5. Linear Regression and Regularization

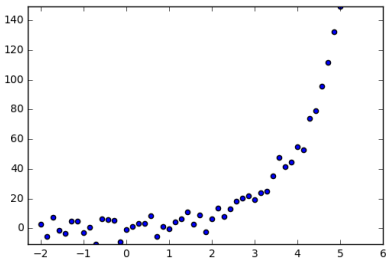
Homework due Mar 8, 2023 08:59 -03

In this question, we will investigate the fitting of linear regression.

5. (a)

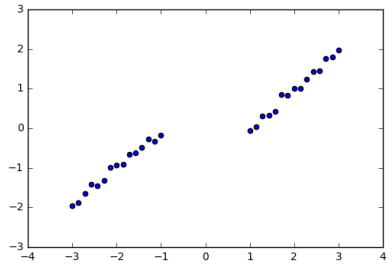
2/2 points (graded)

For each of the datasets below, provide a simple feature mapping ϕ such that the transformed data $(\phi(x^{(i)}), y^{(i)})$ would be well modeled by linear regression.



Which feature mapping ϕ is appropriate for the above model?

- (selected) $\exp(x)$
- $\log(x)$
- x^2
- $\sqrt{x}$



Which feature mapping ϕ is appropriate for the above model?

- $\phi(x) = x + \text{sign}(x)$
- (selected) $\phi(x) = x - \text{sign}(x)$
- $\phi(x) = x \cdot \text{sign}(x)$
- $\phi(x) = x / \text{sign}(x)$

✔

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5. (b)

2.0/2 points (graded)

Consider fitting a -regularized linear regression model to data where are scalar values for each . To fit the parameters of this model, one solves

where

Here is a pre-specified fixed constant, so your solutions below should be expressed as functions of and the data. This model is typically referred to as **ridge regression** .

Write down an expression for the gradient of the above objective function in terms of .

Important: If needed, please enter as a function `sum_t(...)`, including the parentheses. Enter and as `x^{t}` and `y^{t}`, respectively.

-2*sum_t((y^{t} - theta *x^{t} - theta_0) * x^{t}) + 2 * lambda * theta ✔

Write down an expression for the gradient of the above objective function in terms of .

-2 * sum_t(y^{t} - theta*x^{t} - theta_0) ✔

? STANDARD NOTATION

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5. (c)

2 points possible (graded)

Find the closed form expression for and which solves the ridge regression minimization above.

Assume is fixed, write down an expression for the optimal in terms of .

Important: If needed, please enter as a function `sum_t(...)`, including the parentheses. Enter and as `x^{t}` and `y^{t}`, respectively.

Write down an expression for the optimal . To simplify your expression, use . Your answer should be in terms of and **only**

answer should be in terms of and **only**.

Important: If needed, please enter as a function `sum_t(...)`, including the parentheses. Enter and as `x^{t}` and `y^{t}`, respectively. Enter as `barx`.

Now after the optimal is obtained, you can use it to compute the optimal

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In fact, ...g

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