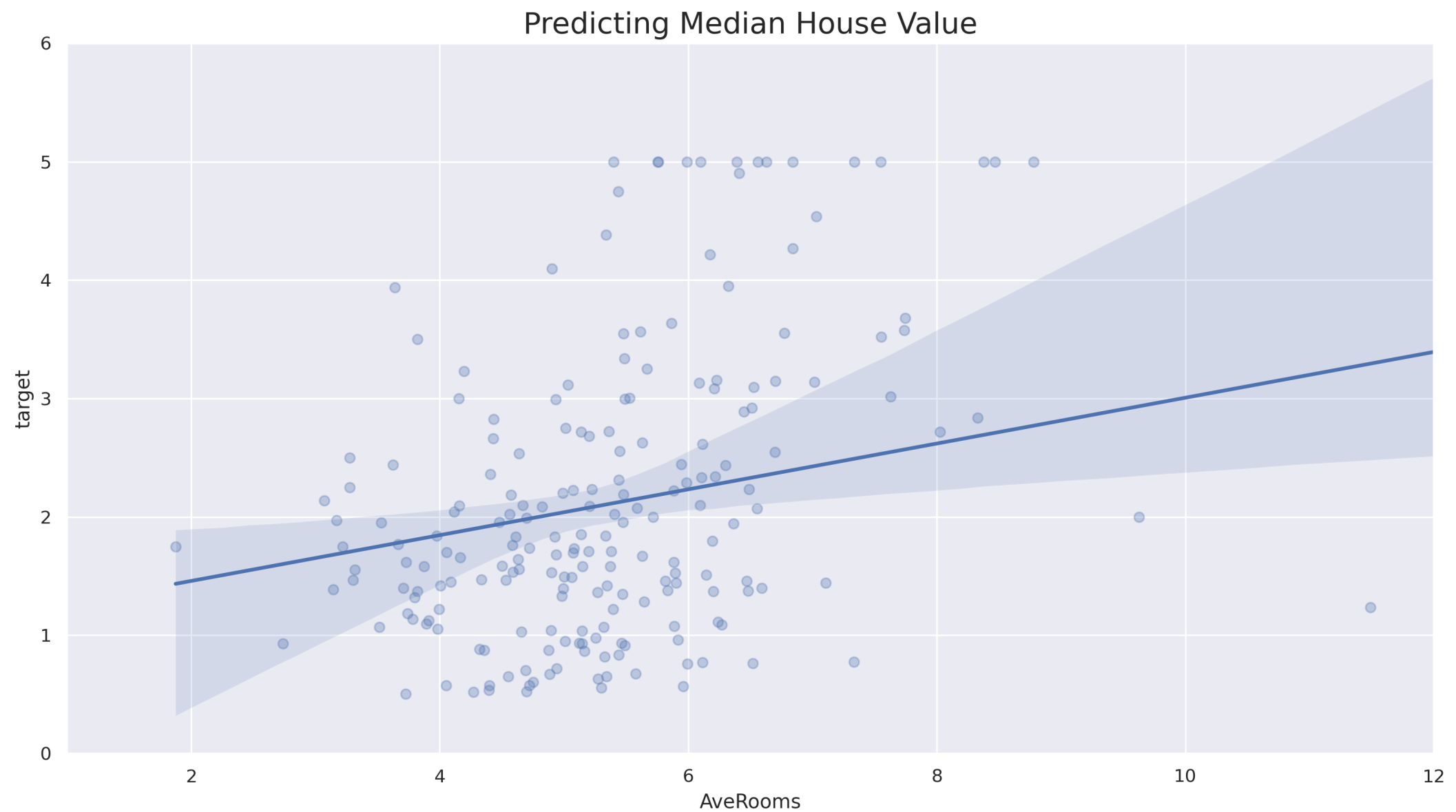# TOPIC – LINEAR REGRESSION

LINEAR REGRESSION

Given a set of data points, Linear Regression gives a straight line that minimizes the square of the distance between the points and the line.

Traditionally the least squares regression line was found using calculus.

LINEAR REGRESSION EXAMPLE

LINEAR REGRESSION IN N-DIMENSIONS

$y = mx + b$

$y = b + mx$ } 2D

$y = B_0 + B_1X_1$

$y = B_0 + B_1X_1 + B_2X_2$

$y = B_0 + B_1X_1 + B_2X_2 + B_3X_3$

$y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + \ldots$

$y = B_0X_0 + B_1X_1 + B_2X_2 + B_3X_3 + \ldots$ } ND

$y = \sum BX$

$y = BX$

LINEAR REGRESSION IN N-DIMENSIONS

$$y = BX$$

Input	Weights	Output
X	B	Y

The goal is the find the best Bs to get X as close as possible to Y.

