### Week 1 Introduction and Linear Algebra

### A. Introduction

1. Machine learning

### B. Linear Algebra 1

2.1 Systems of Linear Equations

2.2 Matrices

2.2.1 Matrix Addition and Multiplication

2.2.2 Inverse and Transpose

2.2.3 Multiplication by a Scalar

2.2.4 Compact Representations of Systems of Linear Equations

2.3 Solving Systems of Linear Equations

2.3.1 Particular and General Solution

2.3.2 Elementary Transformations

## Week 2 Linear Algebra and Analytic Geometry

### A. Linear Algebra 2

2.4.1 Groups

2.4.2 Vector spaces

2.4.3 Vector Subspaces

2.5 Linear Independence

2.6.1 The Basis of a vector space

2.6.2 Rank

2.7 Linear Mappings

2.7.1 Matrix Representation of Linear Mappings

### B. Analytic Geometry 1

3.1 Norms

3.2.1 Dot Product

3.2.2 Bilinear mapping and Inner product

3.2.3 Symmetric, Positive Definite Matrices

3.3 Lengths and Distances

3.4 Angles and Orthogonality

3.5 Orthonormal Basis

3.6 Orthogonal Complement

## Week 3 Analytic Geometry and Model Meets Data

### A. Analytic Geometry 2

3.8 Orthogonal Projections

3.8.1 Projection onto One-Dimensional Subspaces (Lines)

3.8.2 Projection onto General Subspaces

3.8.3 Gram-Schmidt Orthogonalization

### B. Model meets data 1

8.1 Data, Models, and Learning

8.1.1 Data as Vectors

8.1.2 Models as Functions

8.1.3 Models as Probability Distributions

8.1.4 Learning is Finding Parameters

8.2 Empirical Risk Minimization

8.2.1 Hypothesis Class of Functions

8.2.2 Loss Function for Training