

MASTER THESIS

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# Optimization of Neural Network

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*A thesis submitted in fulfillment of the requirements  
for the degree of Engineer (Ing.)*

*in the*

DEPARTMENT OF  
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## Declaration of Authorship

I, Martin BULÍN MSc., declare that this thesis titled, “Optimization of Neural Network” and the work presented in it are my own. I confirm that:

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- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.

Signed:

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Date:

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*“Look deep into nature, and then you will understand everything better.”*

A. Einstein

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# *Abstract*

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## **Optimization of Neural Network**

by Martin BULÍN MSc.

abstract text...

# *Acknowledgements*

acknowledgements text...

# Contents

<b>Abstract</b>	<b>iii</b>
<b>1 Introduction</b>	<b>1</b>
1.1 State of the Art . . . . .	1
1.2 Thesis Objectives . . . . .	1
1.3 Thesis Outline . . . . .	1
<b>2 Methods</b>	<b>2</b>
2.1 Network Pruning . . . . .	2
2.2 Feature Selection . . . . .	2
2.3 Network Visualization . . . . .	2
2.4 Speech Data Gathering . . . . .	2
<b>3 Examples</b>	<b>3</b>
3.1 2D-problem 1: XOR function . . . . .	3
3.2 2D-problem 2: Unbalanced Features . . . . .	3
3.3 2D-problem 3: Rule Plus Exception . . . . .	4
3.4 Train Problem . . . . .	4
3.5 Handwritten digits (MNIST) . . . . .	4
3.6 Phonemes (speech data) . . . . .	4
<b>4 Discussion</b>	<b>5</b>
4.1 Methods Recapitulation . . . . .	5
4.2 Comparison of Pruning Methods . . . . .	5
<b>5 Conclusion and Outlook</b>	<b>6</b>
<b>Bibliography</b>	<b>7</b>
<b>A1 Structure of the Workspace</b>	<b>8</b>
<b>A2 Implementation</b>	<b>9</b>
<b>A3 Code Documentation</b>	<b>10</b>

# List of Figures

3.1	The XOR dataset. . . . .	3
3.2	The dataset with unbalanced features. . . . .	4
4.1	Caption . . . . .	5

# List of Tables



# List of Abbreviations

<b>AI</b>	<b>A</b> rtificial <b>I</b> ntelligence
<b>ANN</b>	<b>A</b> rtificial <b>N</b> eural <b>N</b> etwork

# Chapter 1

## Introduction

Introduction text...

### 1.1 State of the Art

State of the art text... (Rosenblatt, 1958) (Reed, 1993)

### 1.2 Thesis Objectives

Thesis objectives text...

### 1.3 Thesis Outline

Thesis outline text...

## Chapter 2

# Methods

Methods intro text...

### 2.1 Network Pruning

Network pruning text...

### 2.2 Feature Selection

Minimal network structure text...

### 2.3 Network Visualization

Graphical user interface text...

### 2.4 Speech Data Gathering

Speech data classification text...

## Chapter 3

# Examples

results text...

### 3.1 2D-problem 1: XOR function

XOR data...

