# SiRAD: Advanced Restoration Digital System for Photographic Archives and Cultural Institutions

***Andrea de Polo, Fratelli Alinari Photo Archive and Museum of Photography, Firenze, Italy (andrea@alinari.it www.alinari.com)***

## Abstract

*Apollo is the new efficient solution for your archive of vintage photographs. It permits to automatically restore most of the defects which can affect an old photographic print, and even fragmented glass plates. Its user-friendly interface ensures a simple restoration process. The common defects which Apollo can detect and treat are: semi-transparent blotches, cracks, creases and foxing. The Apollo code has been developed in a C++ environment. In order to allow the code portability (also for further client-server applications) Apollo has been divided in two executables: the interface and the processing kernel. Its final version will operate on Windows, Macintosh, and Linux platforms.*

## Project Focus

Photography is a recent form of art, but probably the most diffused in the world. Since its introduction it has supplied us with a huge amount of documents of high cultural value. The ubiquitous fruition of such documents requires as a first step the conversion of old printed material into digital form, for successive manipulation and data management. Unfortunately, the oldest photographic prints are based on fragile materials, which are affected by bad environmental conditions. For this reason, in these years, the care for the preservation and conservation of prints has increased. However there are many damaged pictures that still need to be restored. With classical, physical restoration, the images are dusted and cleaned, the gaps are filled up, the emulsion is consolidated, the gelatin is fixed, and some parts are repainted by hand. This pipeline produces cleaner images, but is extremely expensive, and often the damage is still visible.

The diffusion of scanners and of software to manipulate the image opens a new way to the recovery of photos. The old image, after the digitization, can be virtually restored and, if necessary, reprinted. For this type of digital restoration, the goal is that a person viewing only the restored version should not be able to realize where the changes are. Notice that this case is different from the one of the physical restoration of originals, where the original artwork needs to be preserved. Commercial software exists, which proposes a heavy user-guided restoration, where the defects are not automatically traced, and also all the corrections must be user-suggested. Virtual restoration becomes complex and expensive, and it can be performed only by skilled personnel. Automated restoration is hence required to obtain quick, simple and effective results.

In this paper we briefly present SiRAD, a research project which is being supported by the Friuli Venezia Giulia Italian Region, in cooperation with Fratelli Alinari SpA, and is entirely devoted to the study of novel methods for the automated digital restoration of photographic archives. Then, we propose a dissertation about defect detection and correction in photographic prints. It should be emphasized that at least three different advantages stem from the digital restoration of photographic prints:

- ubiquitous fruition is made easier, since a clean image typically can be much more efficiently coded and transmitted or stored;
- the performances of content description methods for the purpose of retrieval and browsing are improved;
- the visual quality of the output is improved, in particular on low-cost portable displays.

## Restoration Fields

Apollo is currently analyzing and restoring four different kind of photographic deterioration problems. Today the objective is to provide a fully working application that can perform well and professionally speaking under those four target photographic problems. Blotch, Crack, Foxing and Crease are restoration field as it is today. In the future, we plan to cover additional photographic problems like Mold, Discoloration, Color Correction, Fading and so on.

### *Blotch*

Semi-transparent blotches are originated by water or humidity (in Italian they are also called "gore d'acqua"). They superimpose a dark, noisy disturbance to the original information of the pixel. For this reason Apollo preserves the available information: it does not replace the damaged area with a simple color but it enhances the latent details. The restoration process starts when "blotch" is selected in the "processing" menu (Fig. 1). Apollo needs to know where the damaged area is. For this demo version Apollo searches for a mask, where all the points in the blotch are painted in black. We suggest to use a software like Photoshop to create the mask image. Fig. 2 shows an example of mask for the semi-transparent blotch in Fig. 1. The window with the blotch parameters (Fig. 2) permits to choose the file containing the mask and the name of the output. The *distance from the border* and the *width of the flawless region* are two parameters of the restoration. Default values are suggested by the program.

