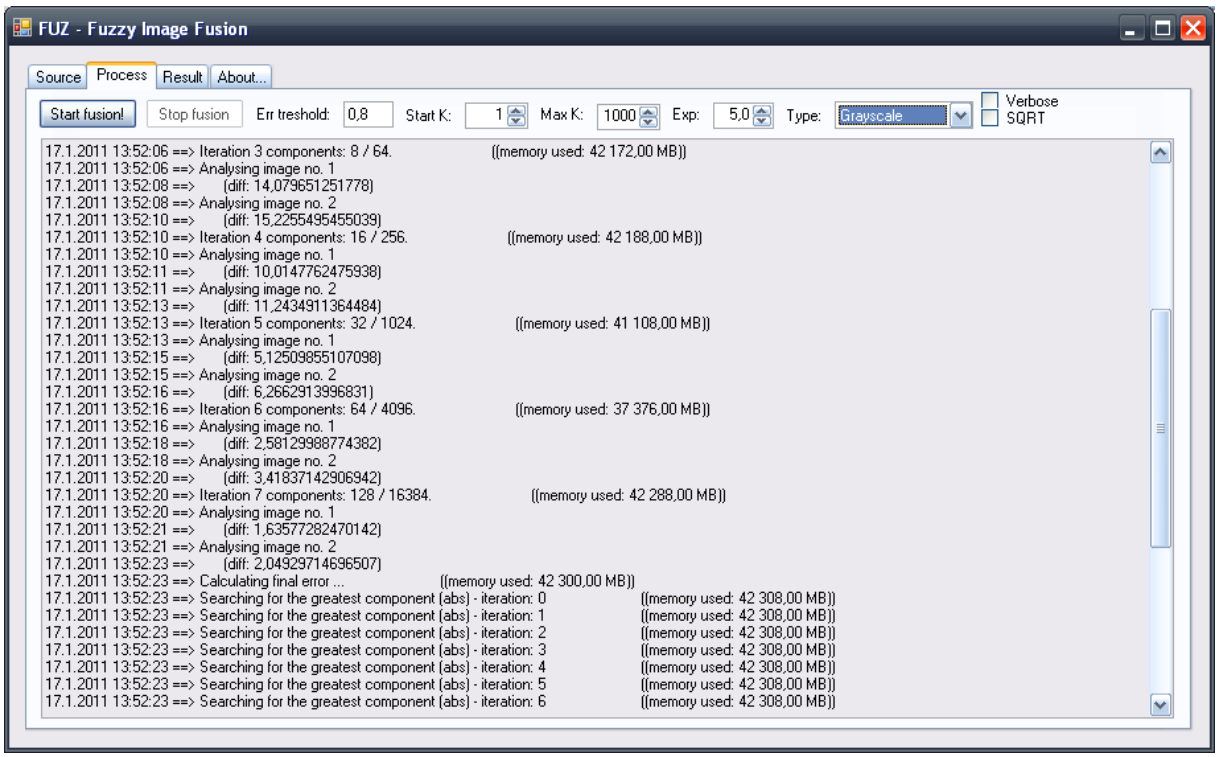
FUZ – Fuzzy Image Fusion

Ver.: 1.2

User manual

IRAFM, University of Ostrava, Czech Republic

http://irafm.osu.cz



1 FUZ – fuzzy image fusion

FUZ – fuzzy image fusion application uses fuzzy transform described in [http://irafm.osu.cz/en/c94_image-processing/] to fuse images in the result image. It is based on properties of fuzzy transform in the locations where the source image changes and the behavior of created components for those locations. A more detailed explanation about the image fusion process and examples can be found on [http://irafm.osu.cz/en/c120_image-fusion/ and http://irafm.osu.cz/en/c95_image-fusion-tool-fuz/] page and its references.

The application takes the set of selected images and settings as an input and generates resulting image containing best parts of each image fused together.

2 Installation

The application is a packet with an installer, which will install all required additional prerequisites to run the software. When necessary, internet connection is required to download requirements.

The current version of the application requires:

- Microsoft Windows XP (or higher)
- Microsoft .NET Framework 2.0 (or higher)

You will probably need administrator privileges to execute the installer.

To install the application, execute the archive and execute “setup.exe” file contained in the archive. Then follow the instructions. Installer will automatically download and install all required missing items.

3 FUZ application

FUZ application is executed by “FUZClient.exe” file located in the target installation folder or start-menu, if this option was selected during installation.

