Multivariate Central Limit Theorem

Le $\underline{X}_1, \underline{X}_2, \ldots, \underline{X}_n$ be a sequence of iid random vectors with common mean $\underline{\mu}$ and covariance matrix $\underline{\underline{\Sigma}}$ (positive definite).

The sample mean is defined as:

$$\overline{\underline{X}}_n = \frac{1}{n} \sum_{i=1}^{n} \underline{X}_i$$

Then we have that:

$$\sqrt{n}\left(\overline{\underline{X}}_n - \underline{\mu}\right) \xrightarrow{d} N\left(\underline{0}, \underline{\underline{\Sigma}}\right)$$

The multivariate CLT generalizes the CLT to the case of random vectors.