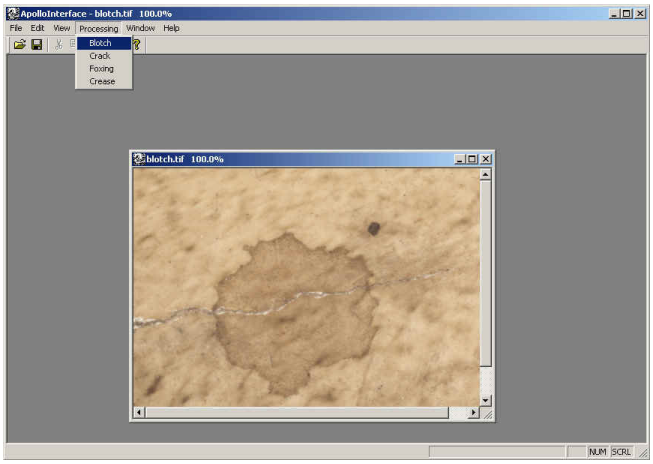


***Figure 1**. How to start the restoration of semi-transparent blotch*

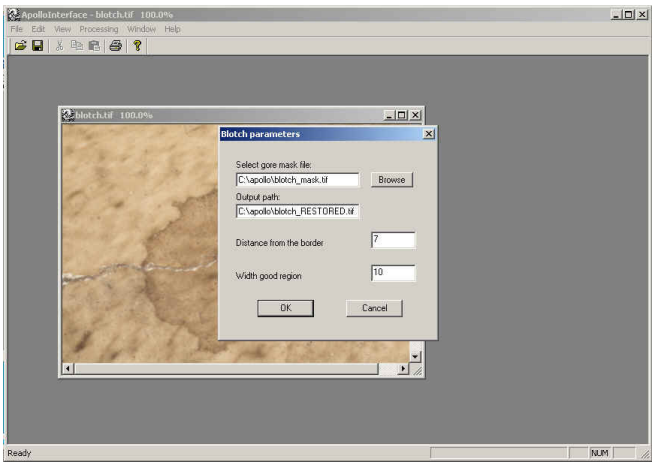


***Figure 2.** Parameters dialogue window*

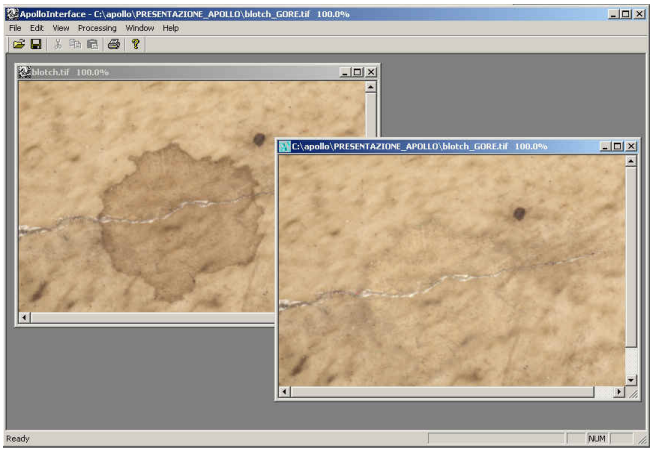


***Figure 3.** Final Result*

## *Crack*

It is the procedure to restore fractured glass plates. The restoration process starts when "crack" is selected in the "processing" menu (Fig. 1). The window with the crack parameters (Fig. 2) permits to choose the file name of the output. The *white threshold* and the *degree start/stop* are parameters of the restoration. Default values are suggested by the program. Apollo asks the user to click one point in one fragment and one in the other fragment (Figs. 3).

