

HP Dust and Scratch Removal



Table of contents:

Introduction.....	2
Technology overview	2
Customer benefit.....	2

Introduction

One half of a micrometer, 3% the diameter of a human hair, is the size of a speck of dust. These minute particles, although hard to see on originals, become painfully obvious when scanned and enlarged. Scratches and abrasions that may have seemed innocuous become huge gashes in the subject matter when a photograph is enlarged.

These artifacts are an unavoidable consequence of viewing and handling our slides, negatives, and photographs. But, when our memories are marred beyond recognition, the issue becomes more personal. Fortunately, there is a way to salvage these images and preserve them from further damage. The answer is within HP scanners.

Technology overview

Through HP Labs' innovative combination of hardware and software technologies, HP scanners allow users to accurately recover slides, negatives and prints that would otherwise be ruined.

Initially, for transparent materials, an infrared (IR) light source is passed over the media. Infrared light passes through the dye in a slide or negative virtually unobstructed. However, if any physical anomalies exist on the material (e.g. dust or scratches) the light will either be blocked or diffracted. This allows the scanner to very accurately locate physical defects.

At this point, most scanners would then remove the errors by smoothing over the areas and blending them to the pixels around them. However, this results in blurring an image which, in certain areas of an image is undesirable. Therefore, HP image scientists have devised a bilateral filter capable of better removing errors while leaving neighboring pixels unaffected.

“The strength of the bilateral filter is that it removes Gaussian noise without blurring image details. To remove sensor noise, the bilateral filter computes a weighted average of local neighborhoods in the image, where the weight of each pixel in the neighborhood depends on the contrast difference of that neighbor with the central pixel. If the difference is small, the neighbor has a high weight, and if it is large, the neighbor has a small weight. To remove defects, we take advantage of pixel credibility with two new mechanisms. The first mechanism reduces the weight of a neighbor when its credibility is low. This mechanism prevents defects from spreading into other pixels. The second mechanism is that when the credibility of the central pixel is low we increase the relative weight of the neighboring pixels. The filter moves between the following two extreme behaviors in a fuzzy manner. When the credibility of a pixel is high (1), it computes a value identical to the bilateral filter (noise removal). When the credibility of a pixel is low (0), it computes a weighted average of the neighboring pixels where each neighbor is weighted according to its credibility (infilling).”¹

Customer benefit

Ultimately, customers receive clearer, more accurate images by simply selecting to remove dust from their images.

¹ Hardware Assisted Dust and Scratch Removal for Scanners, HP Labs Israel

Figure 1 HP dust and scratch removal versus competition

Original slide



HP G4050 scanner



Competitor scanner



© 2006 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Itanium is a trademark or registered trademark of Intel Corporation or its subsidiaries in the United States and other countries.

4AA0-XXXXENW, May 2006

² Results of HP internal testing

