Wald tests

Proof: asymptotic distribution of the MLE

Wald tests for single parameters

Logistic regression model for the dengue data:

$$Y_i \sim Bernoulli(p_i)$$

$$\log\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 WBC_i + \beta_2 PLT_i$$

Researchers want to know if there is a relationship between white blood cell count and the probability a patient has dengue, after accounting for platelet count. What hypotheses should the researchers test?

Wald tests for single parameters

```
m1 <- glm(Dengue ~ WBC + PLT, data = dengue,
          family = binomial)
summary(m1)
```

```
...
##                Estimate Std. Error z value Pr(>|z|)
## (Intercept)  2.6415063  0.1213233   21.77   <2e-16 ***
## WBC         -0.2892904  0.0134349  -21.53   <2e-16 ***
## PLT         -0.0065615  0.0005932  -11.06   <2e-16 ***
## ---
...
```

Wald tests for multiple parameters

Logistic regression model for the dengue data:

$$Y_i \sim Bernoulli(p_i)$$

$$\log\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 WBC_i + \beta_2 PLT_i$$

Researchers want to know if there is any relationship between white blood cell count or platelet count, and the probability a patient has dengue. What hypotheses should they test?

Wald tests for multiple parameters

```
m1 <- glm(Dengue ~ WBC + PLT, data = dengue,
          family = binomial)
summary(m1)
```

```
...
##                Estimate Std. Error z value Pr(>|z|)
## (Intercept)  2.6415063  0.1213233   21.77   <2e-16 ***
## WBC         -0.2892904  0.0134349  -21.53   <2e-16 ***
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## ---
...
```

Can the researchers test their hypotheses using this output?

Wald tests for multiple parameters

Class activity

https://sta712-f22.github.io/class_activities/ca_lecture_10.html

➕ Wald tests for the dengue data