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5. Linear Regression and Regularization

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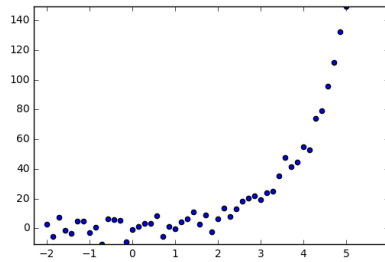
Homework due Mar 8, 2023 08:59 -03

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.



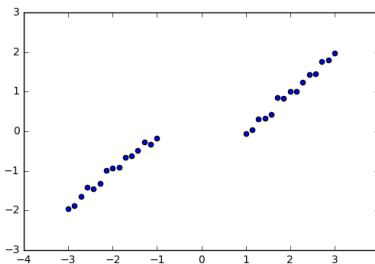
Which feature mapping ϕ is appropriate for the above model?

☒ $\exp(x)$

☐ $\log(x)$

☐ x^2

☐ \sqrt{x}



Which feature mapping ϕ is appropriate for the above model?

☐ $\phi(x) = x + \text{sign}(x)$

☒ $\phi(x) = x - \text{sign}(x)$

☐ $\phi(x) = x \cdot \text{sign}(x)$

☐ $\phi(x) = x / \text{sign}(x)$



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You have used 2 of 2 attempts

5. (b)

2.0/2 points (graded)

Consider fitting a λ -regularized linear regression model to data $(x^{(t)}, y^{(t)})$ where $x^{(t)}$ and $y^{(t)}$ are scalar values for each t . To fit the parameters of this model, one solves

where

Here λ is a pre-specified fixed constant, so your solutions below should be expressed as functions of λ 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 θ .

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

$-2 * \text{sum}_t((y^{(t)} - \theta * x^{(t)} - \theta_0) * x^{(t)}) + 2 * \lambda * \theta$



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

$-2 * \text{sum}_t(y^{(t)} - \theta * x^{(t)} - \theta_0)$



? STANDARD NOTATION

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You have used 1 of 5 attempts

5. (c)

2 points possible (graded)

Find the closed form expression for θ and θ_0 which solves the ridge regression minimization above.

Assume λ is fixed, write down an expression for the optimal θ in terms of $x^{(t)}$ and $y^{(t)}$.

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

Write down an expression for the optimal θ_0 . To simplify your expression, use \bar{x} and \bar{y} . Your answer should be in terms of \bar{x} and \bar{y} .

answer should be in terms of θ_0 and θ_1 .

Important: If needed, please enter θ_0 as a function `sum_t(...)`, including the parentheses. Enter θ_1 and θ_2 as $x^{\{t\}}$ and $y^{\{t\}}$, respectively. Enter \bar{x} as `barx`.

Now after the optimal θ_0 is obtained, you can use it to compute the optimal

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Hint for 5A

2

In fact, θ_0

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? 5c format HTML

2

I was solving the 5c problem, and suddenly in a refresh of the page it appears the message "Could not format HTML for post"

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