CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Security personnel involved in surveillance often need a very High Resolution (HR) digital image close to that of an Analog 35mm film that has no visible artifacts when an image is magnified. Therefore, finding a way to increase the current resolution level is very much needed.

The most direct solution to increase spatial resolution is to increase the number of pixels per unit area where by the pixel size is in effect reduced. This is done by the sensor manufacturers themselves, of course at a higher cost that would later be passed to consumers.

However, as the pixel size decreases, the amount of light available also decreases. This generates shot noise that degrades the image quality severely.

To reduce the pixel size without suffering the effects of shot noise, therefore, there exists the limitation of the pixel size reduction. The optimally limited pixel size is estimated at about 40 μm2 for a 0.35 μm CMOS process.

1.2 Solution

The approach studied in this project, is to use signal processing techniques to obtain an HR image from multiple observed low-resolution (LR) images.

These signal processing techniques have been heavily studied by several research engineers like S.C Park, Capel David, Deepu Rajan et all. The term Super Resolution (SR) has been used by them with regard to the above mentioned Signal Processing Techniques.

The major advantage of the signal processing approach is that it may cost less and the existing LR imaging systems can be still utilized.

The SR image reconstruction is useful in cases where multiple frames of the same scene can be obtained. One application is to reconstruct a higher quality digital image from LR images obtained with an inexpensive LR camera/camcorder for surveillance purposes such as frame freeze or printing.

Synthetic zooming of Region of Interest (ROI) is another important application for surveillance or forensic purposes. Common situations such as to magnify objects in a scene such as the face of a criminal or the license plate of a car.

1.3 Objective

The main objective of this project is to apply Super Resolution (SR) techniques to enhance surveillance images. The aim of this project is to develop software algorithms for current surveillance systems.

Therefore the hardware of the current system can still be maintained and used but with the capability to produce much higher resolution images. Providing a more cost efficient system as opposed to an over all hardware upgrade.

The intent in this project is to develop an efficient application specific algorithm using minimum computation resources such memory and processing power. This would further lower overall cost.

Super resolution techniques are used for three specific purposes namely; to increase pixel density of image, increase number of vertical & horizontal pixels and increase size of a low resolution image.

Therefore creating a high resolution image containing more detail or the term coined by Vandewalle (2005) containing more resolving power than the previous low resolution images.

The specific use of super resolution image for surveillance application in this project is to obtain a clearer and more detailed zoom of a vehicle number plate.

1.4 Scope

The basic premise for increasing the spatial resolution in SR techniques is the availability of multiple LR images captured from the same scene. If the LR (Low Resolution) images have different subpixel shifts from each other and if aliasing is present, then new information contained in each LR image can be exploited to obtain an HR (High Resolution) image.

The scope of this project is to use the information gathered from the LR images to obtain HR by concentrating efforts to eliminate or minimize image distortion due to warping and aliasing.

Warping distortion of concern are those resulting from translation of image pixels in the x and y axis due to movement of target object. Here target object refers to a moving vehicle.

Aliasing distortion results from the inaccurate interpolation of pixels of an image when zoomed in. This results in an unsatisfactory appearance of aliasing artifact in the form of ripples and stair like edges.

The colour image will be acquired from video captured using an analog Video CCTV (Closed Circuit Television) Camera. SR techniques will be used to take advantage of relative scene motions existing from frame to frame of the video sequence.

Images will be selected from relevant frames of the digitized recorded video sequence to be processed offline and not in real time. Since these processing would only be done upon request by surveillance personnel in a real life situation.

Images will be processed using several functions from the MATLAB Image Processing Toolbox, and also several standard MATLAB functions.