Koszalin University of Technology

Applications of artificial intelligence
project report

Handwritten text symbol recognition with deep neural networks

Paweł Frankowski Kacper Ochnik

supervised by
Dr. Adam Słowik

January 30, 2024

Contents

1 Introduction

Handwritten text symbol recognition with deep neural networks.

2 Our Goal

The primary objective of our project is to develop a handwritten text symbol recognition system using deep neural networks. We aimed to create a model capable of accurately identifying and classifying handwritten digits ranging from 0 to 9 on a matrix of 28x28 pixels.

2.1 Specific Objectives

In pursuit of our overarching goal, we have identified the following specific objectives:

1. **Project setup** - Set up the project environment and install the necessary libraries and packages.
2. **Code implementation** - Write Python code to implement the deep neural network architecture. This includes developing modules for data preprocessing, model training, and evaluation.
3. **Data Collection** - Gather a comprehensive dataset of handwritten digits (0 to 9) in a 28x28 pixel matrix format from MNIST.
4. **Learning** - Train the model using the collected dataset.
5. **Optimization** - Improve the model's accuracy through optimization techniques. Accelerate computational efficiency for faster calculations.
6. **Testing** - Create testing GUI for the trained model. Evaluate the model's performance metrics.
7. **Documentation** - Write a comprehensive report documenting the project's objectives, methodology, and outcomes.

2.2 Expected Outcomes

Upon successful completion of our project, we anticipate achieving the following outcomes:

- Develop a robust deep neural network model capable of recognizing and classifying handwritten digits from 0 to 9.
- Train the model to achieve a acceptable level of accuracy.

3 Decision boundary

...

4 Weights and biases - Pawel

...

5 Hidden layers

...

6 Activation functions - Pawel

...

7 Cost function

...

8 Gradient descent - Pawel

...

9 Cost landscape

...

10 Learning algorithm - naive approach - Pawel

...

11 Learning algorithm - calculus approach

...

12 Learning algorithm - digit recognition - Pawel

...

13 Chain rule - Pawel

...

14 Backpropagation

...

15 Testing the network

...

16 Conclusion

This is the conclusion of the document.