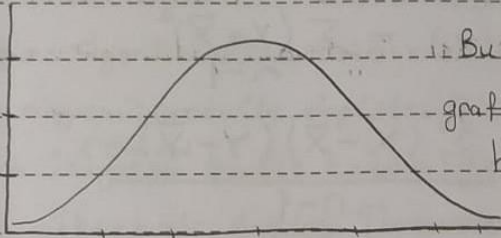


Multivariate Gaussian Distribution

Gök Kısa bir hatırlatma;



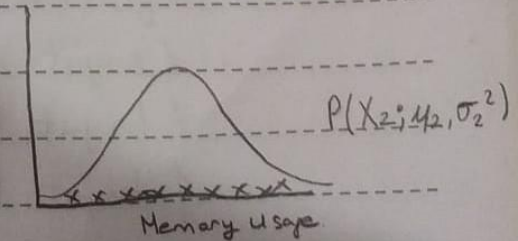
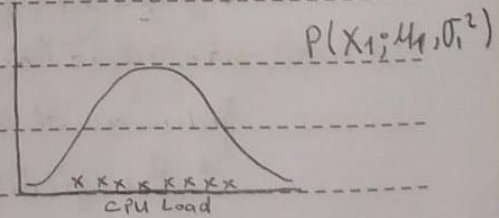
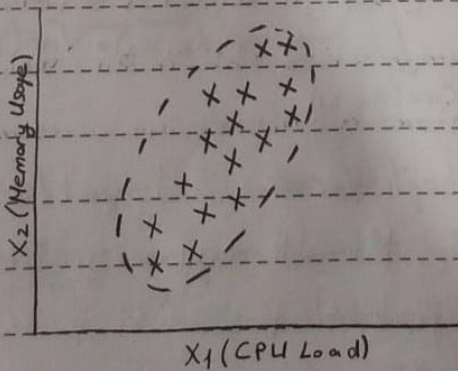
Bu şekil normal dağılım grafiğidir. Ve aşağıdaki formülle hesaplanır.

$$f(x|\mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Bu formül aynı zamanda Gauss dağılımın, olasılık yoğunluk fonksiyonu (pdf) olarak geçmektedir.

Multivariate Distribution

Describes the probabilities for a group of continuous random variables, particularly if the individual variables follow a normal distribution. Each variable has its own Mean and Variance. The strength of the relationship between variables (Correlation) is very important.



Don't model $p(x_1)$, $p(x_2)$, ..., etc. separately.

Model $p(x)$ all in one \Rightarrow Multivariate Normal Dist.

parameters: $\mu \in \mathbb{R}^n$, $\Sigma \in \mathbb{R}^{n \times n}$ (covariance matrix)

$\Sigma \rightarrow$ Covariance matrix.

$$\text{Cov}(x_1, x_1) = \text{Var}(x_1) = \frac{\sum (x - \bar{x})^2}{n-1}$$

$$\text{Cov}(x, y) = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{n-1}$$

$$\Sigma = \begin{bmatrix} \text{Cov}(x, x) & \text{Cov}(x, y) \\ \text{Cov}(y, x) & \text{Cov}(y, y) \end{bmatrix}$$

\hookrightarrow Covariance matrix

Multivariate Gaussian (Normal) Distribution

\hookrightarrow Çok boyutlu ve 2 veya daha fazla değişken

içerir. 2 değişken içermesi bivariate olarak da anılır.

ÖR₇

$$\mu = \begin{bmatrix} 0 \\ 0.5 \end{bmatrix}; \Sigma = \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix}$$

Annotations for Σ :

- $\text{Cov}(x_1, x_1) = \text{Var}(x_1)$ (top-left element)
- $\text{Cov}(x_1, x_2)$ (top-right element)
- $\text{Cov}(x_2, x_2) = \text{Var}(x_2)$ (bottom-right element)
- $\text{Cov}(x_2, x_1)$ (bottom-left element)

\hookrightarrow Bu girdilere bağlı olarak 3 boyutlu 2 değişkene sahip Normal dağılan grafik çizilir

1 boyut x_1 değişkeni

1 boyut x_2 değişkeni

1 boyut Probability Density ($p(x)$)