Abstract

A printed photograph is an image that holds various memories that are printed on a sheet of particular paper. Before the advent of modern computers and digital cameras, someone would have tried to take care a printed photograph well. However, sometimes there's something that doesnt't run with human's wish. For example, in the old movie films or photos, we can find a lot of damages caused by a lot of things, it might be because of inaccurate handling, inaccurate storage, chemical factors, etc. Some damages are cracks and craquelures, scratches, blotches, etc. There is a lot of tools/software on the market aims to help the user to reduce or remove the damage artifacts. But, a manual reduction or removal requires sufficient or long time and when it's finished you might get different or unsatisfying result.

However, every damages has their own solution to make it eliminated and this research only aims to deal with scratches. There has been a lot of solutions to deal with this kind of damage, but the existed solutions mostly only removes vertical, thin, and black or white or mixed-color- from-them scratches. To deal with a lot of shapes, orientation and varied colors scratches, we use a unification of detection with *Hough Transform* and restoration with direction estimation & pixel filling.

The main focus of this final project is to determine whether this combined method can produce images with successful results and assess the success of this method by calculating the value of the NCC and its difference.

The experimental results showed that the difference result from the comparison between the value of NCC original image and the image of the exposed scratch and NCC values between the original image and the image that has been restorated show certain results. If the difference is positive, the result of combined method is successfully doing restoration for the case when the difference is generated is negative, Hough Trasnform failed to detect a scratch as the main peak detection or there's still a primary or residual from scratch that doesn't fit into the region and not restorated. By testing some sample sets shows, showed that the threshold of region growing that can produce good output is 0.01.

Keywords: *Scratch detection, Scratch restoration, Hough Transform, Manipulated images, Direction Estimation*