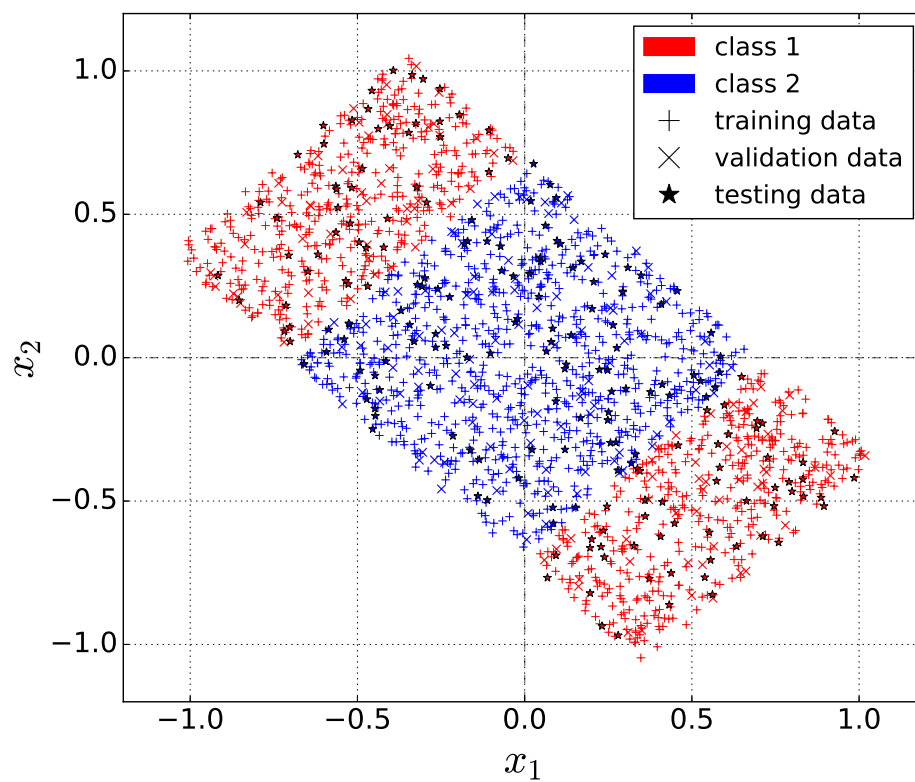


FIGURE 3.1: The XOR dataset.

### 3.2 2D-problem 2: Unbalanced Features

Karnin data...

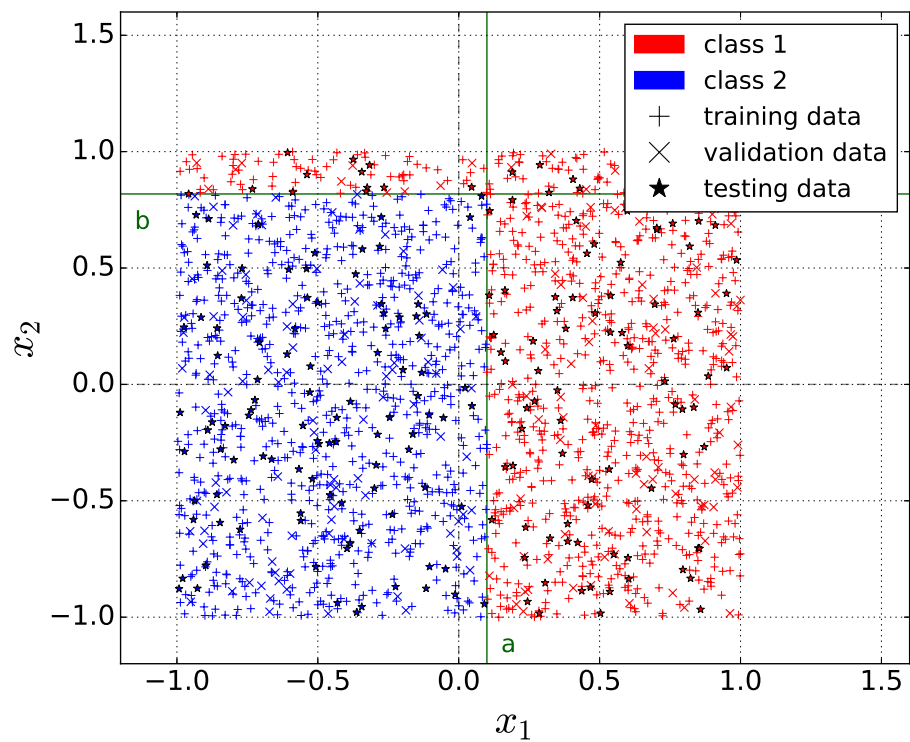


FIGURE 3.2: The dataset with unbalanced features.

3.3 2D-problem 3: Rule Plus Exception

RPE data...

3.4 The Train Problem

The Michalski’s train problem...