LINEAR REGRESSION WITH DATA

B_1	B_2	B_3	B_4	B_0
X_1	X_2	X_3	X_4	y
total_bedrooms	population	households	median_income	median_house_value
1283.0	1015.0	472.0	1.4936	66900.0
1901.0	1129.0	463.0	1.8200	80100.0
174.0	333.0	117.0	1.6509	85700.0
337.0	515.0	226.0	3.1917	73400.0
326.0	624.0	262.0	1.9250	65500.0

The key is to find the right B's!

CHOOSING THE WEIGHTS

y = BX

The weights, also known as the coefficients, are the values for B.

At first try, B is completely random.

After comparing the random predictions to the actual results, B is adjusted depending on whether the error is too high or too low using gradient descent (calculus).

A second iteration proceeds with the new values of B.

During each subsequent iteration, B is adjusted via gradient descent until the error is minimized.

After the error has been minimized for B, the final model is returned.
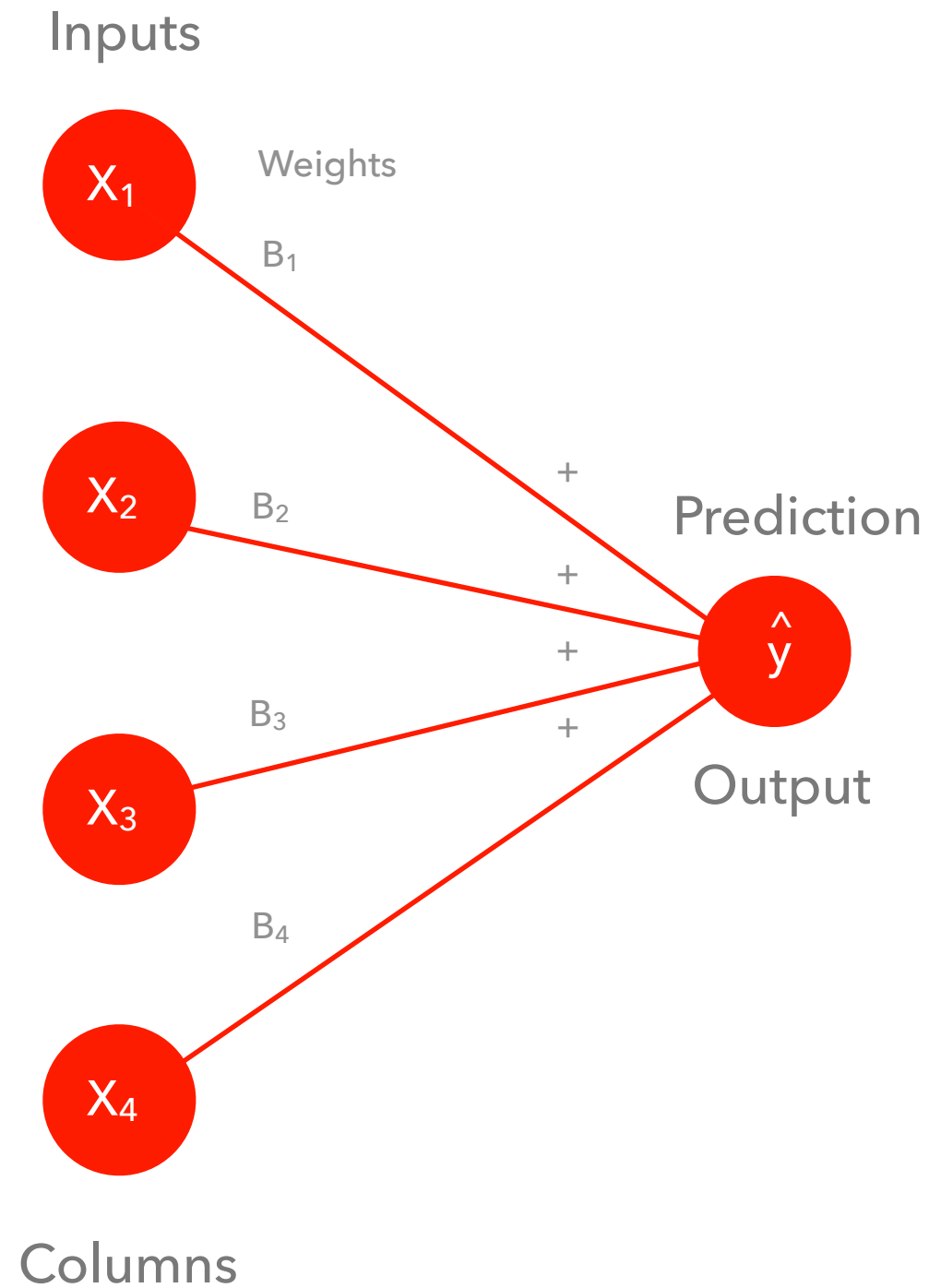
LINEAR REGRESSION

‣ This is one row of data.

‣ Picture depth for N rows.

‣ Multiply X by B and sum the results.

‣ Find Bs to minimize the error.

LINEAR REGRESSION IS MACHINE LEARNING!

It's called machine learning because the model learns its parameters, the Bs, from new data.

More data results in more accurate models and a better regression line.

HAPPY CODING!