Mara Delesa - Velina

Course Admin

16 weeks

Test 1 week 9 } 40p.

Test 2 week 14 during lab }

4-5 HWs 20p

Exam Dec / Jan } 40p

Lectures prep in advance

Book

Gunar Bloom

euler number

irrational number

2,71828 ...

Point how to organise information

Why statistics ?

answear question

Reading

De

Deterministic vs Random models

D.m. - a phenomen approximated by a math function.

round table area

Random m. (stochastic, chance) in probability theory for describing random trials or experiments

number of people crossing bridge between 9am 9am on a weekday

Set theory - Events

Outcome - the result of a random trial denoted by $u_1, u_2 \ldots$

Sample space - the set of all possible outcomes Ω (omega)

Event - a collection of outcomes denoted by capital letters A, B...

Sample space interval $\Omega = [150, 220]$
(measure height)

Probability

Kolmogorov axioms

Axiom 1: if A is any event
then $0 \leq P(A) \leq 1$

Axiom 2: if Ω is entire sample
space, then $P(\Omega) = 1$

Axiom 3:
if event A and B are mutually exclusive
$P(A \cup B) = P(A) + P(B)$

Probability rules

1. $P(A^*) = 1 - P(A)$

2. $P(\emptyset) = 0$

3. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

4.

5.

$$P(A \cup B) \geq P(A) + P(B)$$

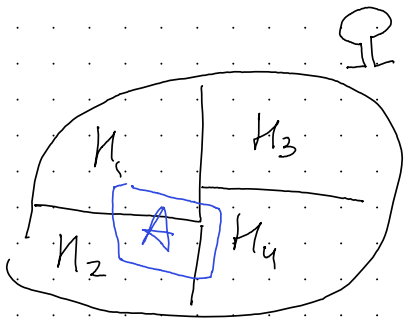
Conditional probability

$$P(B|A) = \frac{P(B \cap A)}{P(A)} \qquad P(A) \neq 0$$

Total Probability theorem

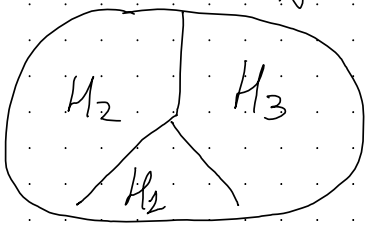
Theorem: if event $H_1, H_2 \dots H_n$ are mutually exclusive, have positive prob-s and together fill Ω completely, any event A satisfy the

$$P(A) = \sum_{i=1}^{n} P(H_i)\, P(A|H_i)$$



We took unit, we want to know A

A - unit is defective



$P(A) = 0.25 \cdot 0.05 + \dots$

$P(H_1)$ — produced by machine 1

$P(A|H_1)$ — defective given that produced by machine OR machine defective probability

Bayes' Theorem

$$P(H_i|A) = \frac{P(H_i)\,P(A|H_i)}{\sum_{j=1}^{n} P(H_j)\,P(A|H_j)}$$

$P(H_i \cap A)$

$P(A)$

true positive $P(+ \mid user)$ 90%
true negative $P(- \mid \text{not user})$ 80%
false positive $P(+ \mid \text{not user})$
+ test positive − test negative

user – person is drug user

Prob the person is user given test posit.

$P(user \mid +)$

$P(user) = 5\%$ prevalence (rate of drug users in the population)

$$P(user \mid +) = \frac{P(+ \mid user)\, P(user)}{P(+)} =$$

$$= \frac{P(+ \mid user)\, P(user)}{P(+ \mid user) P(user) + P(+ \mid \text{non user}) P(non\text{-}user)} =$$

$$= \frac{0.9 \times 0.05}{0.9 \times 0,05 + 0,20 \times 0,95} \simeq 19\%$$