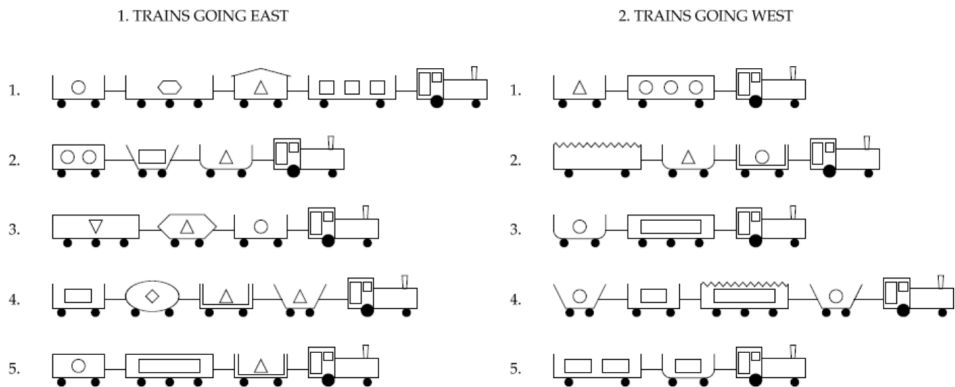


FIGURE 3.3: Michalski’s train problem.

### **3.5 Handwritten digits (MNIST)**

MNIST data... (LeCun and Cortes, 1998)

### **3.6 Phonemes (speech data)**

PHONES data...

## Chapter 4

# Discussion

Discussion text...

### 4.1 Methods Recapitulation

Methods recapitulation text...

### 4.2 Comparison of Pruning Methods

Comparison of results text...

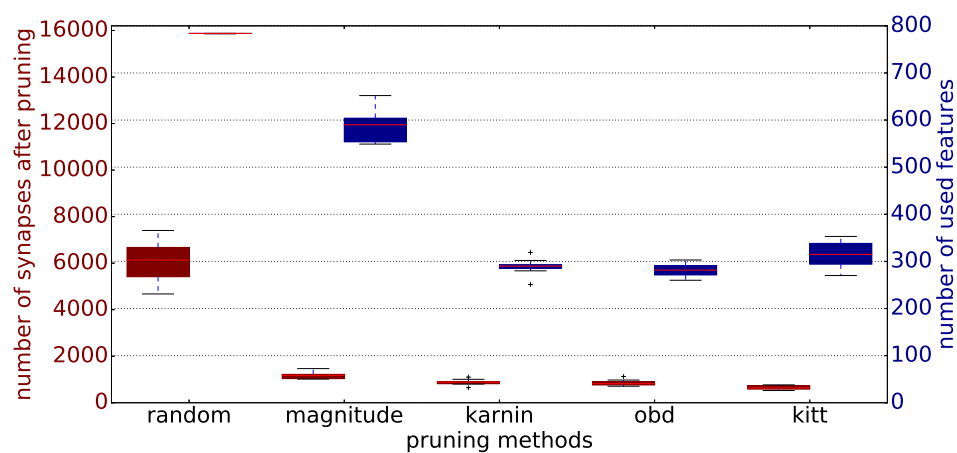


FIGURE 4.1: Caption

## Chapter 5

# Conclusion and Outlook

Conclusion text...

Outlook text...



# Bibliography

- [1] Frank Rosenblatt. “The perceptron: A probabilistic model for information storage and organization in the brain”. In: *Psychological Review* 65 (1958), pp. 386–408.
- [2] R. Reed. “Pruning Algorithms - A Survey”. In: *IEEE Transactions on Neural Networks (Volume:4 , Issue: 5)* (Sept. 1993), pp. 740–747. URL: <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=248452>.
- [3] Yann LeCun and Corinna Cortes. *The MNIST database of handwritten digits*. 1998. URL: <http://yann.lecun.com/exdb/mnist/>.

## Appendix A1

# Structure of the Workspace

## Appendix A2

# Implementation

## Appendix A3

# Code Documentation