An Automatic Method of Sequential Image Processing

Liangliang Kong*, Lin Chen and Man Wang
The College of Engineering, Shanghai Polytechnic University Shanghai, China

*Corresponding author email: llkong@sspu.edu.cn

Abstract. As the visual storage of objective things, images are usually used everywhere in the field of electronic information. Images of objects are collected or drawn to make electronic image files, which are stored into image files, and may be classified into different folders. Image users, such as accounting, HR and so on, often need to reprocess the images and save them into a word file when they use the images. Such manual processing of images is time costing and labor costing. In this paper, a method of automatically inserting and processing images is proposed and implemented. In the method, the sequence of inserting files is recorded in an excel file. Only the name of image file and the excel file need to be maintained. It is convenient to use the method to process images, and the method can be implemented automatically. So it is an effective way to help staffs to edit and insert images.

Keywords: Image/ Pictures; Image processing; Automatic processing; Automatic office.

1. Introduction
People can observe the size, light and shade, color, dynamic and static information of external objects by their eyes. The visual information collected by eyes at a moment can be called images, which are usually stored as two-dimensional analog quantity. Image is the basis of human vision, the objective reflection of nature, and the important source of human understanding of the world and human itself [1]. With the development of electronic information and computer technology, it is convenient for human to quantify, process, save and display images. According to their characteristics, these digital images can be divided into two categories: bitmap and vector. Bitmap is usually represented by digital array, and the common formats are BMP, JPEG, GIF, etc.; while vector map is represented by vector database, common formats include PNG, ICO, DXF, etc.

In different applications of different fields, many enterprises or research institutions or individuals often collect or process many different images, and make them into electronic files after appropriate processing, which are stored in different directories of the computer in order to meet the needs of post-processing in future. When using images, users of image files, such as accounting and HR, often need to edit them into a word file after reprocessing, and complete this task by manual processing, which is time costing and labor costing. However, computers are suitable for this kind of repetitive work, and their speed are very fast. Therefore, it is an effective way to use the computer program to complete this task [2].

In order to facilitate the users to insert and process images, this paper proposes and implements a new method of automatic image processing based on VB.NET. In this method, the insertion sequence of images is recorded in an excel file, and only the name of the image file and the excel file need to be maintained. By this method, a lot of time and labor can be saved. Therefore, it is an effective way to implement automatic office and improve the efficiency of work.
2. Background
Computer language is divided into machine language, assembly language and high-level language. High level language is popular for human to understand and write programs. It has many categories, such as FORTRAN, basic, Pascal, C, C++, Java, Python and so on [3]. Each high-level language has its own advantages or disadvantages. VB.NET is an object-oriented computer programming language developed by Microsoft. Its syntax is inherited from Basic. It is easy to be learned and powerful [4].

3. Basic Principles of the Method of Automatic Insertion and Processing of Images
In the method we proposed, read the excel file which records the sequence of images when they are inserted and processing requirements of the inserted images, save these information in global variables, and then create a word file. According to the information saved in the global variable, insert the images into the word file and process them according to the requirements.

The illustration of the method which can be implemented in Windows OS is shown in figure 1. The bottom layer is Windows OS, the middle layer is consisted of Microsoft .NET Framework, NPOI and Microsoft Office Word, and the top layer is User Program Interface. In order to save the developing work, the method in this paper is mainly proposed based on the middle layer.

![Automatic image processing diagram.](image)

The .NET Framework is an internal Windows component that supports generating and running of next generation applications and XML Web services. Its two main components are common language runtime library and class library. We use it to generate program interface and multi thread management. NPOI is an open-source program by C# to access Microsoft Excel or Word without setting up Office [5][6]. In the method, we use it to access Excel files. We use Microsoft Word to create files and insert images into the files. Both NPOI and Office can access excel and word files, and we use them to access excel and word files respectively. One is to study the difference between them. The other is that the compatibility of Excel version is not good, which easily leads to errors in the developed application. The top software User Program Interface provides users to select Excel files and output some prompt information.

