Appendix A

MATIFUS: a MAtlab Toolbox for Image FUSion

MATIFUS\(^1\) is a Matlab-based toolbox for image fusion with a graphical user interface. It contains numerous routines for multiresolution-based image fusion, and provides a user friendly interface to the image fusion framework proposed in Chapters 6 and 7. Thus, it allows both pixel-based and region-based fusion approaches. MATIFUS is easily extendible in the sense that new types of multiresolution decompositions and fusion rules can be added. Furthermore, MATIFUS facilitates the setting of fusion methods and parameters, and allows to study the influence of such settings on the visual quality of the fusion results, enabling the users to choose the method which is the most appropriate for their particular application.

In the following, we give a very brief overview of the MATIFUS toolbox. The corresponding documentation and website\(^2\) are in preparation.

**Functionalities**

MATIFUS consists of two main panels: the *control panel*, which contains the settings and functions related to the fusion process, and the *visualization panel*, which displays the inputs images, the fused image and other intermediate results such as the segmentation and decision maps.

Fig. A.1 shows the control panel with the default setting parameters. The user can construct several fusion algorithms by the interactive selection of the different parameters in the modules seen in the figure. By clicking the button *Visualization panel* (located at the bottom left of the panel), the so-called visualization panel appears. This panel allows to load up to eight input images and provides several interactive tools of visualization and image manipulation such as denoising, contrast enhancement, zooming, etc.

Fig. A.2 shows the visualization panel after loading three input images and having clicked the *Fuse* button in the control panel with the default parameters (see Fig. A.1).

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Figure A.1: Control panel with default parameters.

Figure A.2: Visualization panel: input images (top) and corresponding composite image (bottom left) and decision map (bottom right).
Figure A.3: Example of a specific fusion algorithm.

Figure A.4: Input images and corresponding composite image, segmentation and decision map using the specific fusion algorithm of Fig. A.3.
The colors used in the ‘decision map’ correspond to the colors of the borders around the input images, showing at each location which input source contributes most to the composite image. The decision maps for all levels and orientation bands can be visualized by selecting the Show all button.

Fig. A.3 and Fig. A.4 show the settings of a chosen fusion algorithm and the corresponding results when the ‘Clock’ images are loaded.

**Systems requirements**

MATIFUS requires

- Matlab, version 5.0 or later;
- the Matlab Image Processing Toolbox for visualization and image manipulation functions.

In principle, MATIFUS will run on all configurations from which Matlab is available. MATIFUS enables the user to select multiresolution schemes from the Matlab Wavelet Toolbox (MathWorks Inc., licensed software), the WaveLab Toolbox (Donoho *et al.* [52]), and the Matlab Pyramid Toolbox (Simoncelli [136]). Implementations of the quincunx lifting scheme and gradient pyramids are also made available.

The Matlab Wavelet Toolbox provides tools for the analysis and the synthesis of signals and images using wavelets. The two-dimensional wavelets are obtained by tensor products of one-dimensional wavelets. The transforms are not limited to dyadic sizes. The wavelet families included in the toolbox are: Morlet, Mexican hat, Meyer, Haar, Daubechies, Symlets, Coiflets and Splines biorthogonal wavelets. Some of these families have additional parameters specifying the number of vanishing moments.

The WaveLab Toolbox is a library of Matlab routines for wavelet analysis and synthesis, that is available free of charge over the Internet [52]. The two-dimensional wavelets are obtained by tensor products of one-dimensional wavelets. Images should have dyadic sizes. The wavelet families included in the toolbox are: Meyer, Haar, Daubechies, Symlets, Coiflets, Dubuc-Deslauries and Splines biorthogonal wavelets.