2004-10-21

STATS 3N03 / 3J04 16-1

BIVARIATE PROBABILITY DISTRIBUTIONS - CORRELATION

RECALL: UNIVARIATE DISTRIBUTIONS

MODEL "POPULATION"

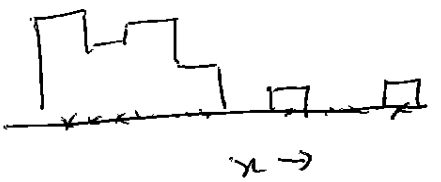
RANDOM VARIABLE X

DENSITY

DATA "SAMPLE"

OBSERVATIONS $(x_1, \ldots, x_n)$

HISTOGRAM



MEAN

$$\mu = \int_{-\infty}^{\infty} x f(x)\, dx$$

SAMPLE MEAN

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

VARIANCE

$$\sigma^2 = \int_{-\infty}^{\infty} (x-\mu)^2 f(x)\, dx$$

$$s^2 = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2$$

Ex $X, Y \sim IN(0,1)$ "INDEPENDENT"

"BIVARIATE STANDARD NORMAL"

$$f_X(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$$

$$f_Y(y) = \frac{1}{\sqrt{2\pi}} e^{-\frac{y^2}{2}}$$

$$f_{X,Y}(x,y) = f_X(x) f_Y(y)$$

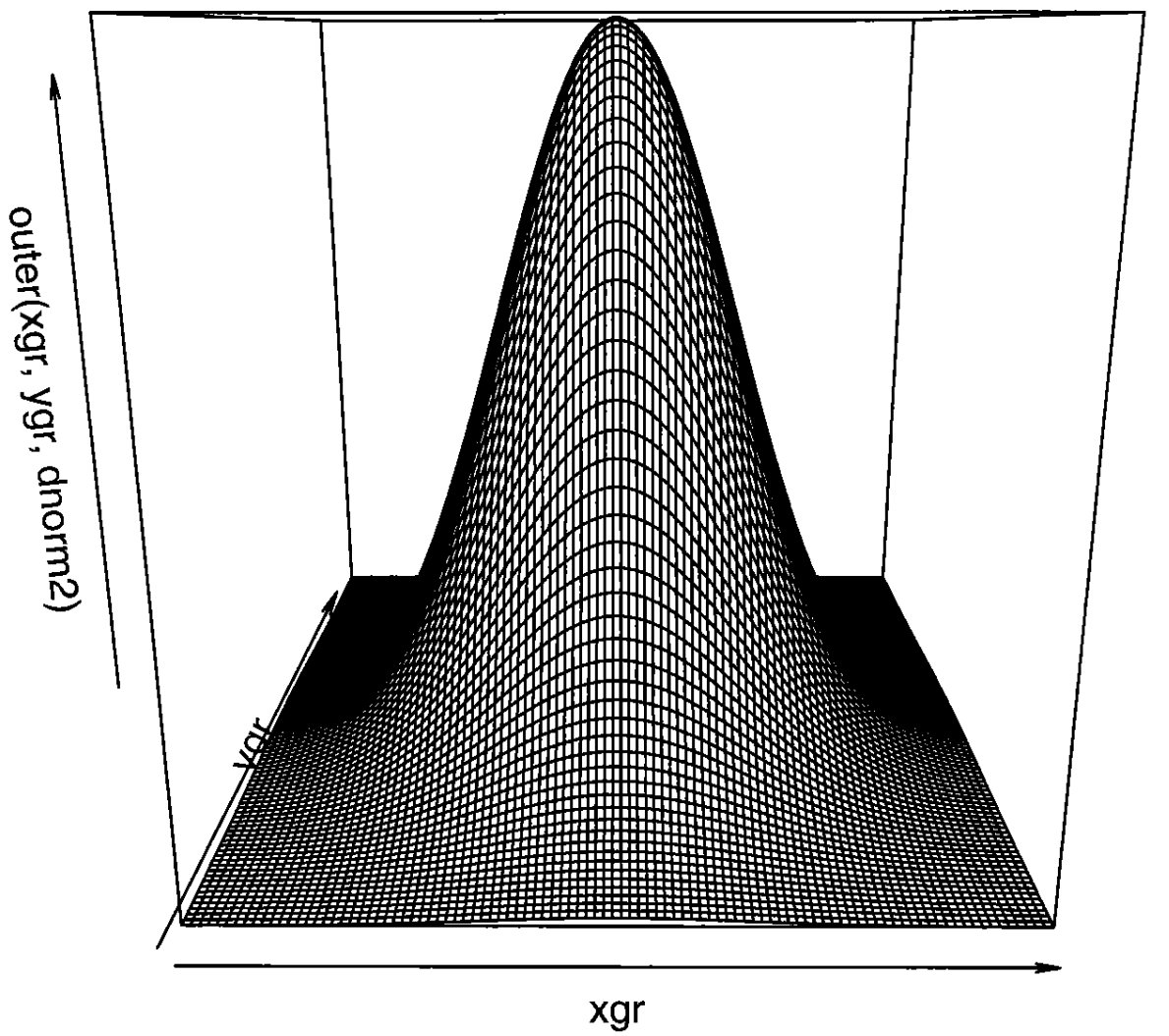
$$= \frac{1}{2\pi} e^{-\frac{1}{2}(x^2+y^2)}$$

```
> dnorm2 <- function(x,y) (1/(2*pi))*exp(-(x^2+y^2)/2)

> xgr <- seq(-3,3,length=100)

> ygr <- seq(-3,3,length=100)

> pdf("dnorm2.pdf")

> persp(xgr, ygr, outer(xgr,ygr,dnorm2))

> persp(xgr, ygr, outer(xgr,ygr,dnorm2), theta=20, ticktype="detailed",
xlab="x", ylab="y", zlab="density")

> persp(xgr, ygr, outer(xgr,ygr,dnorm2), theta=20, ticktype="detailed",
xlab="x", ylab="y", zlab="density", border=NA, shade=1)

> dev.off(3)
```

