Regression and Classification

Where are we?

Lectures 1-5: Intuition for statistics, visualization of regression, ANOVA

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Today (Lecture 6): Regression and classification

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Lectures 1-5: Intuition for statistics, visualization of regression, ANOVA

Today (Lecture 6): Regression and classification

Lecture 7: Classification and Overfitting
Lecture 8: Dimensionality reduction (principal component analysis)
Lecture 9: Dimensionality reduction (PCA and tSNE)
Lecture 10: Clustering (PCA, k-means)

Last two days: Class project

regression vs. classification

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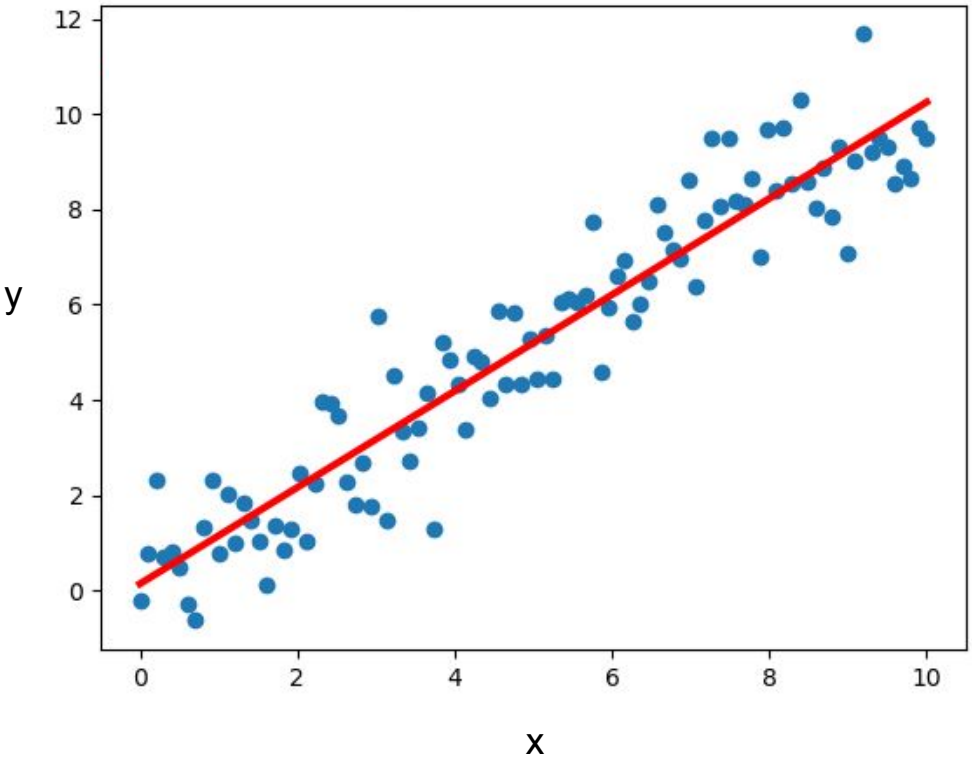

