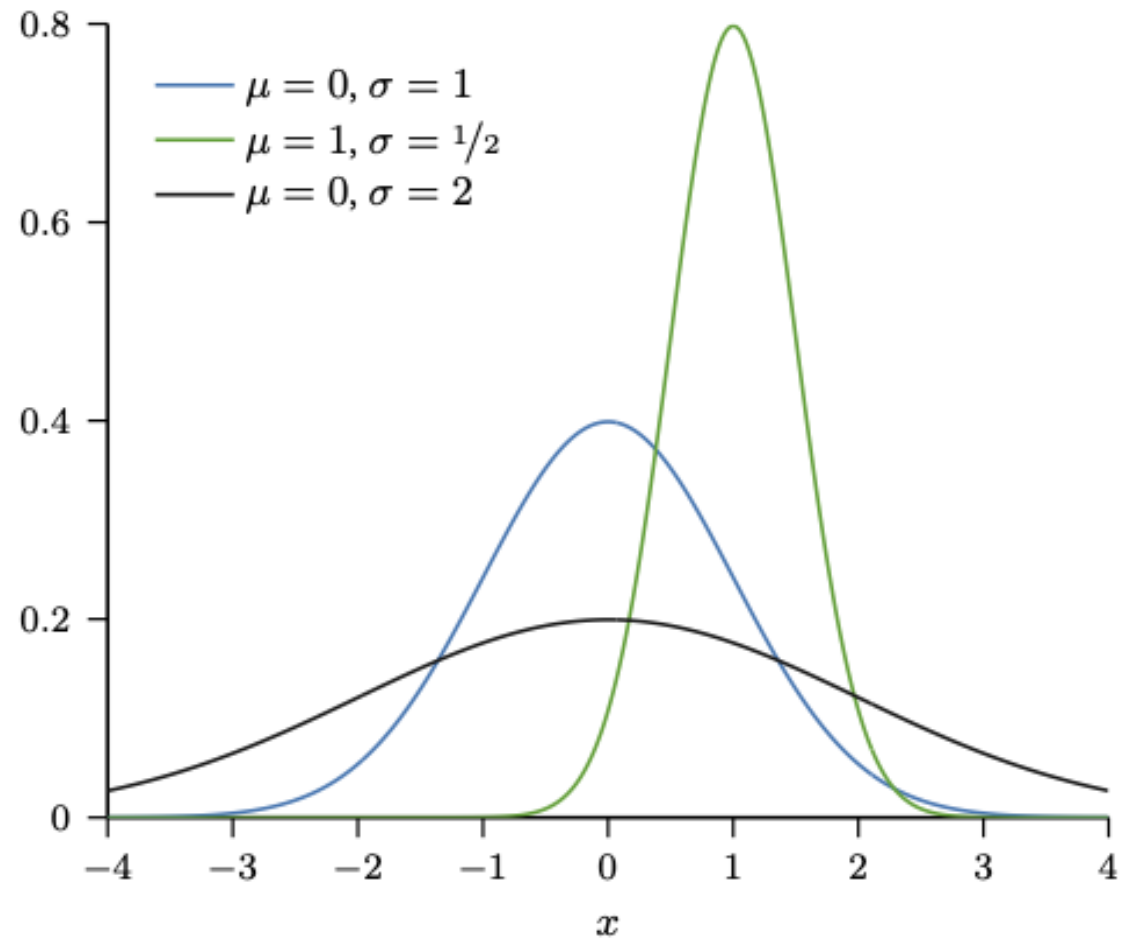# 10-424/624: Bayesian Methods in ML

Lecture 4: Supplement & Figures
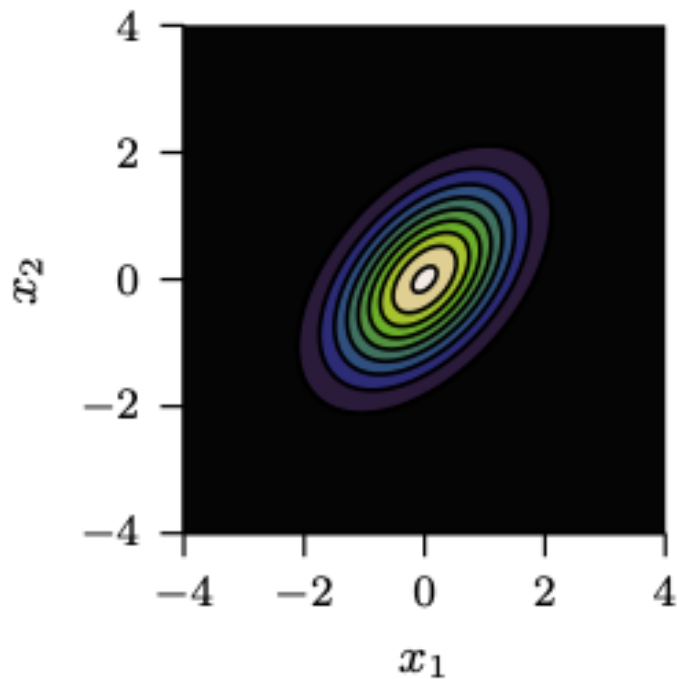
Henry Chai

