Chapter 3
Artificial Intelligence and Machine Learning and Its Application in the Field of Computational Visual Analysis

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ABSTRACT

Artificial intelligence and machine learning applications in image processing are examined in this chapter. It covers AI methods including supervised, unsupervised, reinforcement, and deep learning. Genetic algorithms, rule-based systems, expert systems, and fuzzy logic are AI methods. SVM, decision trees, random forests, K-means clustering, and PCA are machine learning methods. CNN, RNN, and GANs are utilised for object recognition, classification, and segmentation. The chapter discusses how artificial intelligence and machine learning affect accuracy, efficiency, and decision-making. The need to choose proper measurements and procedures for assessment and performance analysis is also stressed. Ethics like justice, privacy, transparency, and human-AI cooperation are covered in the chapter.

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1. INTRODUCTION

Images are vital sources of information in the digital age, and they are utilized in a broad variety of disciplines, including business, science, law, education, politics, the media, the military, medical imaging and diagnostics, art, digital forensics, and sports, to name a few. Recently, fraudulent photographs have caused problems for various applications. Digital photos can be edited using image-editing tools such as digital cameras, personal computers, and image-processing software. This allows images to be altered in a variety of ways. These tools come with functionality for the user interface and can be scaled as needed. The authenticity and reliability of an image are two concerns that are targeted by attempts made at forgery detection. To make images that are unrecognizable and appear so real that the authenticity is lost, techniques such as image splicing, cloning, and editing are used to create fake photographs. These techniques are used to create photos that have been falsified. Thanks to developments in graphics technology and advanced hardware and software tools, the process of creating forged photographs has become straightforward, and digital images may be instantly manipulated. This is possible due to the fact that digital images are stored in a digital format. images can now be altered by anyone, regardless of their level of experience, and the methods for detecting forged images are still in the experimental stages of development. picture tampering and picture forgery have the same fundamental objective, which is to change some of the image's data in order to either hide traces of tampering or alter specific aspects of the image in order to communicate false information.

In recent years, the contribution of artificial intelligence has expanded significantly across all industries. Image processing techniques and artificial intelligence are intertwined. Both of them have collaborated on the development of a number of technologies that are now used in our everyday lives to make even the most difficult tasks easier to accomplish. Image processing and computer vision are often considered to be two of the most important components when constructing an AI model. Image processing can be illustrated as the task of categorization of images into one of various classes, which provides the backbone for other computer vision functions such as detection, segmentation, and localization. AI in the health-care system has been facing strenuous challenges to design and develop intelligent and autonomous health-care solutions. Image processing can be illustrated as the task of categorization of images into one of various classes(Pandey, B. K.,et al.,2011).

According to Rawat et al. (2017), deep learning models have an effect on multiple layers of nonlinear acquired knowledge processing, including the extraction and transformation of functions, pattern classification, and analysis for issue solving. Processing images with the use of a computer has come to be seen as absolutely necessary for finding solutions to problems in the field of medical imaging. Deep learning approaches led to a main breakthrough in the field of image interpretation by assisting, recognizing, classifying, and quantifying patterns in medical imaging. As a result, deep learning looks to be a new building block for obtaining increased efficiency in numerous medical applications (Shen et al,2017b).

According to Wut et al. (2017), the use of AI in medical imaging plays a crucial role in achieving higher levels of diagnostic accuracy and therapeutic efficacy in clinical settings. Utilizing deep learning can lead to significant improvements in the performance of other AI methodologies. For instance, the capability of deep learning in medical images acquired with computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET) for better results (Shen et al,2017b). Although the applications of image processing are numerous, the strategies and principles that are utilized in each of these applications are identical. In the field of artificial intelligence recognition technology,