# A Computational Darkroom for Black-and-White Photography

Soonmin Bae   Sylvain Paris   Frédo Durand
MIT CSAIL

Abstract

We present an image processing technique for the production of compelling black-and-white photographs. We manage global tone variation as well as the small-scale details. To allow for flexible manipulation while preventing artifacts (e.g. halos), we rely on a three-scale decomposition using the bilateral filter. The overall tonal balance is controlled through the large-scale layer, and the texture variations through the detail layers. The parameters can be extracted from an example photo in order to match its visual "look". We also provide an intuitive interface to let the user refine the final rendition to her own artistic feeling.

1. Motivation
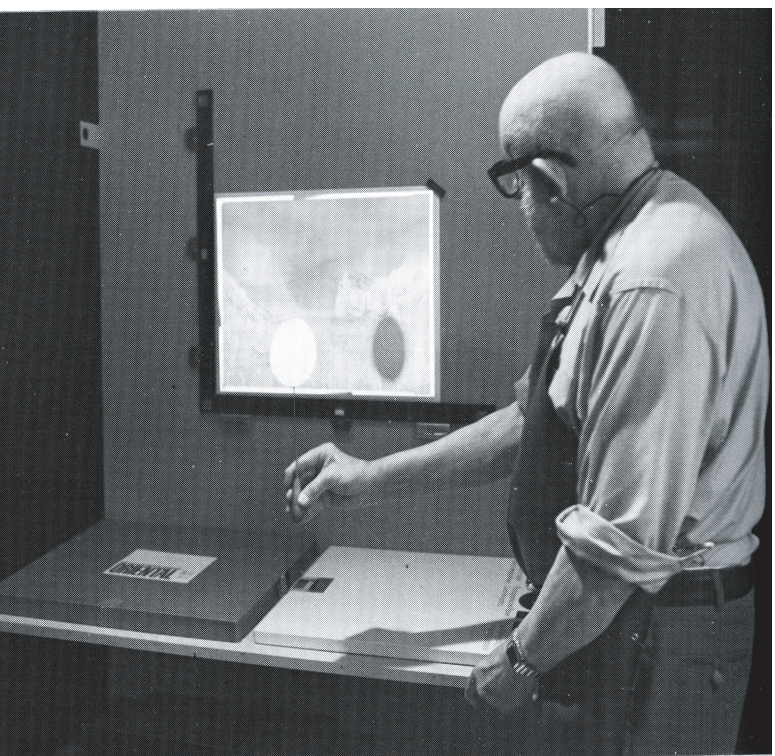
Ansel Adams using a dodging tool (from *The Print* by Adams). He locally contols the amont of light reaching the photographic paper.

Direct print of black and white photographs may not meet the expectation of photographers: tonal balance and local contrast may be insufficient. And the mere printing does not allow master photographers to express their artistic interpretation of the scene. The work in the darkroom is not only a process to transform the negative image into the final print, but also a means for professionals to work on the original shot and explore various artistic rendition of pictures.

For digital photographs, this process is done using photo-editing software. But the available tools make the process tedious and require artistic skills.

