

# Regression Analysis

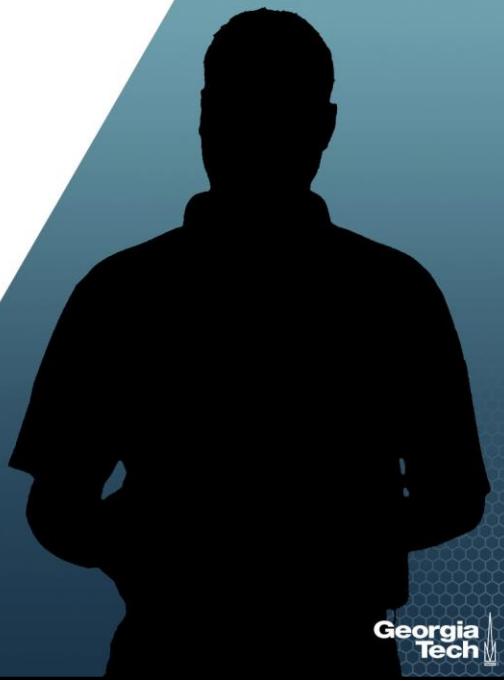
## Logistic Regression

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Model Estimation: Data Example



## About This Lesson



# Data Example: Smoking

- Between 1972 and 1974, a survey was taken in Whickham, a mixed urban and rural district near Newcastle upon Tyne, United Kingdom.
  - Among the information obtained originally was whether a person was a smoker or not.
- Twenty years later a follow-up study was conducted.
  - 76.12% of the 582 smokers were still alive, while only 68.58% of 732 nonsmokers were still alive.

Smokers had a higher survival rate than nonsmokers!  
Call Philip Morris, smoking leads to a longer life span!

Acknowledgement: This example was provided by Dr. Jeffrey Simonoff from New York University.



# Data Example in R

**Data:**  $Y_i$  binary responses  $\sim \text{Binomial}(p_i, n_i)$

- $Y_i$  number of people at risk who survived (Survived)
- $n_i$  number of people at risk (At.risk)

**## Fit a logistic regression model**

```
smoke1 = glm(Survived/At.risk ~ Smoker, weights=At.risk, family=binomial)
summary(smoke1)
```

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	0.78052	0.07962	9.803	< 2e-16 ***
Smoker	0.37858	0.12566	3.013	0.00259 **

$\hat{\beta}_{\text{smoker}} = 0.378$ : The log odds of survival increases by 0.378 for smokers versus non-smokers OR the odds of survival are 46% higher for smokers than for non-smokers (the odds ratio is 1.459).



# Data Example in R

**## Fit a logistic regression model**

```
smoke2 = glm(Survived/At.risk ~ Smoker + Age, weights=At.risk, family=binomial)
```

```
summary(smoke2)
```

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	7.785001	0.454999	17.110	<2e-16 ***
Smoker	-0.240831	0.167885	-1.435	0.151
Age	-0.127419	0.007397	-17.227	<2e-16 ***

$\hat{\beta}_{smoker} = -0.24$  The odds of survival is 27.2% higher for non-smokers than for smokers (odds ratio for non-smokers versus smokers is  $1/\exp(-0.24) = 1.272$ ).



## Summary