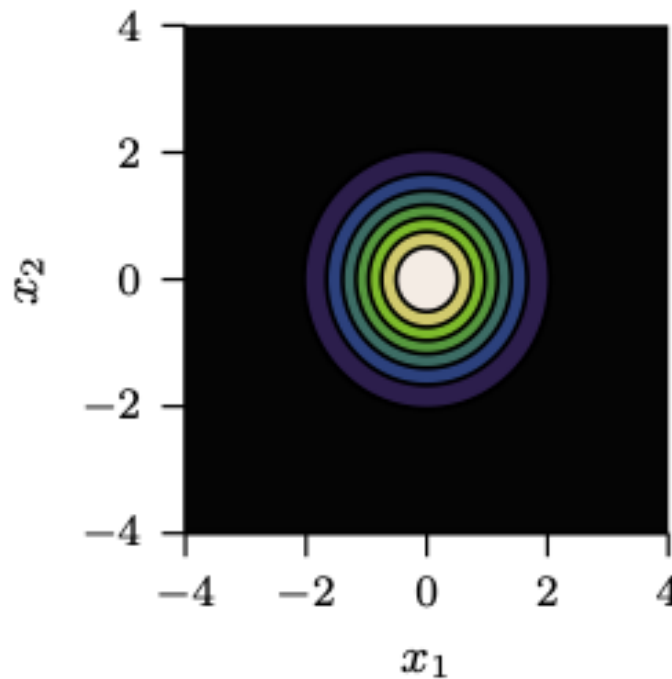1/23/25

Univariate Gaussian PDFs
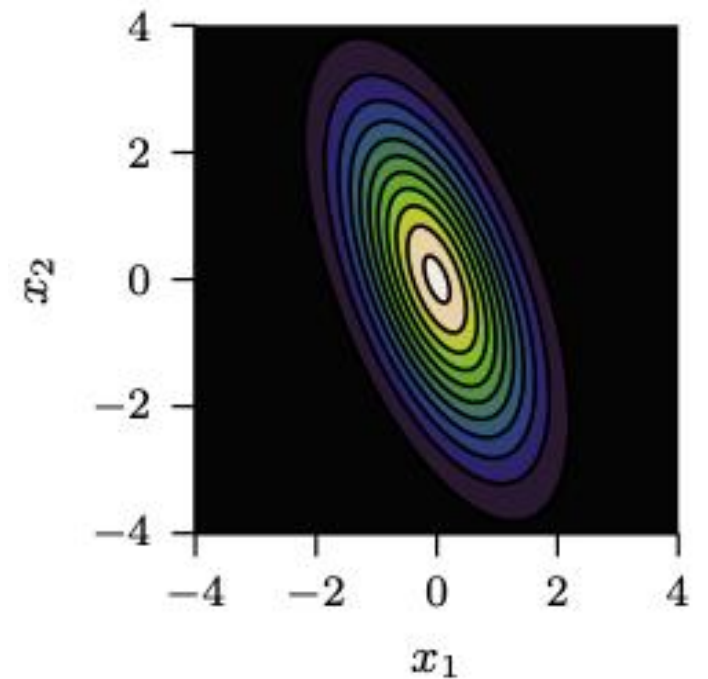

Examples of Gaussian probability density functions for the shown parameter value pairs

