

Regression + Assignment 1

(Neural Networks Implementation and Application Tutorial)

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Overview

- Assignment 1
- Regression
- Assignment 2

Update

Up to 2 points for participation.

Assignment 1

Organization

- Late submissions (>10 mins) will not be accepted unless previously agreed upon
- Other questions?

Notes

- Very nice solutions!
- Reconstruction error on original space, not standardized (we did the same mistake 😬)

Assignment 1

- *Tutor cue:* go through the assignment
- Questions?
- Did it work?
- Were you able to collaborate?

Regression

- What is the difference between classification and regression? 🤔
- What is regression in terms of functions? 🤔
 - ▶ Any function $f : F \rightarrow \mathbb{R}$ (from joint feature space to numbers)
- What is *linear* regression? 🤔
 - ▶ $\hat{y} = x^T \cdot \beta + \beta_c$ (parameters β, β_c)

Which of the following are regression (and linear/polynomial) models? 🤔 1. 5

- 2 $4 \cdot x_1 + 5$
- 3 $4 \cdot x_1 + 3 \cdot x_2^2 + 5$
- 4 $4 \cdot x_1 + 3 \cdot x_1 \cdot x_2 + 5$
- 5 $4 \cdot x_1 + 3 \cdot \sin(x_2^2) + 5$
- 6 $\begin{cases} 4 \cdot x_1 + 5 & \text{if } x_2 \geq 10 \\ 3 \cdot x_1 + 4 & \text{if } x_2 < 10 \end{cases}$

Regression

Regression to Classification 🤔 🤔

Assume that we have a function that outputs a score for every class, e.g. *Predict sentiment into (positive, negative, neutral)*:

(15.0, -2.3, 4.1)

- How do we use this for classification?
 - ▶ Argmax
- Can we get a probability distribution?
 - ▶ Softmax: $\frac{\exp x_i}{\sum_k \exp x_k}$

Loss & Regularization

Loss

- Why L_2 and not L_1 ?
 - ▶ We care about points that are drastically mispredicted, e.g. $L_2(-1, 10)$ and not about almost correctly predicted instances $L_2(-1, -1.1)$
 - ▶ In L_1 , these would have the same weight (gradient)
 - ▶ L_1 leads to some parameters being 0 (sometimes a good thing)

Regularization

- Why do we want to regularize?
 - ▶ Prevent overfitting, prevent reliance on noise
- Ridge regression uses L_2 penalty: *minimize* $\arg \min L_2^2(\hat{Y}, Y) + \lambda \|\beta\|_2^2$
- Lasso regression uses L_1 penalty: *minimize* $\arg \min L_2^2(\hat{Y}, Y) + \lambda \|\beta\|_1$
- ElasticNet regression uses both: *minimize* $\arg \min L_2^2(\hat{Y}, Y) + \lambda_1 \|\beta\|_1 + \lambda_2 \|\beta\|_2^2$

Model Capacity

- What contributes to overfitting?
 - ▶ Overfitting: little data, large model capacity, too many optimization steps
 - ▶ Underfitting: not enough optimization steps, too strict regularization

Bias-variance tradeoff

- Large bias corresponds to ...?
 - ▶ Underfitting/small model capacity
- Large variance corresponds to ...?
 - ▶ Overfitting

Assignment 2

- Any questions?