Multivariate Normal Distribution

Also called **Multivariate Gaussian Distribution** which just a generalization of the **one-dimensional normal distribution**, It models **joint Distributions** of multiple continuous X variables :

$$\frac{1}{(2\pi)^{d/2}|\Sigma|^{1/2}}e^{\frac{-1}{2}(X-\mu)^T\Sigma^{-1}(X-\mu)}$$

- d is the dimension of the vectors
- Σ the covariance matrix **generalization** of σ^2 the variance, its consist of the **Covariances and Variances** of the predictors X
- We take the **determinant** of Σ cause it gives us the factor by which arrays are scaled by this **Covariance Matrix**
- $X^TX = \text{Scalar value}$
- Σ^{-1} cause in the **one-dim** normal distribution we divide by $\frac{1}{2\sigma^2}$
- μ is a vector of the expected values for each X_i