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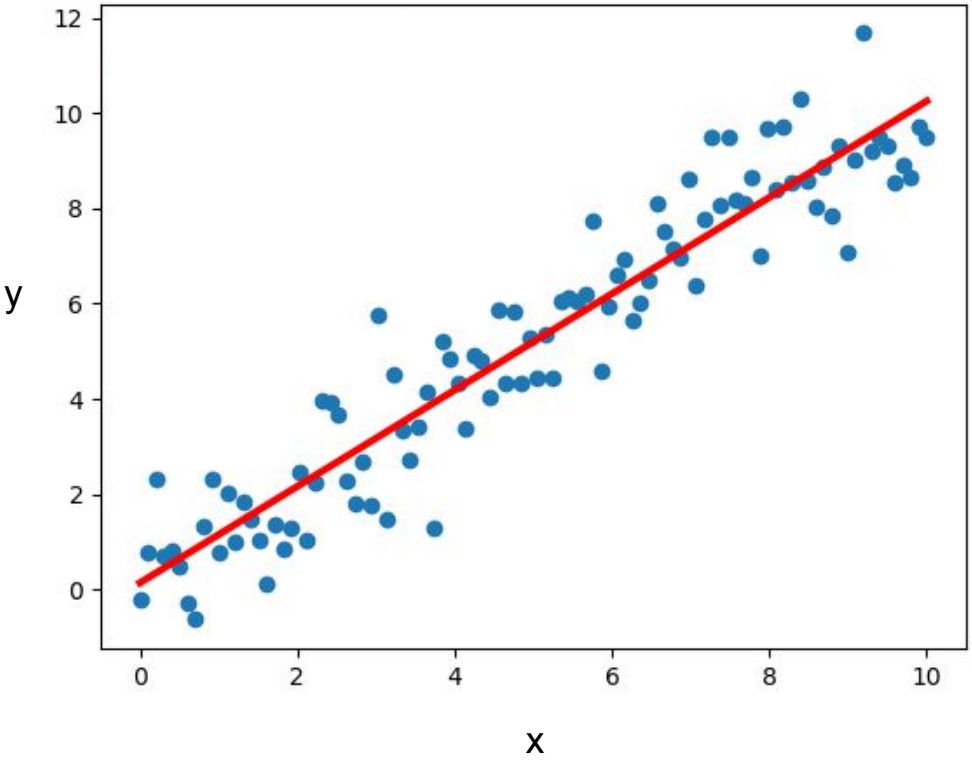

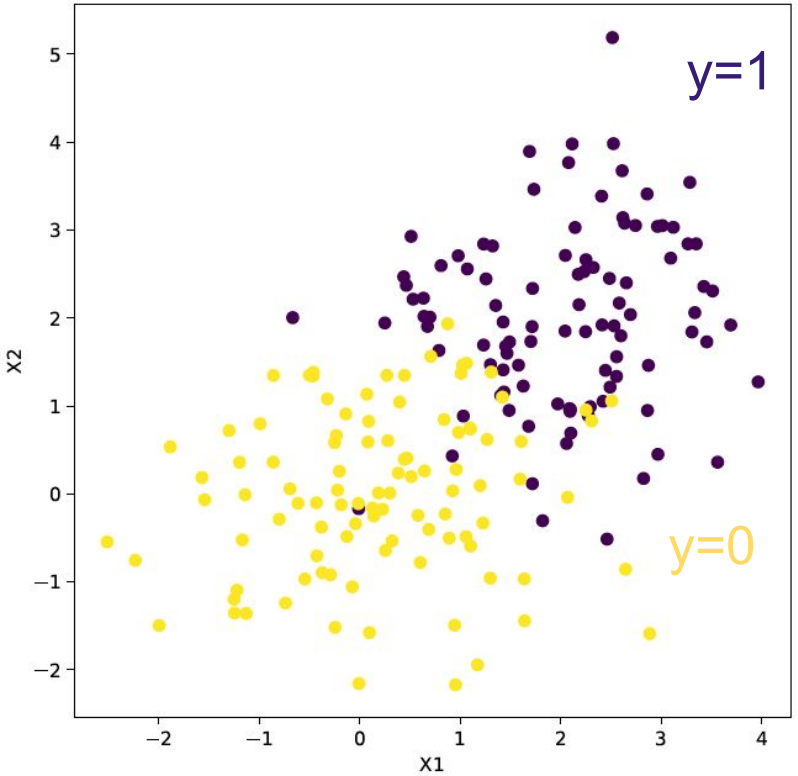

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example 2: image (pixel intensities) → object