## 2. Our approach to photo-editing
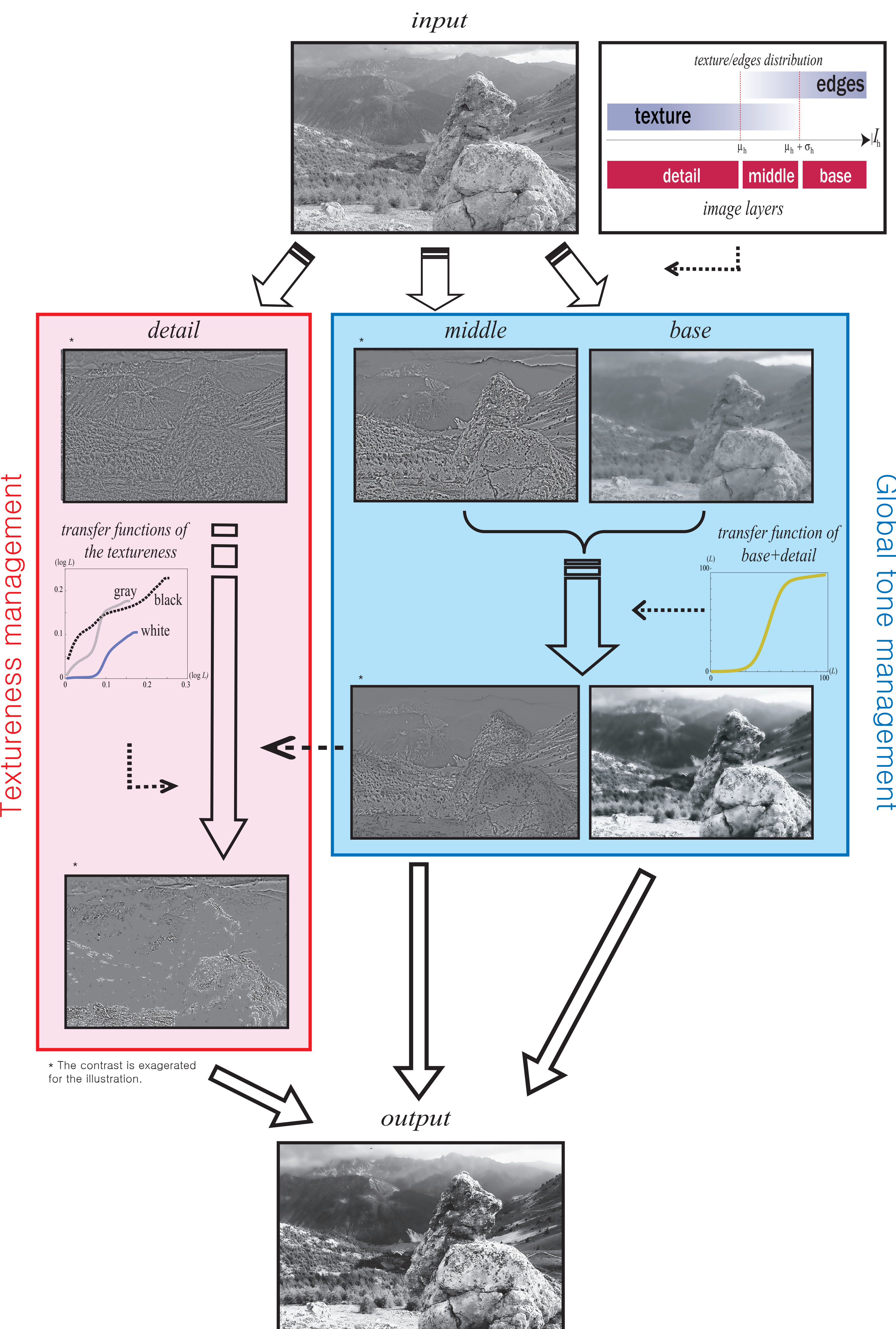
This pipeline separates the controls of the global contrast and of the local textureness. That is, we can change the