WenQuanYi Micro Hei WenQuanYi Micro Hei WenQuanYi Micro Hei Mono

# AB Testing

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June 28, 2016

## Contents



## 1 AB Test

- $H_0$: NULL hypothesis,
  - a particular treatment has no effect
  - there is no difference between the controlled(version A) and treatment(version B) group
- $H_1$: alternative hypothesis
- Type I Error, False Positive, $P(\hat{H_1}|H_0 \text{ is true}), \alpha$, believing a lie, false alarm,
- type II error, Flase Negative, $P(\hat{H_0}|H_1 \text{ is true}), \beta$, faling to raise an alarm
- Power: $1 - \beta$
- Recall: $\frac{TP}{TP+FN}$
- Precision: $\frac{TP}{TP+FP}$

  A random sample of $n$ observations $X_i, i = 1, 2, \cdots, n$ is taken from a normal populatoni with mean $\mu$ and variance $\sigma^2$.
  - sample mean $\bar{X} = \sum_{i=1}^{n} X_i$
  - sample variance $\bar{X}$

## 2 Sample Size

### 2.1 Hypothesis

- Control Group: $X_0 \sim (\mu_0, \sigma_0^2) \Longrightarrow \bar{X_0} \sim N(\mu_0, \frac{\sigma_0^2}{n_0})$
- Treatment Group: $X_1 \sim (\mu_1, \sigma_1^2) \Longrightarrow \bar{X_1} \sim N(\mu_1, \frac{\sigma_1^2}{n_1})$

- $H_0 : \mu_1 - \mu_0 = 0$
- $H_1 : \mu_1 - \mu_0 = \delta \neq 0$
- $n_0 = n_1 = n$

Then,

$$0 + z_{1-\frac{\alpha}{2}}\sqrt{\frac{\sigma_0^2}{n} + \frac{\sigma_1^2}{n}} = \delta - z_{1-\beta}\sqrt{\frac{\sigma_0^2}{n} + \frac{\sigma_1^2}{n}} n = \frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2(\sigma_0^2 + \sigma_1^2)}{\delta^2} \tag{1}$$