ELEG 310 3/5/2019

Hypothesis Testing

H_1: alternative

H_0: null (normal)

Test: measure statistic X

typical test: decide for H_1 if $X > x_0$

else decide for H_0 if $X \le x_0$

False Alarm: decide for H_1 when H_0 is TRUE

Miss: decide for H_0 when H_1 is TRUE

Bayes Theorem

$$P(U=1 \mid X \geq x_0) = P(U=1 \mid T=1)$$

$$= \frac{P(T=1 \mid U=1)\, P(U=1)}{P(T=1)}$$

$$P(T=1) = P(T=1 \mid U=1)\, P(U=1) + P(T=1 \mid U=0)\, P(U=0)$$

let $p = P(U=1)$ $\quad P(T=1) = (1-\nu)p + \varepsilon(1-p)$

$\varepsilon = P(FP)$

$\nu = P(FN)$

Ex. $p = 0.01$ $\quad \varepsilon = \nu = 0.05$ $\quad P(U=0 \mid T=1) = 0.84$

Confusion Matrix

	U=1	U=0
T=1	TP	FP
T=0	FN	TN

Drug Test

T=1 decide user

T=0 decide not

U=1 is a user

U=0 is not a user

TP = true positive

FP = False Alarm

FN false negative

TN true negative

$P(TP) + P(FN) = 1$

$P(TN) + P(FP) = 1$

$P(TP)$ = TP rate

$P(TP) = P(X > x_0 \mid U=1)$

$P(FP) = P(X > x_0 \mid U=0)$

$P(TN) = P(X \leq x_0 \mid U=0)$

$P(FN) = P(X \leq x_0 \mid U=1)$

Chap 3 Combinatorics – Counting

Basic principle $\quad M$ objects $\quad N$ objects

Select 1 $\quad$ Select 1

then there are MN pairs

Ex. 4 objects $\quad a\ b\ c\ d \quad$ Select 2

aa	ab	ac	ad	← with replacement
ba	bb	bc	bd	← ordered $ab \neq ba$
ca	cb	cc	cd	
da	db	dc	dd	

	ab	ac	ad
ba		bc	bd
ca	cb		cd
da	db	dc	

ordered, w/o repl

aa	ab	ac	ad
	bb	bc	bd
		cc	cd
			dd

unordered, w/ repl

ab = ba

ab	ac	ad
	bc	bd
		cd

unordered w/o repl