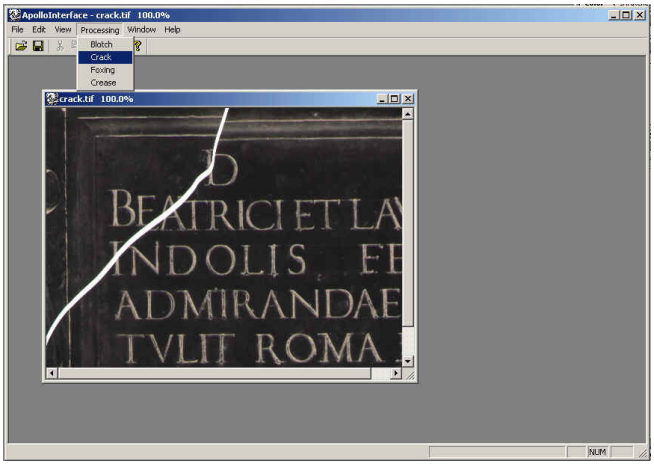


***Figure 1**. How to start the restoration of a crack*

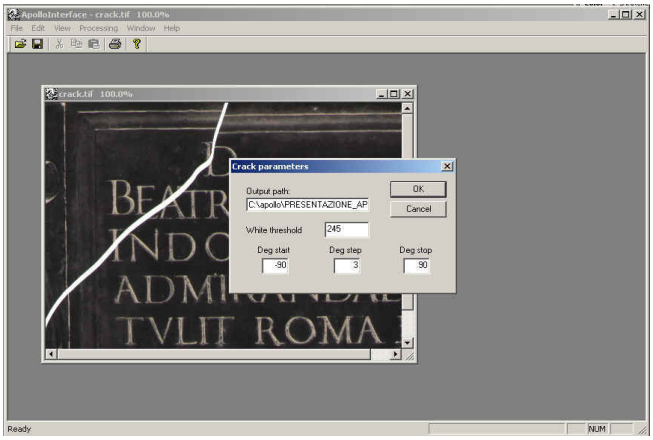


***Figure 2**. Crack parameters dialogue*

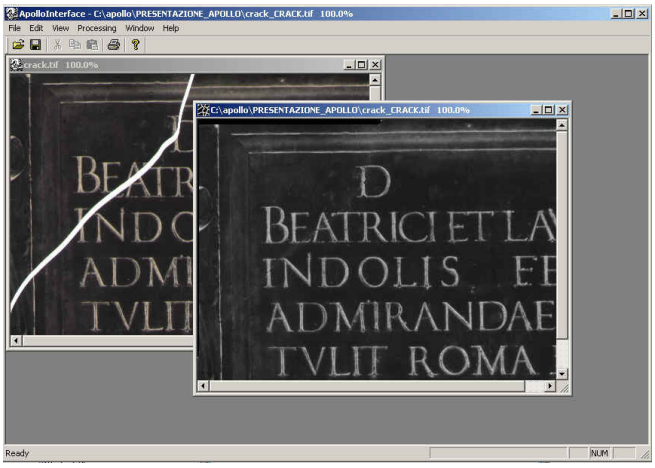


***Figure 3**. Final result*

## *Foxing*

It is the procedure to restore foxing stains in photographic prints. The restoration process starts when "foxing" is selected in the "processing" menu (Fig. 1). The window with the foxing parameters (Fig. 2) permits to choose the file name of the output. The *foxing detection amplitude*, the *distance from the border*, and the *width of the flawless region* are parameters of the restoration. Default values are suggested by the program. The detection and restoration process is completely automatic.