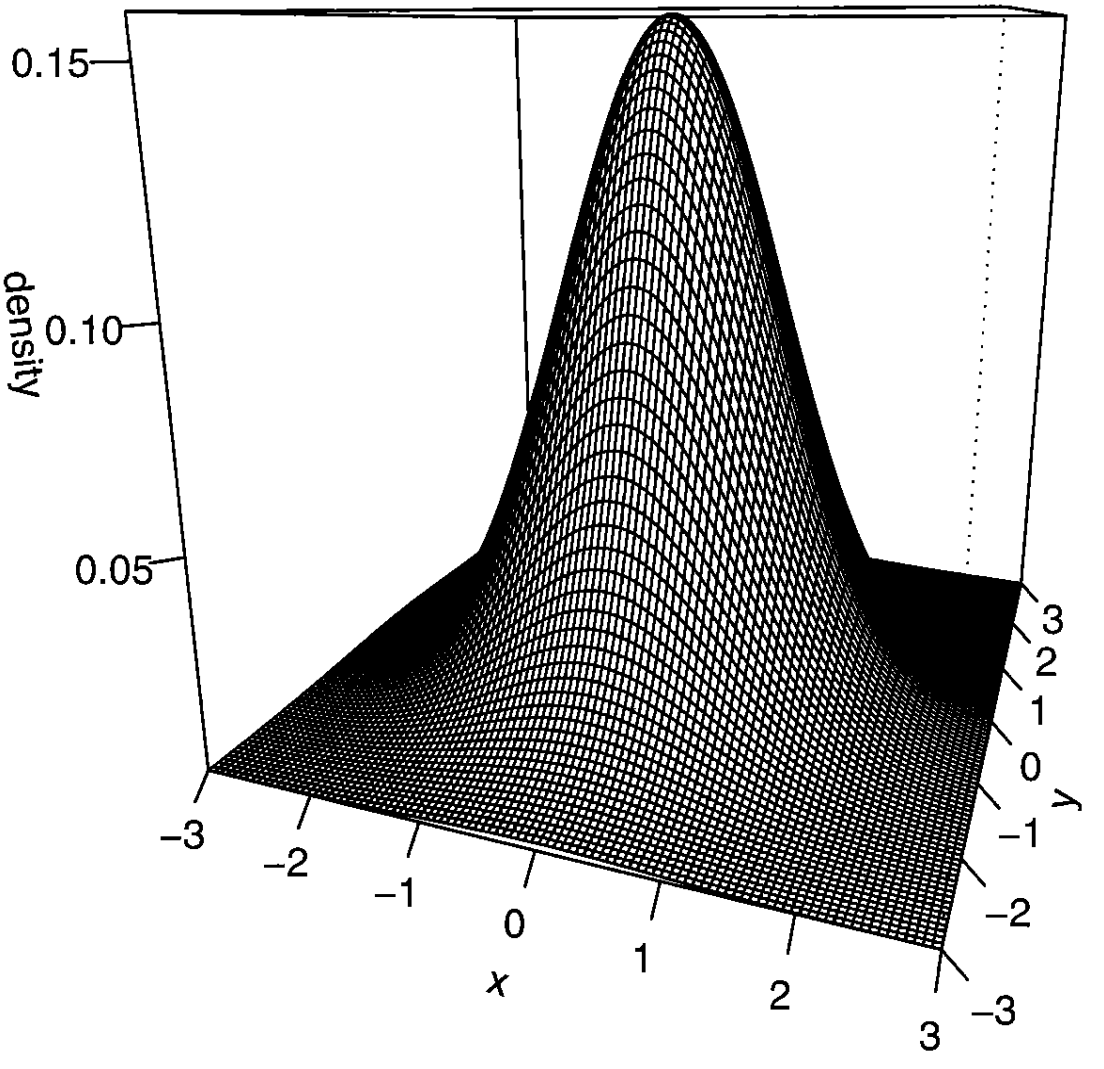
COMPUTE dnorm2 (x,y) AT EVERY POINT ON A 2-DIM GRID DEFINED BY xgr, ygr

16-3

16-4



16-5



16-6