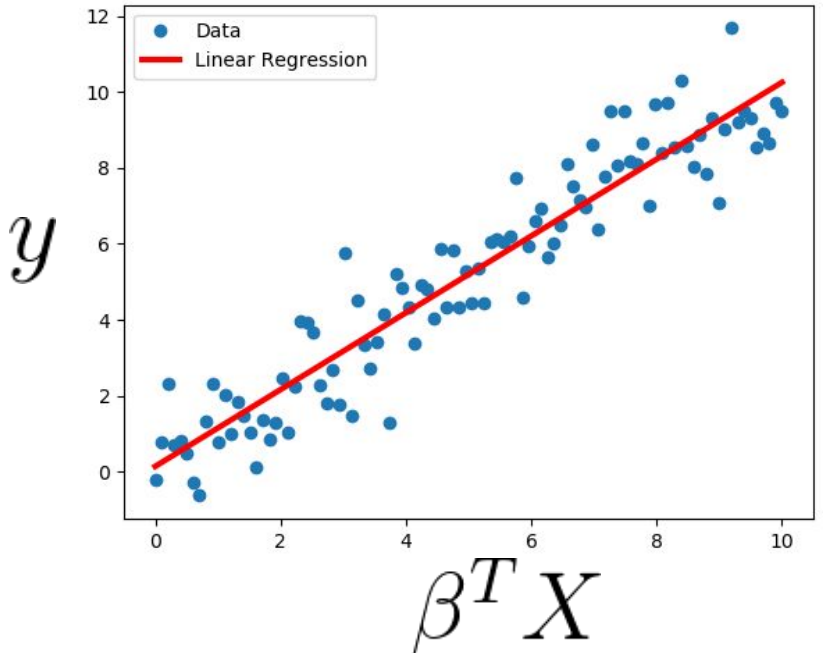
example 3: image (pixel intensities) → response of visual cortical neuron

example 4: responses of visual cortical neuron → orientation of sinusoidal grating

Linear regression

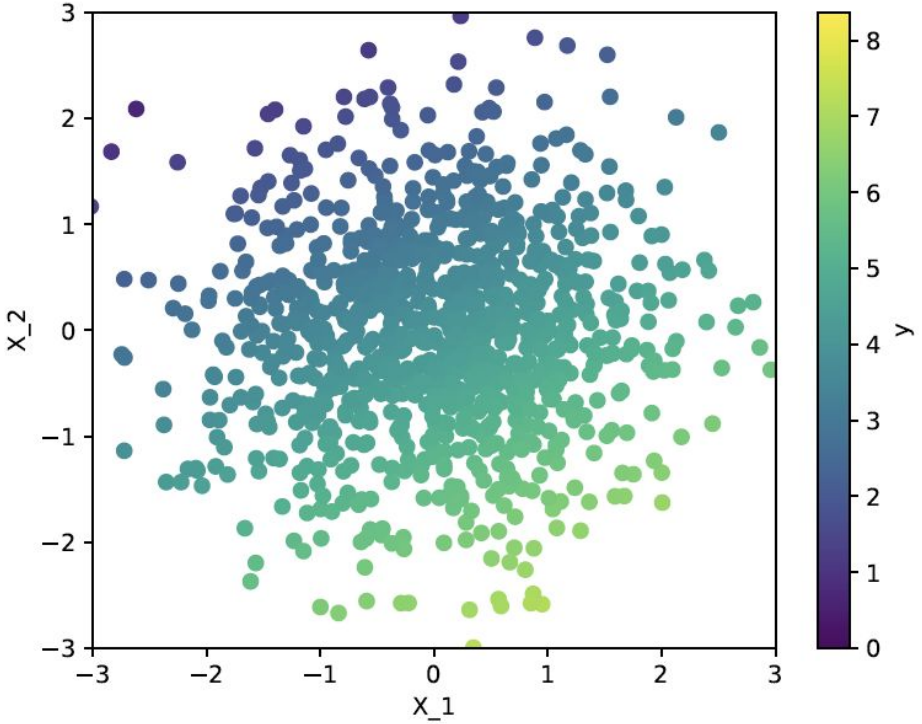
$$y = \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_N X_N$$

