

# -sometitle-

Classifying N-body simulations with and without relativistic corrections  
using machine learning techniques

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**-sometitle-**

Classifying N-body simulations with and without  
relativistic corrections using machine learning  
techniques

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### **Abstract**

Here come 3–6 sentences describing your thesis.

### **Sammendrag**

Here comes the abstract in a different language.



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# Preface

Here comes your preface, including acknowledgments and thanks.



# Chapter 1

## Introduction

This is the introduction

### **1.1 Motivation**

### **1.2 Outline**

### **1.3 Aim**

### **1.4 Nomenclature**





# **Part I**

## **Cosmological Structure Formation**



## **Chapter 2**

# **Background Cosmology**

### **2.1 Describing the Universe**

### **2.2 The Friedmann Equations**

### **2.3 Recombination**



## **Chapter 3**

# **Perturbation Theory**

**3.1 Initial Conditions**

**3.2 Transfer Functions**

**3.3 Power Spectra**

**3.4 Non-linear Evolution and the Bispectrum**



## **Chapter 4**

# **Simulations**

### **4.1 N-body simulations**

### **4.2 Mass Assignments Schemes**





# **Part II**

## **Machine Learning**



## Chapter 5

# Neural Networks

### 5.1 Forward pass - Prediction

#### 5.1.1 Activation functions

#### 5.1.2 Loss functions

### 5.2 Backpropagation - Training

#### 5.2.1 Gradient descent

#### 5.2.2 Optimizers

#### 5.2.3 Regularization

TODO: Add dropout, batch normalization, weight decay, early stopping, data augmentation, etc. [Seljak\_\_1996, 1]



## **Chapter 6**

# **Convolutional Neural Networks**

### **6.1 Convolution**

### **6.2 New Layers**

#### **6.2.1 Convolutional layers**

#### **6.2.2 Pooling layers**

#### **6.2.3 Dropout layers**

