

Chapter 8

Deep Learning: A Case Study for Image Recognition Using Transfer Learning

Semra Erpolat Taşabat

 <https://orcid.org/0000-0001-6845-8278>

Mimar Sinan Fine Art University, Turkey & Bahçeşehir University, Turkey

Olgun Aydın

 <https://orcid.org/0000-0002-7090-0931>

Gdansk University of Technology, Poland

ABSTRACT

Deep learning (DL) is a rising star of machine learning (ML) and artificial intelligence (AI) domains. Until 2006, many researchers had attempted to build deep neural networks (DNN), but most of them failed. In 2006, it was proven that deep neural networks are one of the most crucial inventions for the 21st century. Nowadays, DNN are being used as a key technology for many different domains: self-driven vehicles, smart cities, security, automated machines. In this chapter, brief information about DL theory is given, advantages and disadvantages of deep learning are discussed, most used types of DNN are mentioned, popular DL architectures and frameworks are glanced and aimed to build smart systems for the finance and real estate domains. Finally, a case study about image recognition using transfer learning is developed.

DOI: 10.4018/978-1-7998-3238-6.ch008

1. INTRODUCTION

DL is a form of Machine Learning that enables computers to learn from experience and understand the world in the context of hierarchy of concepts. Because the computer collects information from the experience, it is not necessary to specify any information that the computer needs. Earlier versions of Neural Networks (NN), such as first perceptrons, consisted of an input and an output layer and maximum one hidden layer. Today, networks containing more than three layers (including input and output) are considered as DNN. It means that DNN is a technical term that describes deep learning machines with multiple hidden layers. In DNN, each node layer runs on a set of different properties based on the output of the previous layer. The deeper the neural network, the more complex the features that the nodes can recognize, since the layers merge and combine the properties in the preceding layer (Alpaydın, 2010).

DL is an approach used to create and train NN. Deep Learning Algorithms (DLA) can be considered as decision-making black boxes. The memory of the NN controls the results to operate in the black box with the help of the number sequences known as weights, which define how the inputs are to be combined and assembled. An algorithm that processes a cat image and understands whether this image is a cat-containing image or not, can be a good example of a DLA. In order to build any DLA, complex networks of functions needs to be used. In 2012, articles and results published in the scope of ImageNet competition, where current developments in NN were shared. They became a real turning point for DL studies. Similar improvements have been achieved in natural language processing and speech recognition. In the light of these new techniques, it has become possible to build and train NN to overcome previously unresolved issues. Determining the characteristics of raw input data is a challenging process for ML methods (Warden, 2014).

DNN is crucial for big data sets, Image Processing (IP), speech recognition, sentiment analysis, etc. One of the best examples about the usage of DL can be Google. In 2011, the Google Brain Team started to conduct researches about DL. After a three-year discovery process, Google bought the UK-based initiative: DeepMind. Google has also used DNN developed by the company in Alpha Go games and desktop games. Another service that enables automatic results to be generated through DNN trained with the help of videos collected on servers is Google Now Talk Recognition. The Google Brain Team is also responsible for this project. This system is now called the new version of Google Neural Machine Translation. Google Brain Team has also been working on providing better recommendations to YouTube using DL (Marr, 2017).

Recent developments in the field of DL have brought new techniques. Thanks to these techniques, it is possible to train complex networks. One of these techniques

24 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/deep-learning/269586

Related Content

Prediction of Biosorption Capacity Using Artificial Neural Network Modeling and Genetic Algorithm: Prediction of Biosorption Capacity

Prakash Chandra Mishra and Anil Kumar Giri (2020). *Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications* (pp. 144-158).

www.irma-international.org/chapter/prediction-of-biosorption-capacity-using-artificial-neural-network-modeling-and-genetic-algorithm/237870

Identification of Optimal Process Parameters in Electro-Discharge Machining Using ANN and PSO

Kaushik Kumar and J. Paulo Davim (2022). *Research Anthology on Artificial Neural Network Applications* (pp. 824-842).

www.irma-international.org/chapter/identification-of-optimal-process-parameters-in-electro-discharge-machining-using-ann-and-psy/288988

The Use of Artificial Neural Networks for Objective Determination of Hearing Threshold Using the Auditory Brainstem Response

Robert T. Davey, Paul J. McCullagh, H. Gerry McAllister and H. Glen Houston (2006). *Neural Networks in Healthcare: Potential and Challenges* (pp. 195-216).

www.irma-international.org/chapter/use-artificial-neural-networks-objective/27279

Transfer Learning in 2.5D Face Image for Occlusion Presence and Gender Classification

Sahil Sharma and Vijay Kumar (2019). *Handbook of Research on Deep Learning Innovations and Trends* (pp. 97-113).

www.irma-international.org/chapter/transfer-learning-in-25d-face-image-for-occlusion-presence-and-gender-classification/227846

Adaptive Hybrid Higher Order Neural Networks for Prediction of Stock Market Behavior

Sarat Chandra Nayak, Bijan Bihari Misra and Himansu Sekhar Behera (2016). *Applied Artificial Higher Order Neural Networks for Control and Recognition* (pp. 174-191).

www.irma-international.org/chapter/adaptive-hybrid-higher-order-neural-networks-for-prediction-of-stock-market-behavior/152103