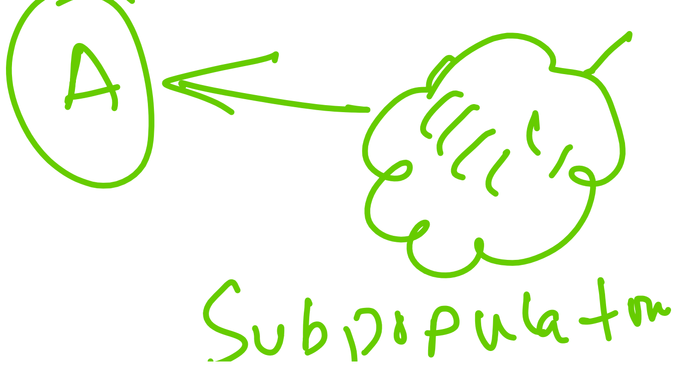
$$\boxed{P(A_1 \cap A_2 \cap \ldots A_n) = P(A_1)\,P(A_2|A_1)\ldots P(A_{n-1}|A_1\ldots A_{n-2}) \times P(A_n|A_1\ldots A_{n-1}).}$$

Product Rule:

- Seyfert like Spectra. (optical band)
  like quasars. (very luminous, bright sources of electromagnetic waves) high surface brightness.
- 10 % of galaxy population.
- have super-massive black holes.

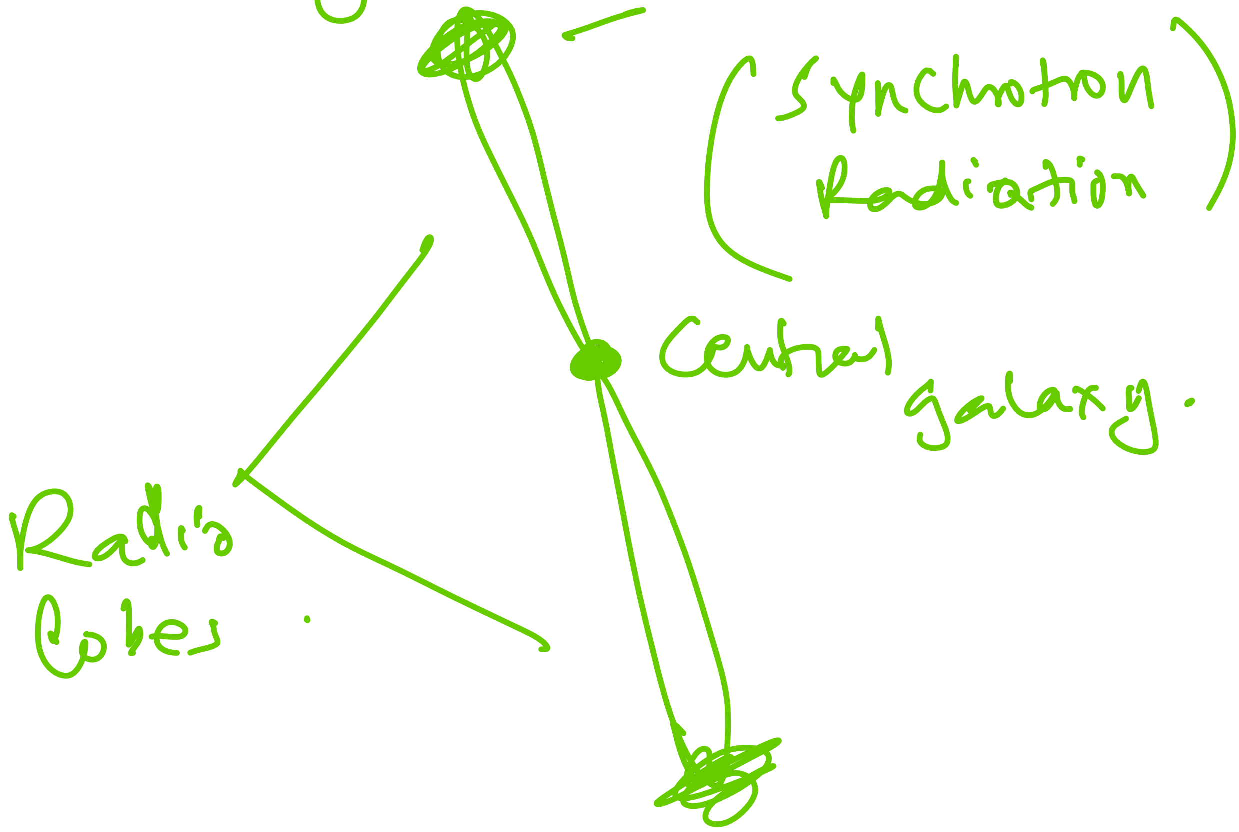
$\underbrace{}$

- Property A



Radio lobes of galaxies.

Radio galaxies



Baye's Theorem

let $B_1, \dots, B_n$ be the partition of the sample space Ω.

$B_i \cap B_j = \emptyset$

$\underbrace{B_i \cap B_j = \emptyset}_{\text{mutually exclusive sets.}}$

If A is any event in Ω

$$P(A) = P(A|B_1)P(B_1) + \cdots + P(A|B_k)\cdot P(B_k).$$

law of total probability.

$$P(A) = P(A \cap B_1) + \cdots + P(A \cap B_k).$$

$$P(A \cap B_i) = P(A|B_i)P(B_i).$$

Theorem:

If $B_1, B_2 \ldots B_k$ is a partition of the sample space then for $i = 1, \ldots k$

$$P(A|B_i)P(B_i)$$

$$P(B_i \mid A) = \frac{P(A \mid B_i)\,P(B_i)}{P(A \mid B_1)\,P(B_1) + \cdots + P(A \mid B_k)\,P(B_k)}$$

Data

Model (parameters : $\vec{\theta}$)

$P(\text{Data})$

$P(\text{Model}, \vec{\theta}) \rightarrow$ Prior.

$$\underbrace{P(\text{Data} \mid \text{Model}, \vec{\theta})}_{\text{likelihood function.}}$$