

Optimization of Target Values in an Artificial Neural Network

Andrassik, Bhuyian, Yakar, Zauner

Definitions

Target Values

- Vectors that represent the expected output a neural Network is trained to produce for a specific given input
- Ground truths that the neural network should aim for during training
- Needed to calculate the accuracy/loss-function - drive the learning process
- Traditionally are represented using one-hot encoding - the correct class is assigned a 1 and the incorrect classes are assigned a 0

Class / Non-Class values

Class Values

- Values assigned to the correct class position in the target vector
- Represents the correct class
- In one-hot encoding the numeric value 1

Non-Class Value

- Value used for all incorrect class positions in the target vector
- Represents the incorrect classes
- In one-hot encoding the numeric value 0

Project Goals

General Project Idea

- Main idea - explore alternative method(s) for defining target values in classification tasks using neural networks
- Assign custom "class-" and "non-class values" for each class; Values can be refined during training
- Improving training efficiency while maintaining (or improving) classification accuracy

Concrete Goals

- Refine the approaches in the original paper we were given
- Evaluate the approaches using the MNIST dataset
- Compare the performance(s) against standard one-hot encoding
- Document findings and reflect on potential benefits and limitations

d_{\max}

ϵ_{\min}

σ

Timeline

26.03.25 - First Presentation

Create a rough outline of the project's content based on the information from the given paper, including loose definitions and a short summary of the introduced methods.

09.04.25 - Second Presentation

Clarify the project idea, define concrete project goals, and deepen the understanding of the topic with special focus on precise definitions of target values, class values, and non-class values.

Write the abstract and milestone plan for the semester.

23.04.35 - Start working on the Paper

Deepen research on alternative target value methods for classification with neural networks.

Select and define an approach for our alternative target encoding.

Plan the implementation steps for generating “class-” and “non-class” values.

07.05.25 - Third Presentation

Initial implementation of the new target encoding method.

Prepare simple experiments using simplified datasets to validate functionality.

21.05.25 - Fourth Presentation

Complete implementation and simple testing of the alternative target value method.

Prepare and conduct experiments on the MNIST dataset. Analyze the model's predictions to evaluate performance compared to traditional one-hot-encoding.

Discuss results and possible improvements.

04.06.25 - Fifth Presentation

Complete improvements and experiments.

Analyze experimental results and compare training efficiency and classification accuracy with traditional methods.

Document findings and prepare initial draft of project report.

18.06.25 - Last PS-Meeting

Final preparations for submission – complete report and presentation.