Machine Learning

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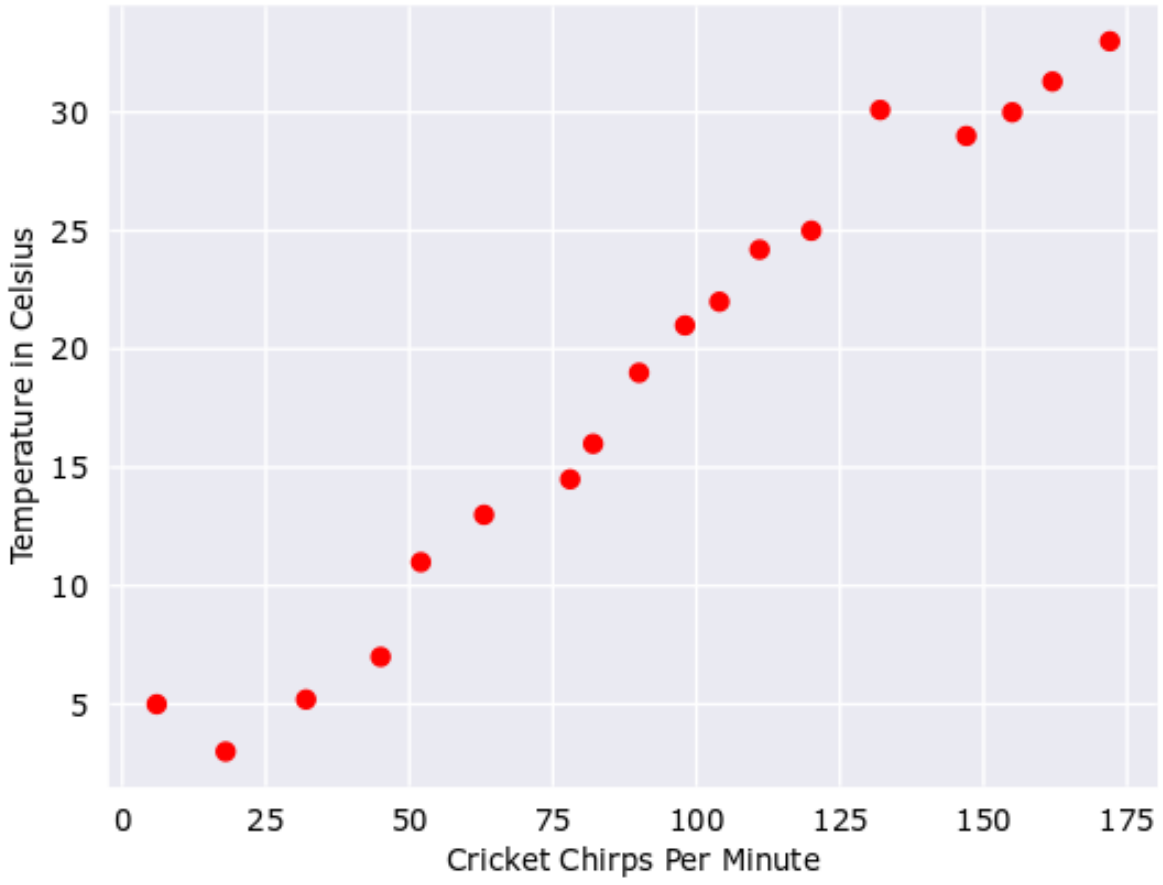
Linear Regression

- Consider the following toy example.
- It has been known that crickets (an insect species) chirp more frequently on hotter days than on cooler days.
- Professional and amateur scientists have cataloged data on chirps-per-minute and temperature.
- Using this data, you want to explore this relationship.