$$y = \beta^T X$$



$$y = \beta^T X$$

intuition: linear regression finds an axis in X that predicts y



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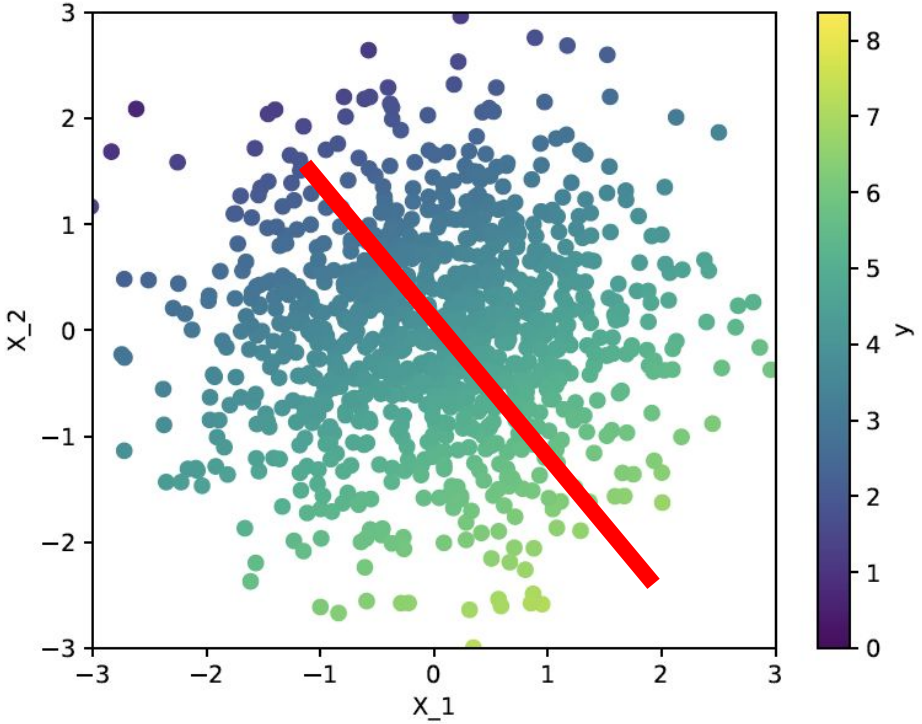

Let’s play with linear regression in Python!

