

Power of Wald test for interaction

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If we consider using Wald test to test the null hypothesis $H_0 : \theta = \theta_0$, the test statistic will be

$$\sqrt{\frac{n}{I^{-1}(\hat{\theta})}}(\hat{\theta} - \theta_0)$$

where $\hat{\theta}$ is the MLE of θ and $I^{-1}(\hat{\theta})$ is inverse of the fisher information evaluated at the MLE.

Under null hypothesis, this test statistic follows a standard normal distribution. If the alternative hypothesis $H_a : \theta = \theta_1 \neq \theta_0$, then the power of our test can be computed as:

$$1 - \Phi(\Delta + z_{\alpha/2}) + \Phi(\Delta - z_{\alpha/2})$$

where $\Delta = \sqrt{nI(\theta_1)}(\theta_0 - \theta_1)$.

The important information above is that the power of Wald test will depend on several things at the same time:

- The difference of $\theta_0 - \theta_1$
- The sample size n
- The **true** information $I(\theta_1)$