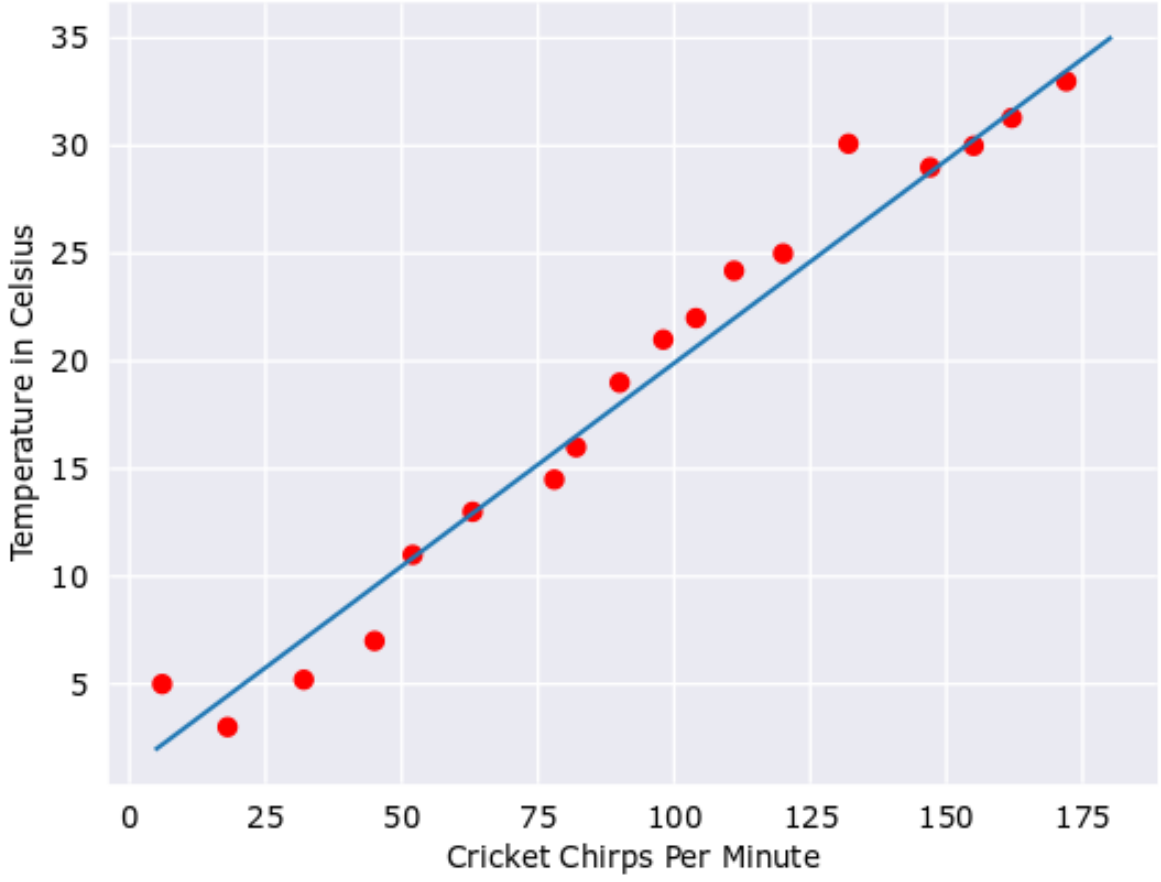
Linear Regression

- First, examine your data by plotting it:



Linear Regression

- You could draw a single straight line like the following to approximate this relationship between chirps and temperature.



Linear Regression

- The line doesn't pass through every dot, but the line does clearly show the relationship between chirps and temperature.
- Using the equation for a line, you could write down this relationship as follows:

$$y = mx + b$$

where:

- y is the temperature in Celsius – the value we're trying to predict.
- m is the slope of the line.
- x is the number of chirps per minute – the value of our input feature.
- b is the y-intercept.

Linear Regression

- By convention in ML, you'll write the equation for a model slightly differently:

$$\hat{y} = b + w_1 x_1$$

  where:

  - y is the predicted label (a desired output).
  - b is the bias (the y-intercept), sometimes referred to as w_0.
  - w_1 is the weight of feature 1. Weight is the same concept as the "slope" m in the traditional equation of a line.
  - x_1 is a feature (a known input).

Linear Regression

- To **infer** (predict) the temperature $\hat{y}$ for a new chirps-per-minute value x_1, just substitute the x_1 value into this model.
- A more sophisticated model would rely on multiple features $x_1, x_2, \ldots, x_n$, each having a separate weight $w_1, w_2, \ldots, w_n$.
- For example, a model that relies on three features might look as follows:

$$\hat{y} = b + w_1 x_1 + w_2 x_2 + w_3 x_3 = b + \sum_{j=1}^{3} w_j x_j$$

Key Terms

- bias
- inference
- linear regression
- weight