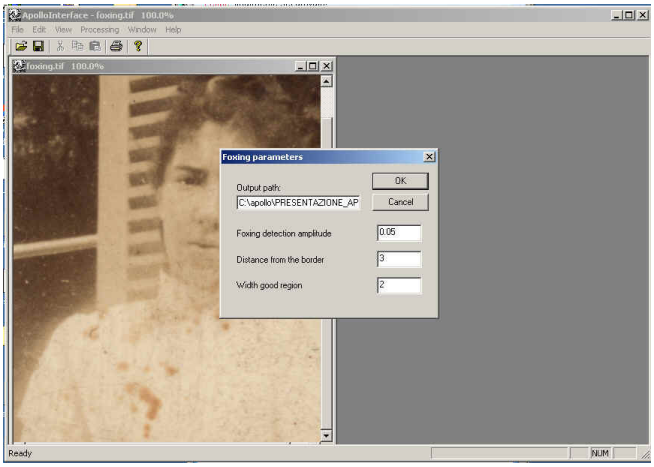


***Figure 1.*** *Settings*

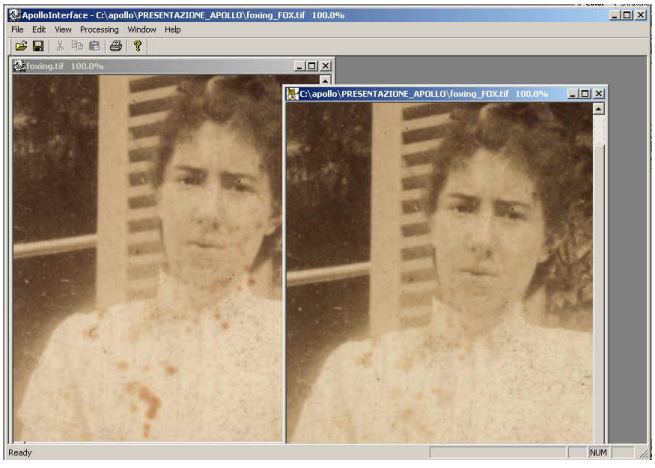


***Figure 2.*** *Final Result*

## *Crease*

It is the procedure to restore creases in photographic prints. The restoration process starts when "crease" is selected in the "processing" menu (Fig. 1). The window with the crease parameters (Fig. 2) permits to choose the file name of the output. The threshold for mean and variance, the filter dimension, and the moving average dimension are parameters of the restoration. Default values are suggested by the program.

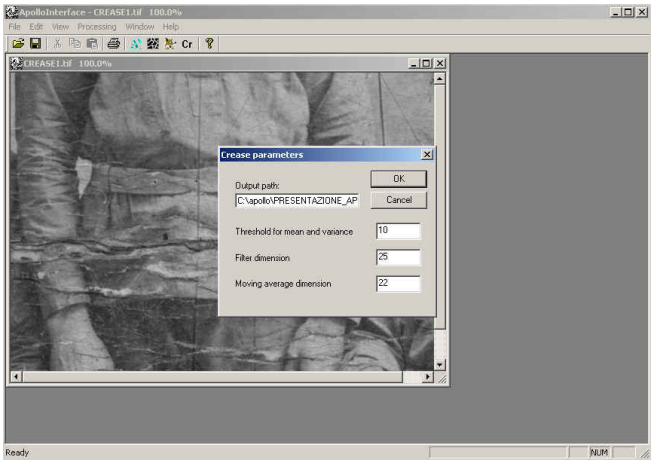


***Figure 1.*** *Settings*

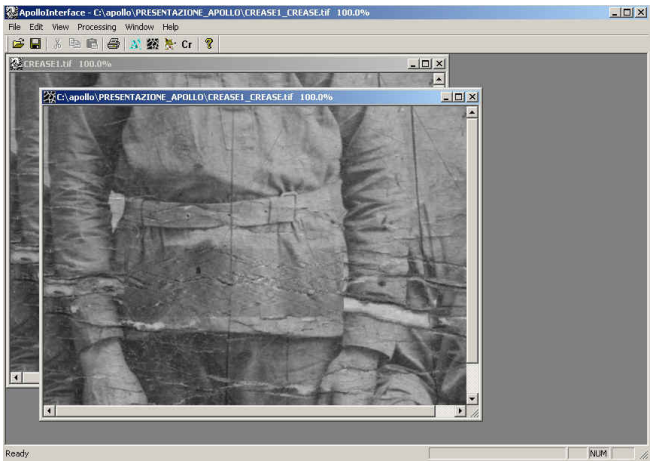


***Figure 2.*** *Final result*

## References

[1] G. Ramponi, “Contrast enhancement in images via the product of linear filters,” *Signal Processing*, vol.77, no.3, pp.349-353, Sept. 1999.

## Author Biography

*Andrea de Polo is Head of the Information Technology office at Fratelli Alinari, the world’s oldest photographic archive located since 1852 in Firenze, Italy. He is member of several standard organization.*