global contrast without altering the image textureness and vice versa, whereas classical tools affect both of them at the same time.
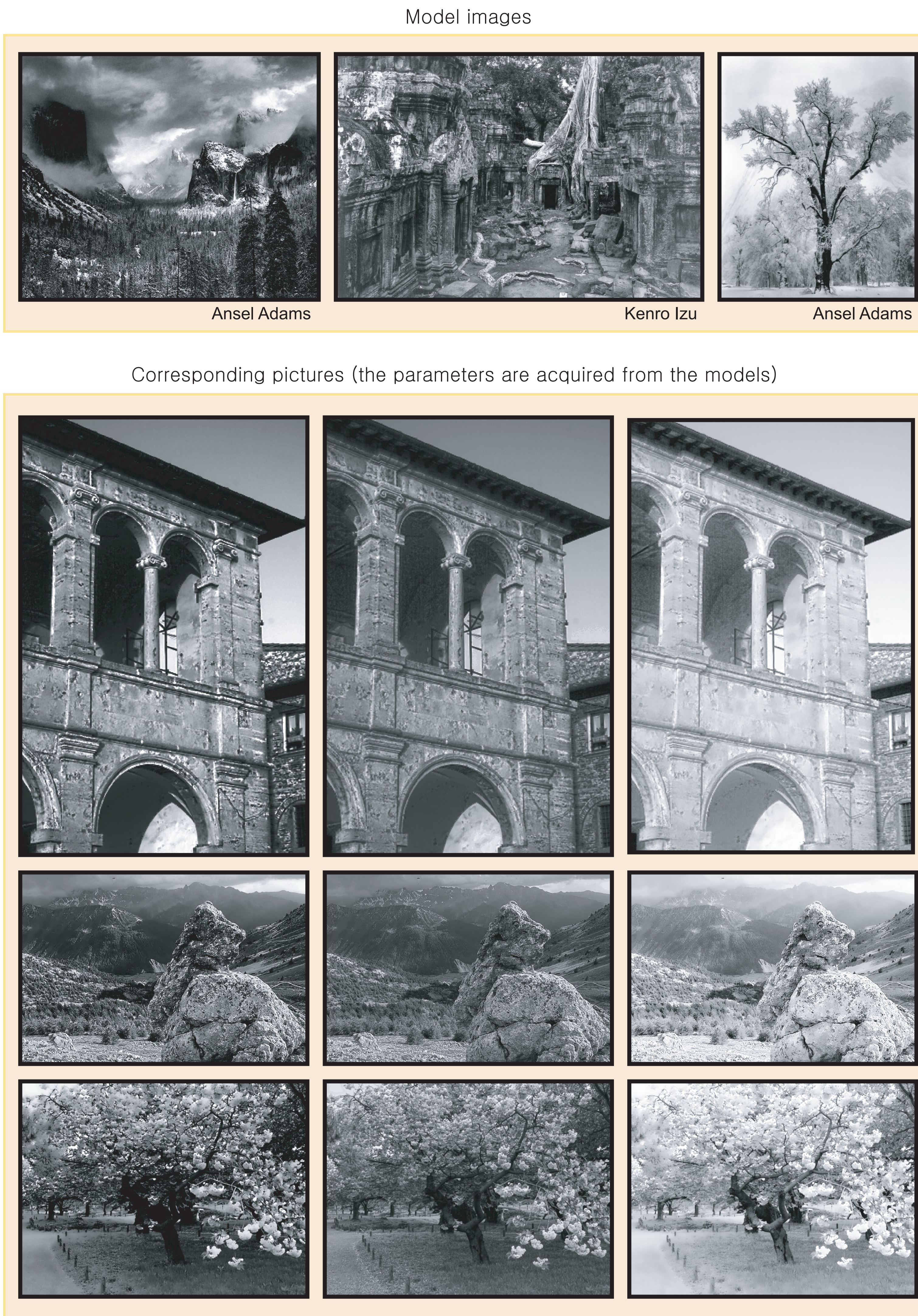
3. Technical Choices

