

Implementation of Auto-Encoders

Lab Assignment 6

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Abstract—Autoencoders are a type of deep learning algorithm that are designed to receive an input and transform it into a different representation. They play an important part in image construction.

Index Terms—Encoder, Decoder, Generative networks, Autoencoder

I. INTRODUCTION

Autoencoder is a type of neural network architecture used to encode and decode data. It consists of an encoder and a decoder part. The encoder part compresses the data into smaller and smaller dimensions, while the decoder then reconstructs the original data from the compressed data. The overall model is trained on the same inputs and outputs so that it learns to obtain the output similar to the input as much as possible. The network architecture for autoencoders can vary between a simple FeedForward network, LSTM network, or Convolutional Neural Network depending on the use case. Autoencoders can be used for eliminating complexity from data, in unsupervised learning problems, and in anomaly detection.

An autoencoder consists of three layers:

- **Encoder:**
The encoder has the task of compressing the input data into smaller dimensions.
- **Bottleneck:**
The bottleneck is the layer between Encoder and Decoder which contains the actual information regarding the compressed knowledge representations.
- **Decoder:**
The decoder decompresses and reconstructs the original data from the compressed data.

Autoencoders are mainly dimensionality reduction (or compression) algorithms with a couple of important properties:

- Data-specific
- Lossy
- Unsupervised

II. METHOD

- The autoencoder function was written using the inbuilt keras library
- Given input data is encoded with the help of a dense layer (Dense()) with ReLu activation function

- The decoder used the encoded data as input along with sigmoid activation function in the dense layer
- The autoencoder model is constructed using the encoder and decoder layers, the final model being optimised using Adam optimiser

III. DISCUSSION

- The auto-encoder is able to reconstruct the original images almost accurately with a loss of 0.0914.
- Thus, we can say that the autoencoder is successfully able to encode and decode the data provided.
- Undercomplete autoencoders are those that are used for dimensionality reduction.
- Autoencoders like the denoising autoencoder can be used for performing efficient and highly accurate image denoising.
- Variational Autoencoders can be used to generate both image and time series data.
- Undercomplete autoencoders can also be used for anomaly detection.
- Autoencoders like the under complete autoencoder and the sparse autoencoder do not have large-scale applications in computer vision

IV. CONCLUSION

Autoencoders are generally used for

- 1) Dimensionality reduction
- 2) Denoising
- 3) Anomaly/outlier detection

We have implemented the autoencoder function that can be used to train on images or other data in order to compress it and later be used for further application

APPENDIX (CODE)

the code is available here