Legend:
- $\mu = 0, \sigma = 1$
- $\mu = 1, \sigma = \frac{1}{2}$
- $\mu = 0, \sigma = 2$

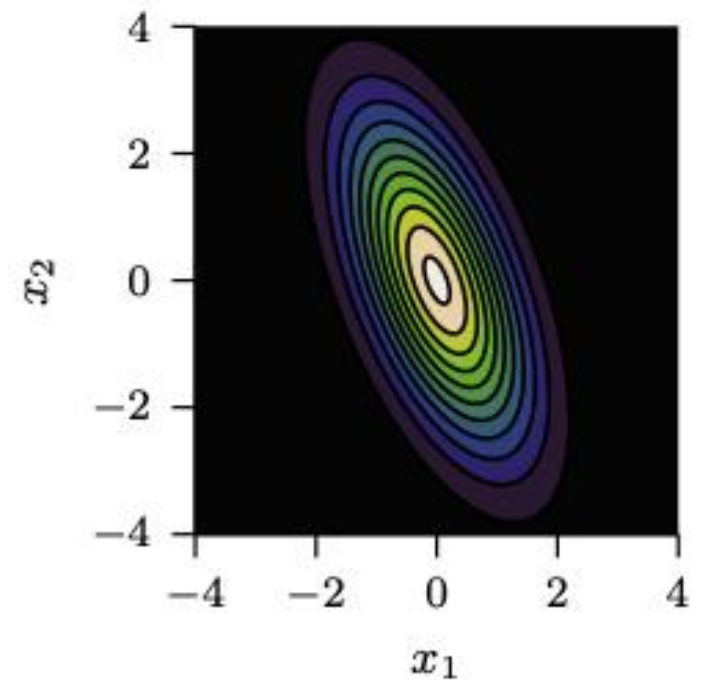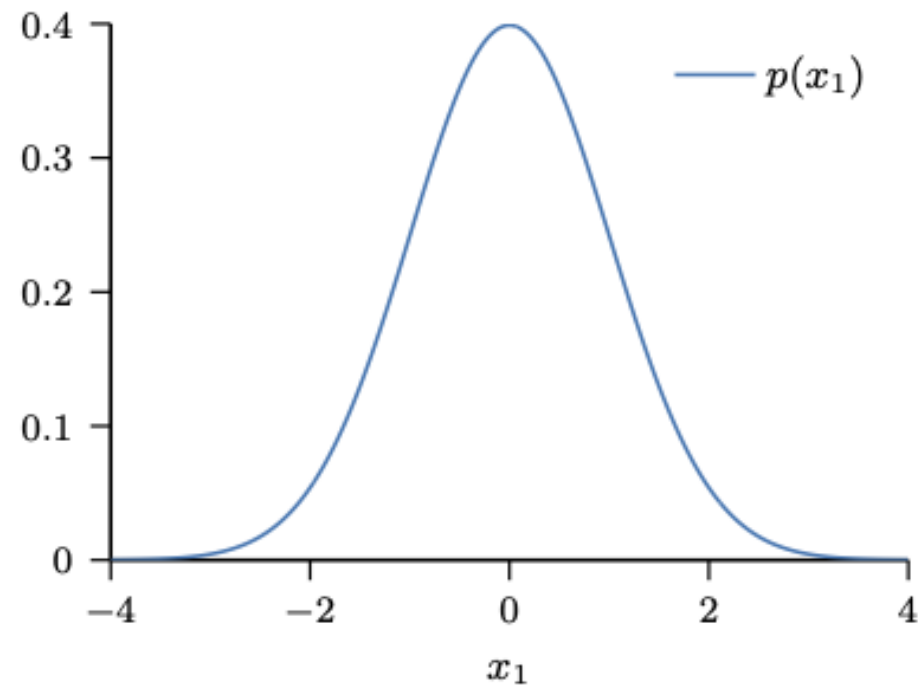$$\Sigma = \begin{bmatrix} 1 & 1/2 \\ 1/2 & 1 \end{bmatrix} \qquad \Sigma = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \qquad \Sigma = \begin{bmatrix} 1 & -1 \\ -1 & 3 \end{bmatrix}$$

