Statistics and Data Analysis

Unit 04 – Lecture 02: Simple Linear Regression (OLS)

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February 17, 2026

https://github.com/tali7c/Statistics-and-Data-Analysis

Quick Links

Overview Model Fit and Diagnostics Exercises Demo Summary

Agenda

Learning Outcomes

- Write the simple linear regression model

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- Interpret slope and intercept in context

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- Explain R-squared (intuition)

Model: Key Points

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- Slope: expected change in y for 1-unit increase in x
- Intercept: predicted y at x=0 (interpret carefully)

Model: Key Formula

$$y = \beta_0 + \beta_1 x + \epsilon$$

Fit and Diagnostics: Key Points

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- Look at residual plots for patterns
- Outliers can dominate the fitted line
- High R^2 does not guarantee a good model

Exercise 1: Prediction

Model: yhat = 10 + 2x. Predict y when x=7.

Solution 1

- yhat $= 24$

Exercise 2: Residual

If actual y=20 at x=7, compute residual.

Solution 2

- 20-24 = -4

Exercise 3: Interpret slope

Slope is 5 thousand INR per extra room. Interpret.

Solution 3

- Each extra room increases predicted price by 5k INR (on average).

Mini Demo (Python)

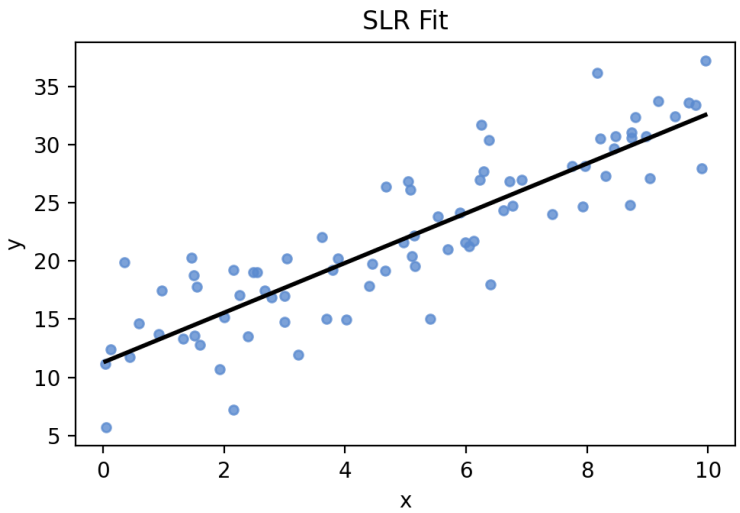
Run from the lecture folder:

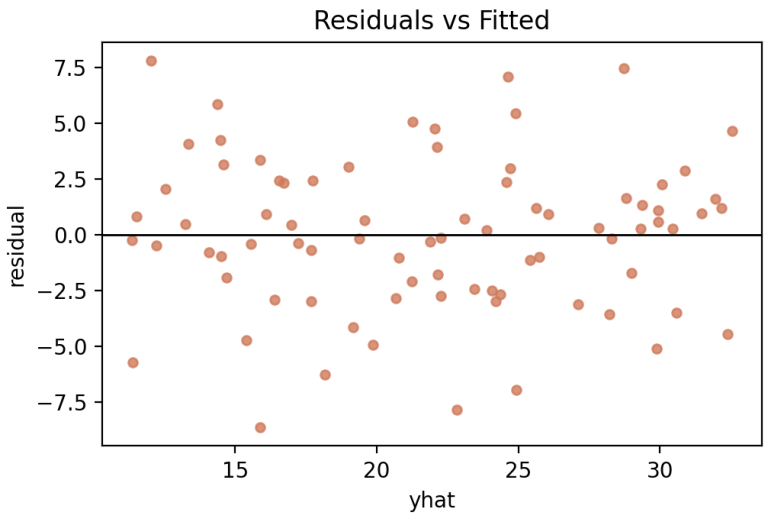
```
python demo/demo.py
```

Outputs:

- `images/demo.png`
- `data/results.txt`

Demo Output (Example)





Summary

- Key definitions and the main formula.

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- Key definitions and the main formula.
- How to interpret results in context.
- How the demo connects to the theory.

Exit Question

Why do we check residual plots even if R^2 is high?