As illustrated in figure 2, according to the task requirements, firstly, we first select Order Excel File. Secondly, open the excel file and read the image file name and size and identification of the image to be inserted in sequence until the end of the file. Thirdly, close the excel file and create a new word file, set up the page, insert them into the word file according to the image file information stored in memory, and process the format of images one by one. At last, after processing all the images, save and close the word file. The program ends and the task of image process is completed.
4. Experiments of the Implement of the Method

In the method, the application is developed in Window OS and is stored as InsertImage2Word as illustrated in figure 3. As shown in figure 3, there is an excel file path edit box and corresponding path selection button. There are also insert / pause / stop buttons and status bar time and progress indication.
According to the process of image processing in figure 2, first of all, to read the content of the excel file, a file stream object is created by the function FileStream(file_name_xlsx_source, FileMode.Open, FileAccess.Read). In the function, the first parameter is the excel file name, the second and the third parameter is the file opening and reading and writing settings respectively. Then, an XSSFWorkbook object is created to read the image file and its information and store it in a string array. And then a Word.Application Object and StreamWriter object are created, configure the page setup settings of the word page. Finally, insert and setup images one by one according to the contents of the stored string array. If a loop is used to implement, the users of the method will feel not good, there will be no response of the application. So a thread is used to implement the method. The thread of image processing can be implemented by VB.NET as follows:

Private Sub InsertPics2Word(ByVal objPicsInsert As PICS_INSERT)
    Variables Define program statements
    For iLoop = 0 To objPicsInsert.picLoopCount – 1
        Pause program statements
        QueryAddr: Try
            For kLoop = 0 To countPicOnceThread – 1
                Read Image file name and infos;
                If (image filename is legal) Then
                    onlineDocxWriteResult.Activate()
                    onlineWord.DisplayAlerts = False
                    onlineWord.Selection.TypeText(…)
                    onlineWord.Selection.TypeParagraph()
                    onlineWord.Selection.InlineShapes.AddPicture(strKeyword, False, True, missing)
                    onlineWord.Selection.TypeParagraph() 'insert a line
                    Try
                        onlineDocxWriteResult.Save()
                    Catch
                        MsgBox(Err.Description)
                    End Try
                Else
                    Output error infos to log txt file program statements;
                End If
            Next
            objPicsInsert.picCurLoopNum = objPicsInsert.picCurLoopNum + 1
            curRoundNum = objPicsInsert.picCurLoopNum
            ……
        Catch ex As Exception
            Exception handling
        End Try
        If objPicsInsert.picCurLoopNum > objPicsInsert.picLoopCount - 1 Then
            Exit For
    End For
End Sub

Figure 3. The application of the method.
End If
Next
countFinish = countFinish + 1
onlineDocxWriteResult.Close(Word.WdSaveOptions.wdSaveChanges)
onlineWord.Quit()
onlineWord = Nothing
streamOnlineWriterResult.Close()
streamOnlineWriterResult = Nothing
If flagErrorInput Then
    Shell("notepad.exe " & file_name_txt_realtime_result)
Else
    File.Delete(file_name_txt_realtime_result)
End If
End Sub

5. Experiment of an Example
In this paper, we took an example of automatically processing financial invoice images to validate the application of the method. In this experiment, the number of images which were to be processed was 455, the time what the application took to automatically process the images was 721 seconds, the average time of inserting and processing one image was 1.63 seconds per image, but the total manual operation time what it took in the application was only less than 30 seconds.

To compare with the proposed method, we took another experiment of manually processing those exactly same images. 455 pictures were inserted and processed manually, which took 13650 seconds to complete the processing. The average time for inserting and processing one image was 30 seconds.

Comparing these two experiments results, the method proposed in this paper could save a lot of time of inserting and processing images by an automatic way. It is an effective and convenient way for office people to improve the efficiency of work when there are lots of images need to be processed.

6. Conclusion
Since the method we implement in this paper could simulate operations of office people to insert and process images, it is an automatic way of processing images. When office people use the method to automatically insert and process images, they only need to edit the sequence of inserting images and requirements of processing images, and point out the file path. Since the method could simulate the hard work of image inserting and processing, experiments results have shown it is an automatic way to improve the efficiency of work for office people.

Reference
[1] Duan D G and Wang J Y 2013 Image Processing and Application (Beijing: Beijing University of Posts and Telecommunications Press )
[2] Zhang Z, Ni H X and Yuan C M 2013 Master Matlab Digital Image Processing and Recognition (Beijing: People's Posts and Telecommunications Press)
[3] Frese U and Hirschmüller H 2015 Special issue on robot vision: what is robot vision? Journal of Real-Time Image Processing vol10 (Berlin:Springer-Verlag) pp597–598
[4] Liu T H, Ma Y and Liu J W 2019 Practical Course of VB.NET Programming (Beijing: Tsinghua University Press)
[5] Martin J 2014 Visual Studio 2013 Cookbook (Birmingham: Packt Publishing)
[6] Wang L, Zhou X S and Jiang Z J 2012 A Real-Time Process Scheduling Policy in Windows Proc. Int. Conf. on Computer Science & Service System (Piscataway, N.J.: IEEE Press)