Project "Topic: Eigenvalues and Eigenvectors in Principal Component Analysis" Title IB3702 Mathematics for Machine Learning

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1 Introduction

Machine learning (ML) relies heavily on mathematics. Luckily, ML is a rather new branch of computer science, which means that it has access to hundreds of years of advancements in the field of mathematics to base its core around, rather than having to discover new mathematical concepts. This means, usually, that the mathematics used in ML is rather straightforward. You build upon centuries worth of linear algebra and calculus to model, analyse and interpret data.

One technique to interpret data, and the topic of this report, is 'Principal Component Analysis' (PCA). PCA is a linear dimensionality reduction technique used in exploratory data analysis, with one main purpose — to reduce the dimensionality of a dataset, i.e., to reduce the number of columns (variables) which in turn makes the underlying dataset easier to process by computers. It does this by transforming the data into a new set of variables, the principal components (PCs), which are uncorrelated and ordered by the amount of variance they capture from the original data. The first principal component captures the most variance, the second captures the second most, and so on. This transformation is achieved through the mathematical concepts of eigenvalues and eigenvectors.

The aim of this report is to explore a new field of mathematics and gain knowledge in it. We will connect the theoretical concepts of eigenvalues and eigenvectors from linear algebra to their practical use case in PCA.

2 Preliminaries

3 Methods

4 Numerical Examples

5 Collaboration

6 Reflection

6.1 Student a: Tobias Hungwe

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6.2 Student b: Harman Singh

References