

Design and Research of an Image File Format with Rich Information

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Abstract: The effect of image processing is determined by the amount of information provided by the image files. With the development of integrated circuit and sensor technology, the image information acquisition technology has been greatly improved, we can obtain higher and higher image quality, and it is possible that image files contain more and more abundant information. The realization of technologies such as image target detection and recognition, image and video retrieval, image segmentation, matching and understanding has a high dependence on image quality. By use of a series of sensors or instruments, we collect relevant data and add relevant information in image files, adding some information to traditional image files, such as: complex environmental information (smoke, fog, rain, clouds, snow, etc.), feature targets Distance, brightness, etc., are conducive to the processing of graphic feature data. The paper analyzes the hierarchical structure of image information, the necessity and feasibility of the increase of image file information, how to increase the relevant information in the image file format, and the significance of the rich information image file format.

Keywords: Image File Format, Image Processing, Image Information Hierarchy, Image Understanding

1. Introduction

With the development of big data, cloud computing and artificial intelligence, image processing has become more and more widely used in modern information technology. Computer vision, scene understanding of driverless cars, and image recognition are complex issues in image processing. How to improve the accuracy of image understanding is a pressing issue at present. Based on deep neural network image classification and target detection, image annotation processing, network model training and testing require feature processing, and the complex image environment is not conducive to feature processing. With the rapid development of integrated circuits, the degree of chip integration has been greatly improved, the processing speed has been rapidly developed, the integration of sensors has become higher and higher, and the size of sensors and measurement equipment has become smaller and smaller. These smaller sensors or measuring devices are integrated into the image acquisition device, and rich information image files are generated by the system. The development of these technologies also makes it possible to add more information

to the image processing file format [1].

2. The Hierarchical Structure of Image Information

Ordinary image files contain a lot of information. According to the degree of abstraction of the image file information and the research methods, it can be generally divided into three levels, from the bottom layer to the top layer in order: image processing, image analysis, and image understanding.

Image processing is the transformation of image information, which is to perform various processing on image data to improve the visual effect of the image and build a basis for automatic recognition, or compression coding of the image to reduce the storage space or transmission time required for it [2].

Image analysis is the detection and measurement of objects of interest in the image to obtain their objective information

to establish a description of the image [3]. It is a process from image to data, where the data can be the result of detection of a target feature or a symbolic representation based on measurement.

Image understanding is based on image analysis, using knowledge, experience, etc. to further study the nature of the objects in the image and their interrelationships, and to understand the meaning of the image content and the interpretation of the original objective scene.

Image understanding	Semantic high level (symbol)
Image analysis	Semantic medium level (object)
Image processing	Semantic low level (pixels)

Figure 1. The hierarchical structure of image information.

3. The Format Information of Traditional Image Files

For different image file types, the traditional image file contains different file information. The general structure of the image file mainly includes three parts: file header, file body, and file end [4].

The main content of the file header includes the information of the software that generates or edits the image file and the parameters of the image itself. These parameters must completely describe all the features of the image data and are the key data in the image file [5]. According to different files, some parameters are optional, such as compression algorithm, some files are not compressed, and some files can be compressed in a variety of ways.

The body of the image file mainly includes image data and a color transformation lookup table or palette data. This part is the main body of the document and plays a decisive role in the size of the document. If it is a true color image, there is no color conversion lookup table or palette data [6]. For several color palettes, each color value is represented by a number of bits.

The tail of the file can contain some user information. The tail of the file is optional, and some file formats do not include this part. Because the volume of the file body is much larger than the file header and the tail of the file, the space occupied by the color conversion table or the palette in the file body is generally much smaller than the image data. Therefore, the capacity of the image file can generally represent the capacity of the image data (compressed or uncompressed).

An RGB-format color image can be regarded as a three-dimensional matrix, with each number in the matrix

representing the brightness of a different color at different locations of the image. However, these three-dimensional matrices are not stored directly when the images are saved, they are firstly compressed and then stored. Therefore, the process of reading an image is actually the process of reading the compression-encoded result and then decoding it [7].

The amount of data in the image, also called the capacity of the image, is the space the image occupies in the memory, in units of bytes. The amount of data in an image is related to many factors such as the number of colors, the size of the picture, the format of the picture, and so on. The larger the picture and the greater the number of colors, the better the quality of the picture and the larger the file size, and vice versa [8]. The size of an image data volume is proportional to the resolution of the image and the depth of the image. Image files store pixel locations, color information, or grayscale information. An ordinary JPG file stores the following information:

Table 1. A JPG file stores the following information.

