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Applications of Image Processing

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This research paper is an attempt to explore the applications of image processing in various fields such as healthcare and public services. This paper provides an overview of the importance of image processing and the various tools that can be used for analyzing videos and images.
Keywords: Image processing, Video Analytics, MATLAB, Image Analysis, Face recognition, Neural Networks.

Introduction

Unstructured data is dominated by video files, images, audio clips, and text. The importance of mining information from images and videos is gaining prominence. The necessity to refine image files finds its foothold in almost every field such as healthcare, retail, administration, and security. The collection of image data is growing bigger each day and so is the need to use this information effectively.

Various techniques are existing for handling image analytics. It includes image acquisition, image enhancement, image processing, classification, image compression, segmentation, and image recognition. The process of mining images is almost similar to text mining. Image recognition is the process of identifying and detecting an object or a feature in a digital image or video. This concept is used in applications like security surveillance and face recognition. Image processing involves identifying and extracting key features and using them as input to a machine learning model. Classification of numbers is an example for this. Earlier traditional computer vision techniques were used for image recognition. But lately, deep learning is extensively used in image recognition. Convolutional neural network is used to automatically learn relevant features from sample images and automatically identify those features in new images [1].

Image Processing

Image processinghas great potential for research as there are many untapped areas in this field. Since large number of images are generated through many applications there is a challenge for quick image retrieval in an efficient manner. Images can be retrieved based on query, by specifying keywords or by browsing through the image database. This process has to be made as efficient and quick, as text retrieval. This feature will have tremendous use in the medical domain. Using a user interface, doctors can exploit the abundance of medical resources for educational and clinical purposes. They can do research on abnormal conditions by retrieving and comparing images of related abnormalities and study the diagnosis provided.

Another area of image processing is analyzing video data. Video content analysis (VCA) is a subset of computer vision. Video content analysis is especially useful in mining patterns and information from CCTV footage. There are applications that requires face recognition in video footage. For example, in the investigation of a crime,CCTV footage of the crime area will be the main source of clue for investigators. However, in most cases it is very tough to identifythe face, vehicle registration number by merely watching the video. In such situations image processing and comparison with thousands of other images will greatly help in finding the culprit.

For a computer, image is a collection of pixels and each pixel is like an array of numbers. Each image will have attributes like number of channels that defines the array dimension, and depth that defines the maximum bit size of the number stored in the array. Images can be binary, grayscale or RGB. Computers cannot understand images. Images has to be broken into small parts that would act as templates to train the computer. This process is not possible unless algorithms are used. While working with images it is mostly considered in terms of 3-D arrays, with the dimensions referring to height, width and color channel.

Neural Networks

Neural networks is a special type of machine learning algorithm. Convolutional neural network (CNN), is a deep, feed-forward artificial neural network that is mainly used for analyzing visual data. Convolutional layers apply a convolution operation to the input, passing the result to the next layer. The convolution emulates the response of an

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individual neuron to a visual stimuli [2]. Some of the challenges faced in object detection are variations in viewing the image, difference in image illumination, hidden parts of the image, and isolating background noise. Deep CNNs work by consecutively modeling small pieces of information and combining them deeper in network. Traditional approaches to image processing cannot handle the vast amount of variations in images. Due to the ease of using many deep layers, CNNs can model complex variations and behavior giving highly accurate predictions [3].

There are many libraries/languages available for deep learning and it has interface for Python, Java, and MATLAB. Some of the popular libraries are TensorFlow, Theano, and Keras amongst which,TensorFlowis widely used. It is quite a powerful neural network library.Keras is a high level library and considered as one of the most popular library for image processing. However, it has dependency on low level libraries like Theano / TensorFlow.

As an example, consider using Kerasfor asimple image recognition problem. Requirement is to have Keras installed and use tensorflow for backend. Consider the problem of identifying digits from a 28*28 image. We can use a set of images for training and testing. Python is used to understand this implementation. Apart from Keras some other libraries that are used are numpy and scipy.Dataset is loaded and preprocessed. Here image will be represented in terms of numpy array. Data is divided into training and test set. A model is built using neural networks. We can use one of the optimizers available in Keras called as Adam. Once the model is built it has to be trained and finally evaluated. This is one of the example of how Keras is used for image recognition [4].

Video Analytics

Video analytics is another area where again one should decide on the specific objects and events that has to be analyzed and detected. The requirement might be to track movements, face recognition, object analysis, etc [5]. Although image analytics is catching up there is not much advancement in the area of real time analysis of video feeds. Analysis is only done on the recorded feeds. It is very essential for real time analysis of videos to help with accidents, crime, and other critical issues. It is similar to how GPS captures information in real time about road congestion and provides continuous updates to users on their smartphones.

MATLAB has a very extensive image processing toolbox that can be used for video analytics effectively. It can be used for image enhancement, image segmentation, noise reduction, detecting image objects, etc. It provides a comprehensive set of reference-standard algorithms and workflow apps. Common image processing workflows can be automated. Comparison and batch processing of large image datasets is possible. Even 3D images can be processed. It is the most widely used tool for image processing. Although R has not many libraries for image processing, imager can be used. It contains about 100 functions and can be used for loading and saving images in various formats, displaying images, working with pixel, interpolation, and resizing of images.

Conclusion

Due to the enormous potential of image processing in various real time applications there is lot of scope for research in this area to study more in depth and unravel its complexities. Python, R, and MATLABcan be successfully used with its powerful APIs and libraries to develop various models for extracting useful information from images and videos.

References

[1] Andy Lee, (2015). Comparing Deep Neural Networks and Traditional Vision Algorithms in Mobile Robotics, Swarthmore University.

[2] Bernd Jähne; Horst Haußecker (2000). Computer Vision and Applications, A Guide for Students and Practitioners. Academic Press.

[3] Aarshay Jain, (2016). Deep Learning for Computer Vision – Introduction to Convolution Neural Networks.

[4] Faizan Shaikh, (2016). Optimizing Neural Networks using Keras, Analytics Vidhya.

[5] Carlo S. Regazzoni, Andrea Cavallaro, Ying Wu, JanuszKonrad, and ArunHampapur (2010). Video Analytics for Surveillance: Theory and Practice, IEEEXplore