University of Zurich[UZH]

Lecture
Mathematical Foundations of Computational Linguistics

Spring Semester 2022

Assignment 6

Classification, Regression & Gradient Descend

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Information on the submission:

- **File format: compressed folder of a pdf and your code**
- Submission deadline: **May 31, 12:15**
- Filename in the following format: *username1_username2_mfcl_exerciseNo.pdf*, e.g. *hmuster_pmstr_mfcl_ex06.pdf*
- **Learning partnerships in pairs** are **recommended**. Please submit your solutions only once.
- Please state your first and last name on the submission sheet.
- Submit your file via the exercise module on OLAT. Please hand it in on time.

Machine Learning Notebook

We have prepared the notebook *ex1_ml.ipynb* for you, covering the topics **Classification (with a class separating hyperplane)**, **The Cost Function J and its 1st Derivative (Slope)**, **Gradient Descend** and **Regression**.
Work yourselves through the notebook and make sure to understand every step.

Note: There are 5 questions in the notebook for you to solve. Make sure to implement the required code (indicated by ## TO-DO ##) and to answer all of the questions. (10 P)

Classification and Regression - Revisiting Assignment 5

In this task you are going to revisit the **Classification and Regression** task from assignment 5. The goal is for you to now program subtask 1 (**but in three dimensions (with 2 features)**) with the knowledge gained from the previous exercise. You are free to use snippets of code from the *ex1_ml.ipynb* notebook.

Note: Use the skeleton code provided in the *prog_A5_classification_regression.ipynb* notebook, which contains the new adapted task and make sure to implement the required code (indicated by ## TO-DO ##). (5 P)

Machine Learning

*Some more **Machine Learning** practice!* (5 P)
You have the following feature vectors $x^{(1)} = (2, 4, 3)$ and $x^{(2)} = (2, 4, 1)$ and an initial weight vector is $w = (1, 1, 1)$.
Note: The superscript is the instance count and subscripts are used to refer to the individual dimensions, e.g. $x_3^{(1)} = 3$ and $x_3^{(2)} = 1$.

1. Calculate $y_{pred}^{(j)}$ for the instances $x^{(j)}$ with $j \in \{1, 2\}$.
2. Assume that $y_{obs}^1 = 8$ and $y_{obs}^2 = 4$. Calculate the cost.
3. Calculate the 1st derivate of the cost function for the value $k = 3$.

Attention: You are not allowed to program this task!
This task is intended to give you more practice in solving such tasks (manually/by hand).

Exercise Collection

Propose one small exercise (**incl. solution!**) to one of the following topics: (3 P)
MLE, Bayes Theorem, Probability Theory, Combinatorics, Expected Values, Variance, Standard Deviation (Standard Error), Decision Tree, Entropy, Hypothesis Testing (Student's t-test, χ^2-test).

Feedback

Please provide a few keywords to each question.

1. Which parts of the exercise did you struggle with?
2. What parts were new to you?

3. How much time did you spend on solving the exercise?

In case you have any questions or problems please let us know via the OLAT-Forum.
Good luck and have fun!