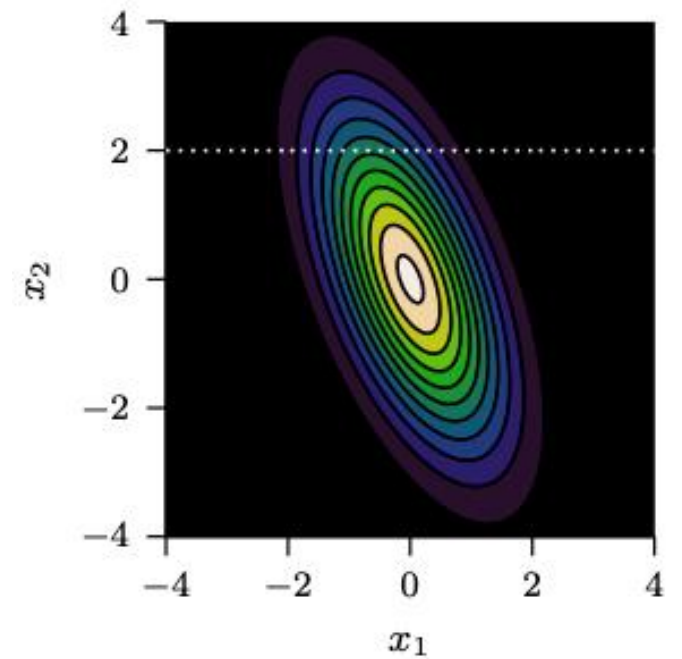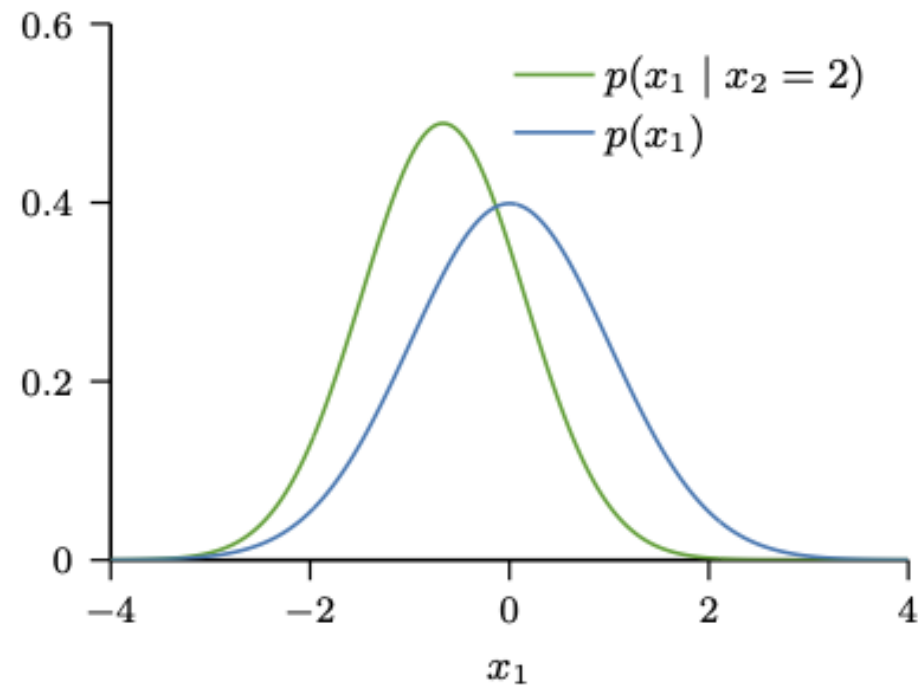Examples of zero-mean Gaussians for the shown covariance matrices

