CS589: Machine Learning - Fall 2017

Quiz 4

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Instructions: You have 20 minutes to complete this quiz. There are 11 questions. Each is worth 9 points, with 1 point free. Only the final answer for each question will be graded, with no partial credit. Each minute late the quiz is turned in will result in a 20 point penalty.

1. This question will also be on the final

Consider the "logistic regression" method. Which type of data should this be applied to?

1. (circle one) **(a)** / **(b)**

(a) Data where $y_i \in \{-1, +1\}$
(b) Data where $y_i \in \mathbb{R}$

3. A Scenario For Regression

Setup

Take a regression dataset $(x_1, y_1), ..., (x_N, y_N)$ where $x \in \mathbb{R}^2$ and $y \in \mathbb{R}$ and a corresponding validation set $(x_1, y_1), ..., (x_{N'}, y_{N'})$. You have $N = 100$, $N' = 100$, and $p = 2$. You train a linear model using squared loss with ridge regularizarion and a ridge penalty of $\lambda = 0.1$. When training, you use the basis expansion $h(x) = (x_1^2,\ x_1x_2,\ x_1x_2,\ x_2^2)$ with $M = 4$ outputs. After training, you observe a mean training squared loss of 21.1 and a mean validation squared loss of 21.3. (Regularization penalties are used while training, but not included in the losses shown here.)

Change: Now, you re-train, instead using kernel ridge regression, with a kernel of $K(x, x') = \left(x^T x'\right)^2$. Again, you use a regularizaton constant of $\lambda = 0.1$.

Questions (All losses refer to squared loss)

2. Is it possible to now observe a mean train loss of 21.1? **Possible / Not possible.**
3. Is it possible to now observe a mean validation loss of 21.1? **Possible / Not possible.**
4. Is it possible to now observe a mean train loss of 21.2? **Possible / Not possible.**
5. Is it possible to now observe a mean validation loss of 21.2? **Possible / Not possible.**
6. Is it possible to now observe a mean train loss of 21.3? **Possible / Not possible.**
7. Is it possible to now observe a mean validation loss of 21.3? **Possible / Not possible.**

2. A Scenario For Classification

Setup

Take a classification dataset $(x_1, y_1), ..., (x_N, y_N)$ where $x \in \mathbb{R}^2$ and $y \in \{-1, +1\}$ and a corresponding validation set $(x_1, y_1), ..., (x_{N'}, y_{N'})$. You have $N = 100$, $N' = 100$, and $p = 5$. You train a support vector machine model using hinge loss with ridge regularizarion and a ridge penalty of $\lambda = 0.1$. When training, you use some fixed kernel $K(x, x')$. After training, you observe a mean training squared loss of 5.3 and a mean validation squared loss of 5.7. (Regularization penalties are used while training, but not included in the losses shown here.)

Change: Now, you define a new kernel K' simply as $K'(x, x') = 3K(x, x')$. You re-train using this kernel, again with a regularization constant of $\lambda = 0.1$.

Questions

8. Is it possible to now observe a mean train hinge loss of 5.0? **Possible / Not possible.**
9. Is it possible to now observe a mean validation hinge loss of 5.0? **Possible / Not possible.**
10. Is it possible to now observe a mean train hinge loss of 6.0? **Possible / Not possible.**
11. Is it possible to now observe a mean validation hinge loss of 6.0? **Possible / Not possible.**