**INTRODUCTION MACHINE LEARNING**

**EXERCISE 3**

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Exercice 1: Linear Models:

1. Name these concepts:

The point-wise loss

Global loss

 : objective function or error function

: Parameter vector or (p+1)-dimensional hypothesis.

* direction vector excluding wo or the p-dimensional direction vector.

1. How would the figure below change if wo is halved ?:
2. What is the difference (if any) between decision boundaries for linear and logistic regression:

The key difference is the predicted output.

* Linear regression: predicts a continuous output and its decision boundary is a straight line.
* Logistic regression: predicts a probability (between 0 and 1) and uses a sigmoid function to map a linear combination of features to this probability. The decision boundary in logistic regression can take a nonlinear form.

1. The lecture notes slides state that a key difference between ridge  and lasso  regression is that, with lasso regression, parameters can be reduced to zero. Explain why.

This is because Lasso regression uses L1 regularization, which adds a penalty term proportional to the absolute value of the coefficients. As a result, some coefficients can be reduced to zero, effectively removing the corresponding features from the model

1. Why can the gradient descent method not be applied for ?

can not be expressed as a differentiable function, also because the loss function considered when applying 0/1 loss is typically non-convex.

Exercise 2: Pointwise Loss Functions

In the lecture notes, slide ML:III-63 on loss computation for logistic regression in detail, the rightmost plot "Loss over hyperplace distance" shows the pointwise logistic and 0/1 loss for a logistic regression model for ,that means, for examples with c = 1. In this exercise you will investigate the case of examples with c = 0.

1. Show that

For c = 0