The layers are separated by two bilateral filters with different tolerance for intensity variations. This achieves a better layer separation than a single bilateral filter.

The *textureness* is estimated using a local average of the energy of the middle and detail layers.

We propose a user interface inspired by existing image-editing software. In addition to the user control, the parameters can be acquired from a model image using histogram transfer.

4. Results

Model images

Ansel Adams   Kenro Izu   Ansel Adams
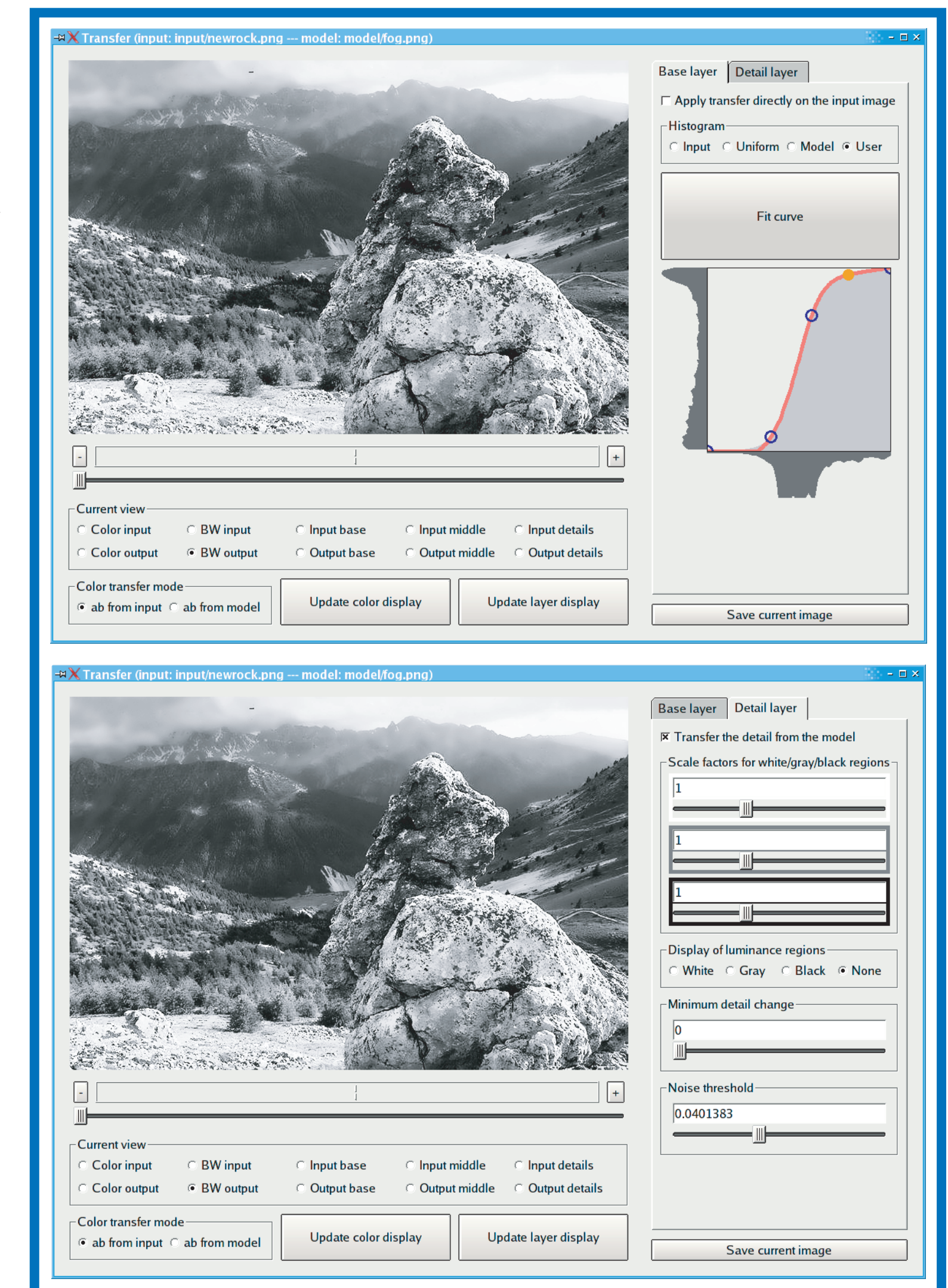
Corresponding pictures (the parameters are acquired from the models)

5. Ongoing work

We are currently working on a better layer separation. We are also considering additional controls over the image look. Finally, we investigate the possible options to work with color photographs.