

Deep Learning

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1 Introduction

2 A Brief Overview of Tensors

You are likely familiar with scalars, vectors, and matrices. These can be thought of as analagous data structures in zero, one, and two-dimensions, respectively. When generalizing to N dimensions, we refer to these collectively as tensors. A scalar is a zero-order tensor, a vector is a first-order tensor, and a matrix is a second-order tensor. A third-order tensor can be visualized as a stack of matrices. A fourth-order tensor would then be a vector of third order tensors. A fifth-order tensor is a matrix of third-order tensors... and so on.

2.1 Tensor Products

Tensor additon and subtraction are self-explanatory if matrix addition and subtraction are understood. The same cannot be said for tensor products. Below is an overview of important tensor products.

2.2 Tensor Decompositions

2.2.1 CP Decomposition

2.2.2 Tucker Decomposition

2.2.3 Tensor Train

3 Selecting A Network Architecture

4 Convolutional Neural Networks

4.1 What Is Convolution?

4.2 Image Classification Example

5 Recurrent Neural Networks

6 Generative Models

6.1 Generative Adversarial Neural Networks

6.2 Variational Autoencoders