Field	Attribute	Explanation
Format	jpg	
Format Version	"	Null
Width	424	Pixels
Height	300	Pixels
Bit Depth	24	
Color Type	True color	
Format Signature	"	Null
Number Of Samples	3	
Coding Method	Huffman	
Coding Process	Sequential	
Comment	{}	

4. Add More Information to the Image File

4.1. Rich Information Image File Generation System

By use of some new sensors to get richer information, we can add these information to the image file. The rich information image file generation system includes software system and hardware system. The hardware system adds some sensors and sensor control systems and related interface parts on the basis of the original camera system [9]. Through the software part of the embedded system, the rich information of these sensors is added to the image file, so that a rich information image file is synthesized. Compared with the traditional image acquisition equipment, more abundant information can be obtained: GPS, magnetic sensors, luminance sensors, gas sensors, distance sensors, etc. [10]

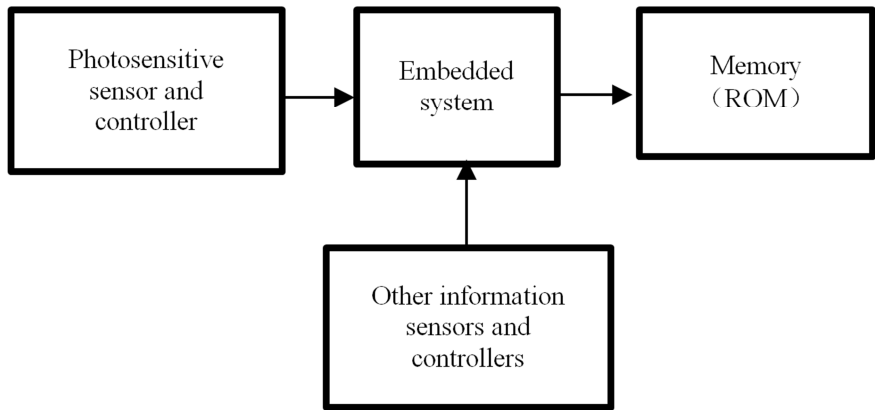


Figure 2. The rich information image file generation system.

4.2. Additional Information

The new sensors are added to collect relevant data for analysis and processing, and add relevant information to the image file. In the process of image processing, such as image fuzzy processing, image denoising, image enhancement processing, and so on, we can make use of rich information and do the related processing conveniently. Usually, complex weather conditions bring a series of technical difficulties to image processing, such as images obtained in haze, rain, snow and so on. It is very difficult to carry out image

detection or target recognition. If the image is identified or detected, the image preprocessing is done to the haze, rain and snow removal according to the predetermined algorithm, so the accuracy of image recognition and image detection will be greatly improved [11-12]. According to the different information provided by the rich information image file, the image file is preprocessed according to the corresponding algorithm, and the accuracy of image recognition and image understanding will be very high.

Table 2. New information added to the rich information image file.

Information item	Comment
Time	The time to get the image
Weather conditions	Fog, rain, snow, dust and other weather
Feature target distance	The size of the shooting device from a target in the image
Brightness	Brightness when taking pictures
Location	Location information when shooting
Other environmental	Information Special environmental information such as smoke and fire scenes

4.3. The File Structure of Rich Information Image Files

Some sensor information is added to the traditional image file, and the structure of the file is also changed. Without considering image compression, rich information items are added after the file header. Alternatively, the relevant rich

information is encoded, and the encoded information table is stored at the end of the file [13]. When it is necessary to access this information, the specific rich information type is queried in the table through encoding. At the same time, the extension of the file name is changed to ri+ original extension name, for example: JPG extension to riJPG.



Figure 3. The hierarchical structure of image information.

4.4. Software for Processing Rich Information Image Files

The image file format determines what type of information is stored in the file, how the file is compatible with various application software, and how the file exchanges data with other files. The rich information image file format records and stores the format of the image information. In order to store, process, and propagate the digital image, a certain image format must be used [14-15]. The pixels of the image are organized and stored in a certain manner, and the image data is stored into a file to obtain an image file. In order to be suitable for the file operation of the traditional application

software, the rich information and file headers in the image file may be combined, or the conventional image application software may be upgraded to be suitable for operating the rich information image files.

5. Advantages of Rich File Information in Image Processing

In the process of image processing, the more image scene information is provided, the more conducive to image processing. For example, image filtering, that is, to restrain the noise of the target image under the condition of keeping

the details of the image as much as possible, is an indispensable operation in the image preprocessing [16]. The effect of the image processing will directly affect the effectiveness and reliability of the subsequent image processing and analysis.

According to the rich information provided by the image file, the corresponding processing algorithm is selected. In the aspects of image feature extraction, image foreground and background information processing, it can not only improve the speed of image processing, but also improve the accuracy of image processing. Especially in image processing based on deep learning, computer vision and unmanned driving, it is necessary to deal with a large number of large data video and image analysis and understanding, and the use of rich information image files for preprocessing, which is beneficial to improve the accuracy and difficulty of the following tasks, such as target detection and recognition. Rich information format files will be widely used in these areas. [17]

6. Conclusion

In this article, a new image file format is proposed based on the traditional image file, which contains rich scene information during image generation. Some of the latest sensors and embedded systems are used to collect the scene information, and add these information to the image files to form a new rich information image file. According to different file information, the corresponding image processing algorithm can be selected for image processing, thus highlighting the image features in the image. These image features are very important both in single image file processing, or in large volume image processing in computer vision based on deep learning or convolutional neural network. Indeed more research is needed to find out the best algorithms to use rich information to process the images described in this study.

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