2-dimensional Gaussian PDFs

$$\Sigma = \begin{bmatrix} 1 & -1 \\ -1 & 3 \end{bmatrix}$$

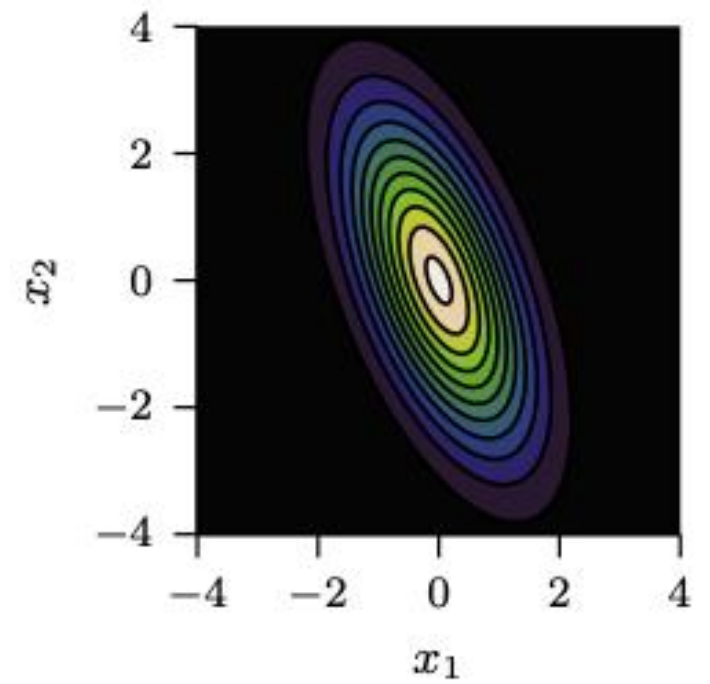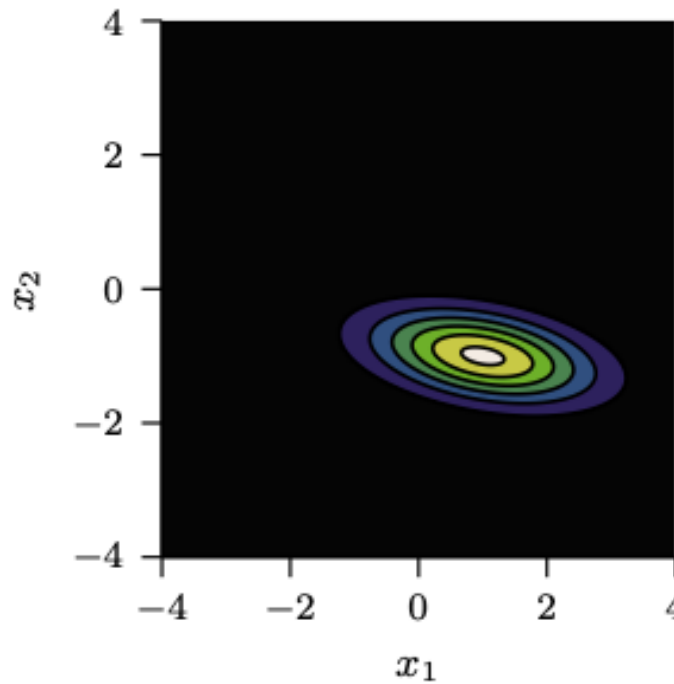Marginal distribution of x_1 for the shown 2-dimensional Gaussian

Closure under Marginalization

$$\Sigma = \begin{bmatrix} 1 & -1 \\ -1 & 3 \end{bmatrix}$$

Condition distribution of x_1 given $x_2 = 2$ for the shown 2-dimensional Gaussian

Closure under Conditioning

Transformation of the shown 2-dimensional Gaussian,

$\boldsymbol{y} = A\boldsymbol{x} + \boldsymbol{b}$ where $A = \begin{bmatrix} 1/5 & -3/5 \\ 1/2 & 3/10 \end{bmatrix}$ and $\boldsymbol{b} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

$\Sigma = \begin{bmatrix} 1 & -1 \\ -1 & 3 \end{bmatrix}$

Closure under Affine Transformation