One and two sample hotelling T^2-test

Multivariate Statistic

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Hypothesis Testing on μ
One-sample

Assumptions

- Obs. IID
- MVN distributed

Hypothesis

$$H_0 : \mu = \mu_0$$
$$H_1 : \mu \neq \mu_0$$

$$T_0^2 = (\bar{x} - \mu_0)\left(\frac{S^2}{n}\right)^{-1}(\bar{x} - \mu_0) \sim \frac{p(n-1)}{n-p}F_{p,n-p}$$

Hypothesis Testing on μ
One-sample

Hypothesis

$$H_0 : \mu = \mu_0$$
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$$T_0^2 = (\bar{X} - \mu_0) \left(\frac{S^2}{n} \right)^{-1} (\bar{X} - \mu_0) \sim \frac{p(n-1)}{n-p} F_{p,n-p}$$

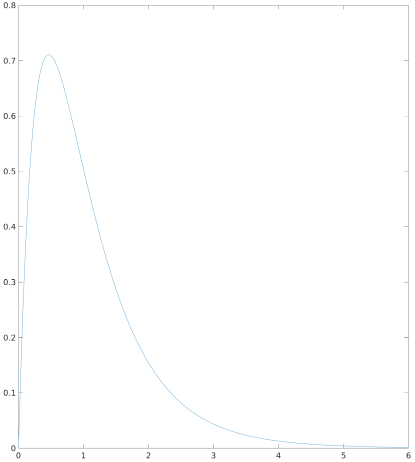
$$t_0^2 > \frac{p(n-1)}{n-p} F_{p,n-p,\alpha}$$

Reject

$$P(F_{p,n-p} > \frac{n-p}{p(n-1)} t_0^2)$$

Hypothesis Testing on μ

One-sample



Hypothesis Testing on μ
Two-sample

Assumptions.

Model:

- Pair wise observations. X and Y.

Difference model:

- $D = (X - Y) \sim N(\mu_D, \Sigma_D)$

Hypothesis

$$H_0 : \mu_D = \delta$$
$$H_1 : \mu_D \neq \delta$$

- Equal Σ

$$S_p = \frac{(n_1 - 1)\, S_1 + (n_2 - 1)\, S_2}{(n_1 - 1) + (n_2 - 1)}.$$

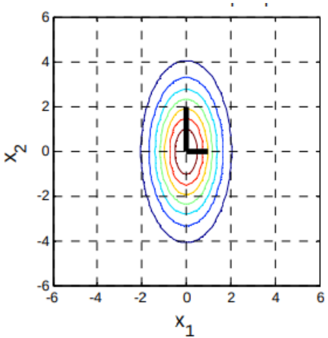
- Unequal Σ

$$T^2 = \left(\bar{D} - \delta\right)^T \left(\frac{S_1}{n_1} + \frac{S_2}{n_2}\right) \left(\bar{D} - \delta\right).$$

Confidence regions
subtitle

Confidence region for δ

$$\forall \delta \in \mathbb{R}^P : \left(\bar{D} - \delta\right)^T \left(\frac{S_d}{n}\right)^{-1} \left(\bar{D} - \delta\right) < \frac{p\,(n-1)}{n-p} F_{p,n-p,\alpha}.$$



Bartlett test
subtitle

Hypothesis:

$$\begin{aligned} H_0 &: \Sigma_X = \Sigma_Y \\ H_1 &: \Sigma_X \neq \Sigma_Y \end{aligned}.$$