**MLSM 2020 - Quiz 3**

**02/10/2020 - 14/10/2020 at 23:59**

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**Questions based on Lecture 4 and 5**

(1) (1.0 pt.) In the hard-margin SVM we have the constraints $y_i \mathbf{w}^T \mathbf{x}_i \geq 1$ for all $i = 1, \ldots, m$. For a pair, $(y, \mathbf{x})$, of a new sample example we have $y\mathbf{w}^T\mathbf{x} < 1$ but $y\mathbf{w}^T\mathbf{x} > 0$. What does it mean?

(1) This example is wrongly classified.
(2) This example is classified correctly but it is within the margin.
(3) We can not decide on which class contains this example.

(2) (1.0 pt.) In the soft-margin SVM we have the constraints $y_i \mathbf{w}^T \mathbf{x}_i \geq 1 - \xi_i$ for all $i = 1, \ldots, m$. If a pair, $(y_i, \mathbf{x}_i)$, of a training example is correctly classified which set of values contains the corresponding slack variable $\xi_i$?

(1) $\xi_i < 0$
(2) $\xi_i = 0$
(3) $0 \leq \xi_i < 1$

(3) (1.0 pt.)

We are given only positive examples in an SVM problem. We might include a new example in which the input is the zero vector, $\mathbf{0}$, and its label is equal to $-1$. It is called as one-class classification problem.

What does the SVM do if the new example, $\mathbf{0}$, is not included? Assume that there is no bias term in the SVM.

(1) It tries to separate all positive examples from the $\mathbf{0}$ even if it is not included into the examples.
(2) The result has no any meaning.
(3) All slacks will be 0.

(4) (2.0 pt.)

Let 6 points be given in the plane, $X = \{(-1, 0), (2, 1), (2, -1), (1, 0), (-2, -1), (-2, 1)\}$, and the corresponding labels in the same order $y = \{1, 1, 1, -1, -1, -1\}$. Compute $\mathbf{w}$ by the algorithm given by the Slide "Stochastic gradient descent algorithm for soft-margin SVM ". Process the examples in the given fix order instead of randomly drawing them. The parameters defined on the slide are set in the following way. The penalty weight is set by $\lambda = 1$, and the learning speed is given by $\eta = 0.1$.

Which of these coordinates can give the solution for $\mathbf{w}$? Round the numbers up to 2 decimals, and take the closest one.

(1) $(-0.54, 0.2)$
(2) $(0.66, 0.12)$
(3) $(0.52, -0.02)$