Logistic regression

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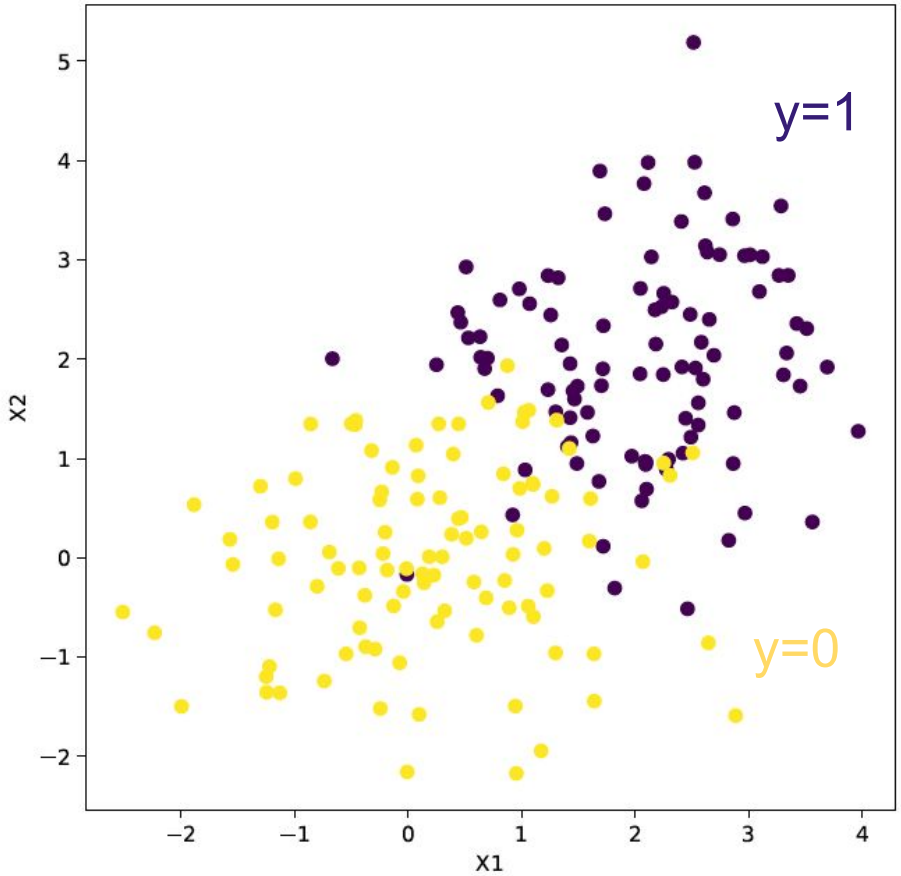
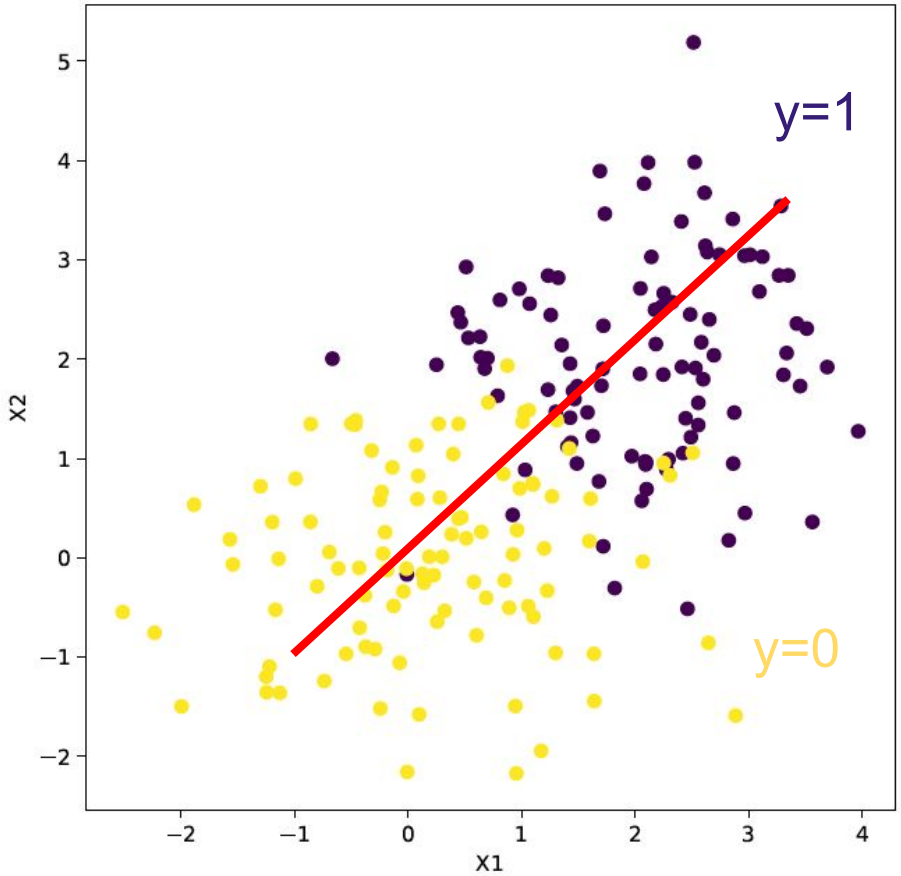
- intuition is straightforward for 2 classes (i.e., clusters)
- extends nicely to K classes, where K > 2

Logistic regression: How to output 0 or 1?



Logistic regression: How to output 0 or 1?



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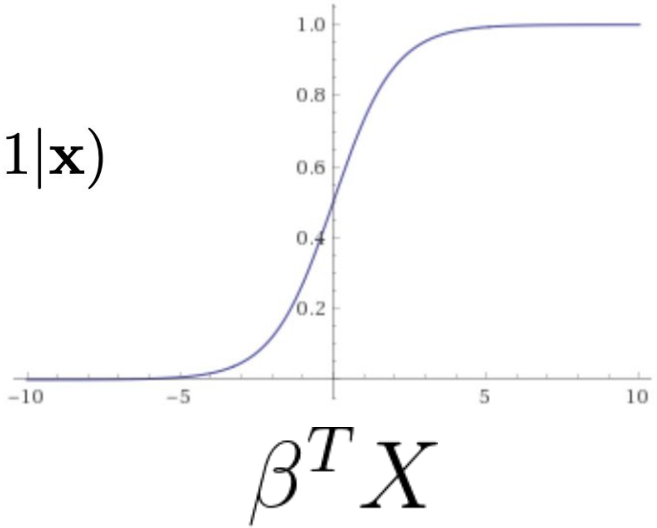
for logistic regression:

$$P(y = 1|\mathbf{x}) = \frac{1}{1+e^{-\beta^T \mathbf{x}}}$$

$P(y = 1|\mathbf{x})$



Let’s practice logistic regression in Python!