Chapter 1

Introduction

1.1 Introduction

With the improved technologies of digital still camera (DSC), people start to care about whether they can spend less money but buy a commercial DSC with high quality. In the past, only high-end lenses for single lens reflex (SLR) or digital single lens reflex (DSLR) were equipped with expensive hardware such as high/low speed shutter, high ISO (international Standards Organization) speed, and high resolution CCD\CMOS sensor to easily get high performance images. Nowadays, achieving both high quality and low price makes the products more competitive. These benefits stimulate the need to develop economically commercial DSCs with distinct shape, colorful performance, and less noise.

Obviously, adding extra hardware components is undesirable. Software methods by combining multiple images are more reliable. Many related researches, such as flash/No flash pairs [1-3], spatial/temporal domain of noise reduction [4-5], high/low speed shutter for high dynamic range (HDR) [6-9] [15], have been proven that the performance of image was almost the same as high-level cameras after synthesized by several images with different properties. However, the challenges and limitations of these techniques are from camera shakes and moving objects which will cause unpleasant image ghost and degraded quality if two images are misaligned. Therefore, it is more applicable to develop an accurate, efficient, and cost effective registration algorithm for fusion applications.

1.2 Objective

Image registration and image fusion were studied separately in the past and both of them were processed by computer. Our objective is to integrate above two techniques into DSC to increase the dynamic range under the scenes containing both low and high illumination. Taking the efficiency into account, a modified registration algorithm from Greg Ward [14] and an improved fusion algorithm for high dynamic range (HDR) from Wyckoff [15] were proposed.

Generally speaking, DSCs have three important pre-processes including automatic focus (AF), automatic white balance (AWB), and automatic exposure (AE). The light value of the sensor is estimated through the pre-processes and form two patterns of color filter arrays. Our image registration (I.R) and image fusion for HDR techniques which are inserted behind the pre-processes can be directly operated by these patterns and then produce one high-quality image. Afterward the image is processed by enhancing its edges and color, then the format of Joint Photographic Experts Group (JPEG) is encoded and output. The image pipeline stage is shown in **Fig. 1-1.**

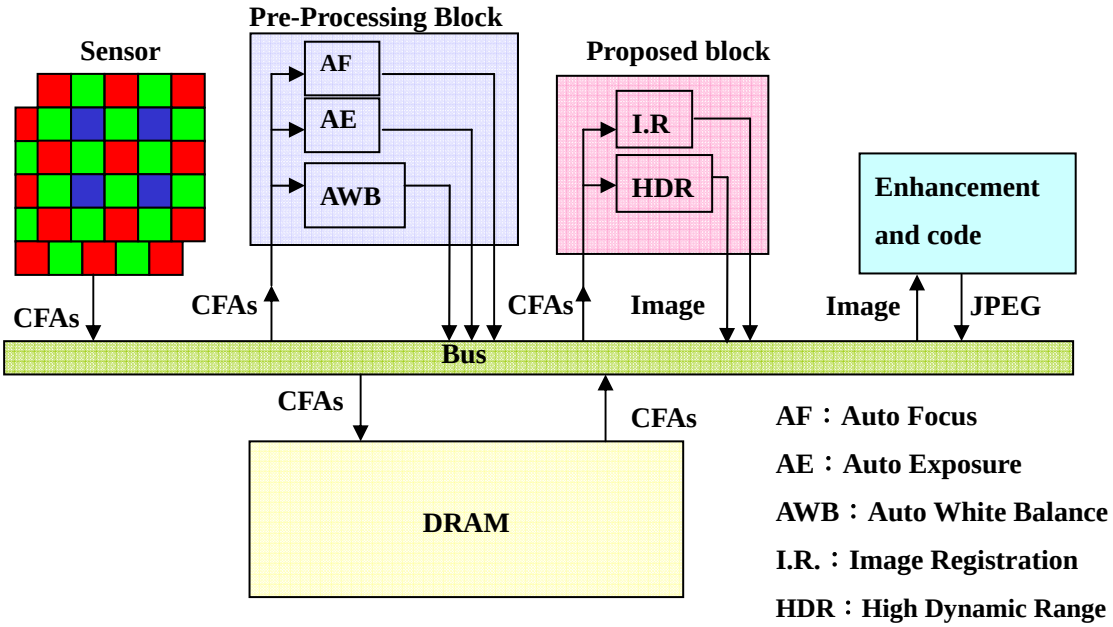

Fig. 1-1 Image pipeline stage of DSCs.

1.3 Organization

This thesis is organized as follows: In chapter 2, we will introduce the prior arts of registration algorithms and discuss the advantages and disadvantages of each other. Moreover, the concept of fusion application for high dynamic range (HDR) will be described. In chapter 3, some issues of Ward's registration algorithm will be discussed by specific experiments and the improved algorithm will also be proposed. In chapter 4, the issues of Wyckoff's HDR application will be explained and the improved methods will be presented. In chapter 5, the experimental results integrated above two techniques will be shown. In chapter 6, conclusions and future works will be given.