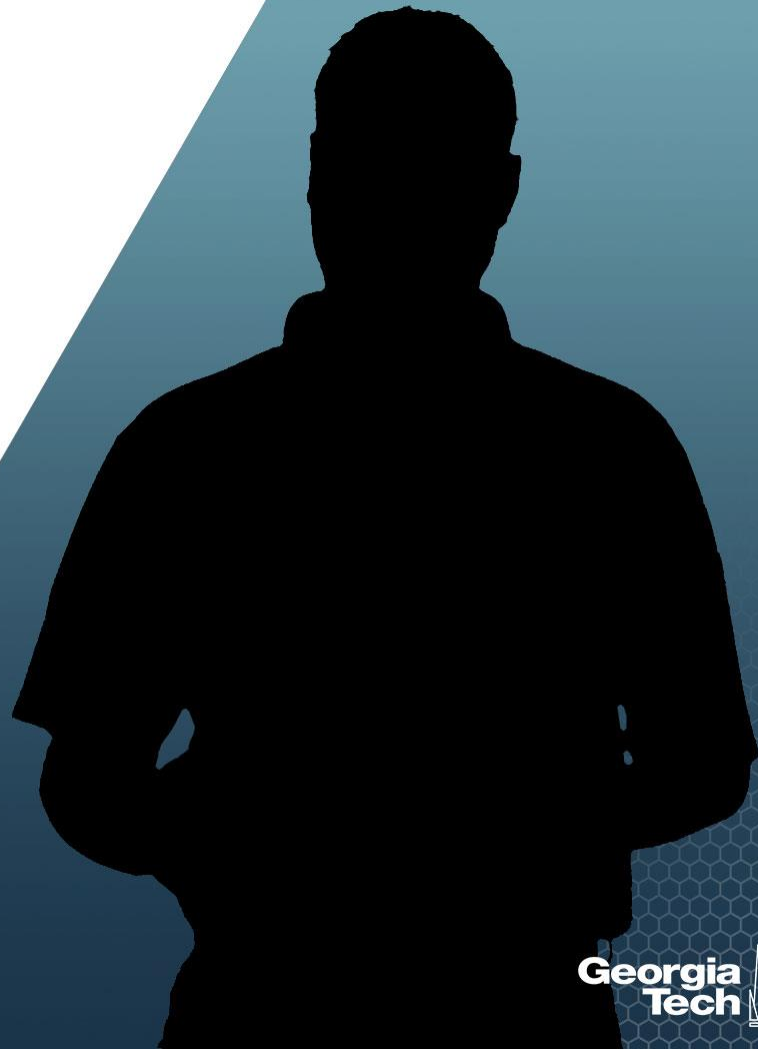# Regression Analysis
Simple Linear Regression

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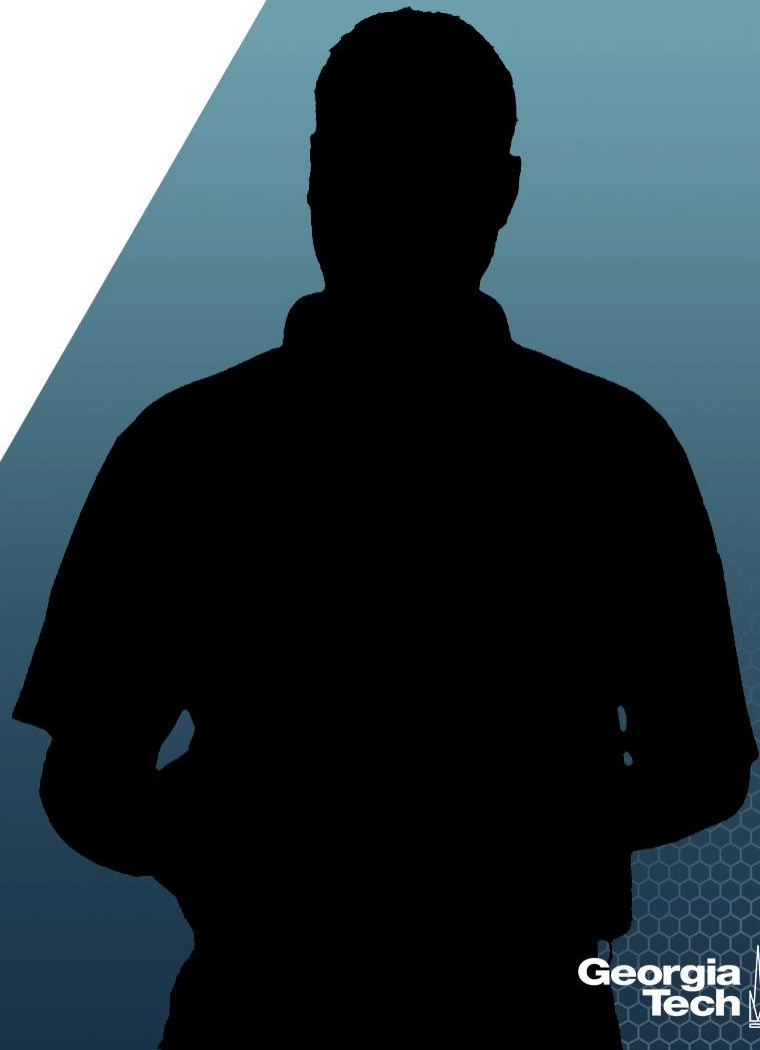
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Regression Concepts:

Statistical Inference Examples

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About This Lesson

Linear Regression: Example in R

A company, which sells medical supplies to hospitals, clinics, and doctor's offices, had considered the effectiveness of a new advertising program.

Management wants to know if the advertisement is related to sales. This company intends to increase the sales with an effective advertising program.

What inferences can be made on the regression coefficients?

Example in R: Inference

a. What is the estimate of the coefficient β_1 and its variance? What is its sampling distribution?

b. What is the estimate of the coefficient β_0 and its variance?

c. Is the coefficient β_1 statistically significant? What is the p-value of the test? Interpret.

d. Is the coefficient β_1 statistically positive? What is the p-value of the test? Interpret.

e. Obtain the 99% confidence interval for β_1.

f. What is the p-value of a hypothesis testing procedure?

Example in R (cont'd)

summary(model)

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-157.3301	145.1912	-1.084	0.29
adv	2.7721	0.2794	9.921	8.87e-10

Residual standard error: 101.4 on 23 degrees of freedom

a. The estimate for b_1 is 2.7721. The variance estimate is 0.2794^2. The sampling distribution is a t-distribution with 23 degrees of freedom.

b. The estimate for b_0 is -157.3301. The variance estimate is 145.1912^2.

c. The estimate for b_1 is statistically significant, as evidenced by a p-value of 8.87×10^{-10}.

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Example in R (cont'd)

e. β_1 statistically positive: $H_A: \beta_1 > 0$
We accept the alternative hypothesis because p-value is $4.43 \times 10{-}10$. (The test statistic is 9.921.)

f. The the 99% confidence interval for β_1 is (1.988, 3.557)

g. The p-value is *a measure of how rejectable the null hypothesis is*. The smaller the p-value, the more rejectable the null hypothesis is for the observed data.

tvalue = 9.921
1- pt(tvalue, 23)
[1] 4.433214e-10
confint(model, level=0.99)

	0.5 %	99.5 %
(Intercept)	-564.930546	250.27032
adv	1.987712	3.55652

Please read the P-value Statement by the American Statistical Association at: *https://doi.org/10.1080/00031305.2016.1154108*

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Summary