

Chapter 7

Role of Deep Learning in Image and Video Processing

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ABSTRACT

Image and video processing research is becoming an important area in the field of computer vision. There are challenges such as low-resolution images, poor quality of videos, etc. in image and video data processing. Deep learning is a machine learning technique used in the creation of AI systems. It is designed to analyse complex data by passing it through many layers of neurons. Deep learning techniques have the potential to produce cutting-edge results in difficult computer vision problems such as object identification and face recognition. In this chapter, the use of deep learning to target specific functionality in the field of computer vision such as image recovery, video classification, etc. The deep learning algorithms, such as convolutional neural networks, deep neural network, and recurrent neural networks, used in the image and video processing domain are also explored.

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INTRODUCTION

The mechanism used to construct or deconstruct visual images and videos for Deep learning applications are new area of machine learning that can be quite difficult to meet the challenges like low resolution images, recovery of data from old images, human and object detection through computer vision in real time etc. Video processing works with detection and classification, whereas image processing deals with picture enhancement and image analysis. In order to tackle obstacles, image data is examined and analysed using picture filtering, morphological processes, and segmentation. Deep learning necessitates the ability to learn features automatically from data, which is often only achievable when a large amount of training data is available, particularly for issues with high-dimensional input samples, such as photographs.

Image Processing

The process of transferring a picture to a digital format and processing it to extract useful information is known as image processing. When using specific signal processing approaches, the image processing system normally interprets all pictures as 2D signals. Visualization, Pattern recognition, Retrieval, Recognition, Sharpening and Restoration are five types of image processing techniques Image filtering, morphological procedures, and segmentation are used to evaluate and analyse image data to address these difficulties. It needs masses of training data, particularly for issues with high-dimensional input samples, like photos, to learn features automatically.

Deep learning is a concept that aims to mimic how the human brain analyses information to make decisions, predictions, and recognition. In deep learning, computers learn from a given data set to discover patterns and traits. Deep learning uses training data to construct a model that can categorise data. In deep learning, data is input into a deep neural network to learn and forms a model to generate the intended output. Figure 1 shows the work flow of data (SRC: <https://nanonets.com/blog>).

Deep learning is a promising topic in picture and video analysis. Deep learning methods aid in automated imaging segmentations with emphasis on different attributes collected from the picture or video datasets. It gives a novel technique of identifying anomalies and improved diagnosis. The software is led to describe a model able to anticipate the proper result using training datasets. The prediction model is evaluated against a known dataset apart from the training set.

Applications of Image Processing

The modern day is emerging with new technology, and the digital revolution is in full swing. Image processing can be done in various domains like health, non-destructive evaluation, forensic studies (for handling evidences), material science, film industry (For editing, visualising), document processing, graphical arts, and printing industry are all examples of image processing applications.

Some use cases of Image Processing are as follows.

- Defence Services: Vehicle navigation, Target tracking and detection, automatic target recognition and missile guidance.
- Medical Imaging / Visualization: Assist medical practitioners in interpreting medical imaging and diagnosing abnormalities more quickly.
- Aid in surveillance and biometric authentication for law enforcement and security.

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