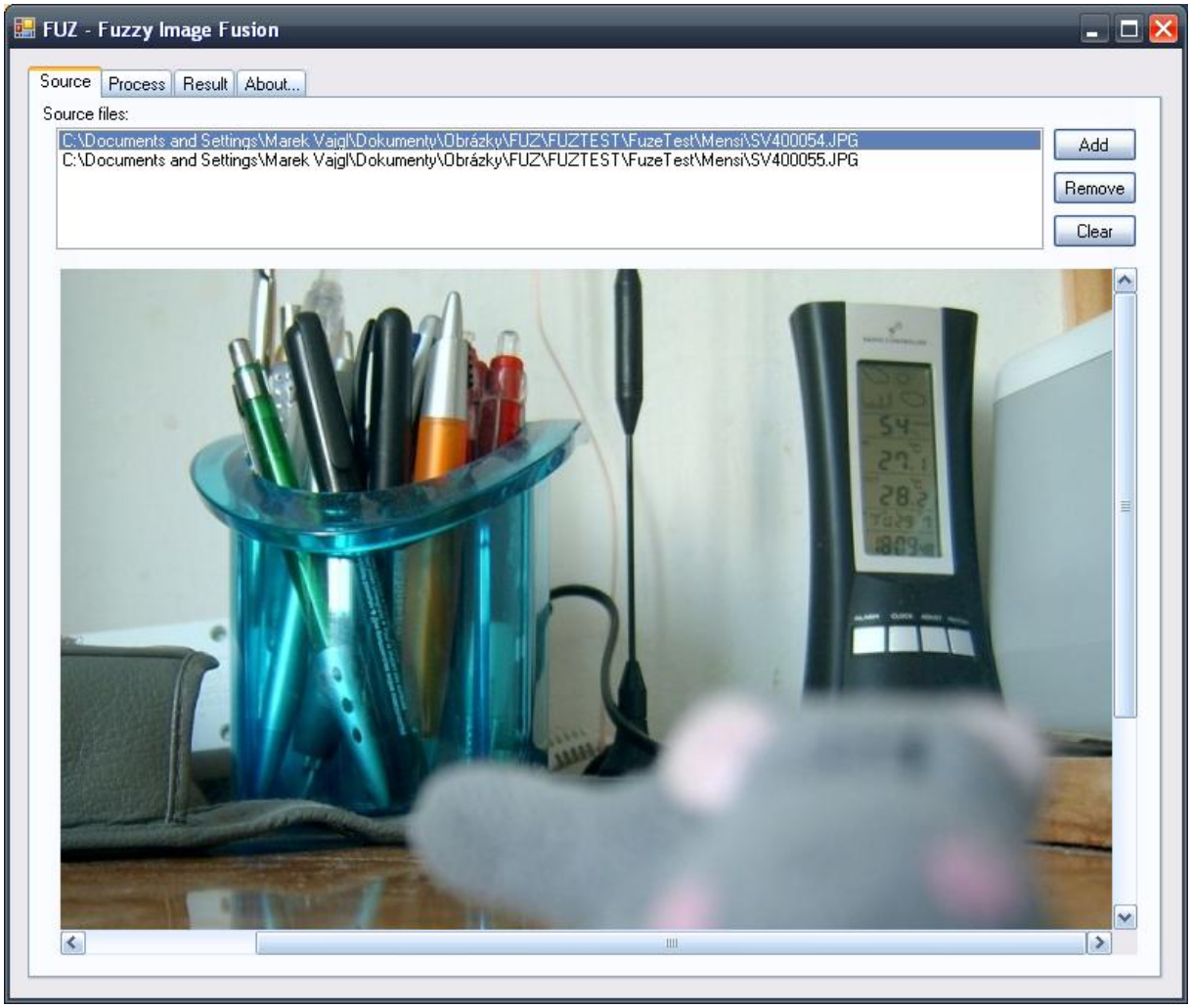
The main application window contains a tab browser with four main tabs:

- **Source** – this tab contains definition of source images;
- **Process** – this tab contains information about fusion process or other important info;
- **Result** – this tab contains result image (if fusion has been successfully done);
- **About** – this tab shows information about the application.

Description of the tabs follows.

3.1 Source tab

This tab is used to define a set of source images.



It consists of a list of the selected image files, three buttons and image area, where the currently highlighted image of the list is shown.

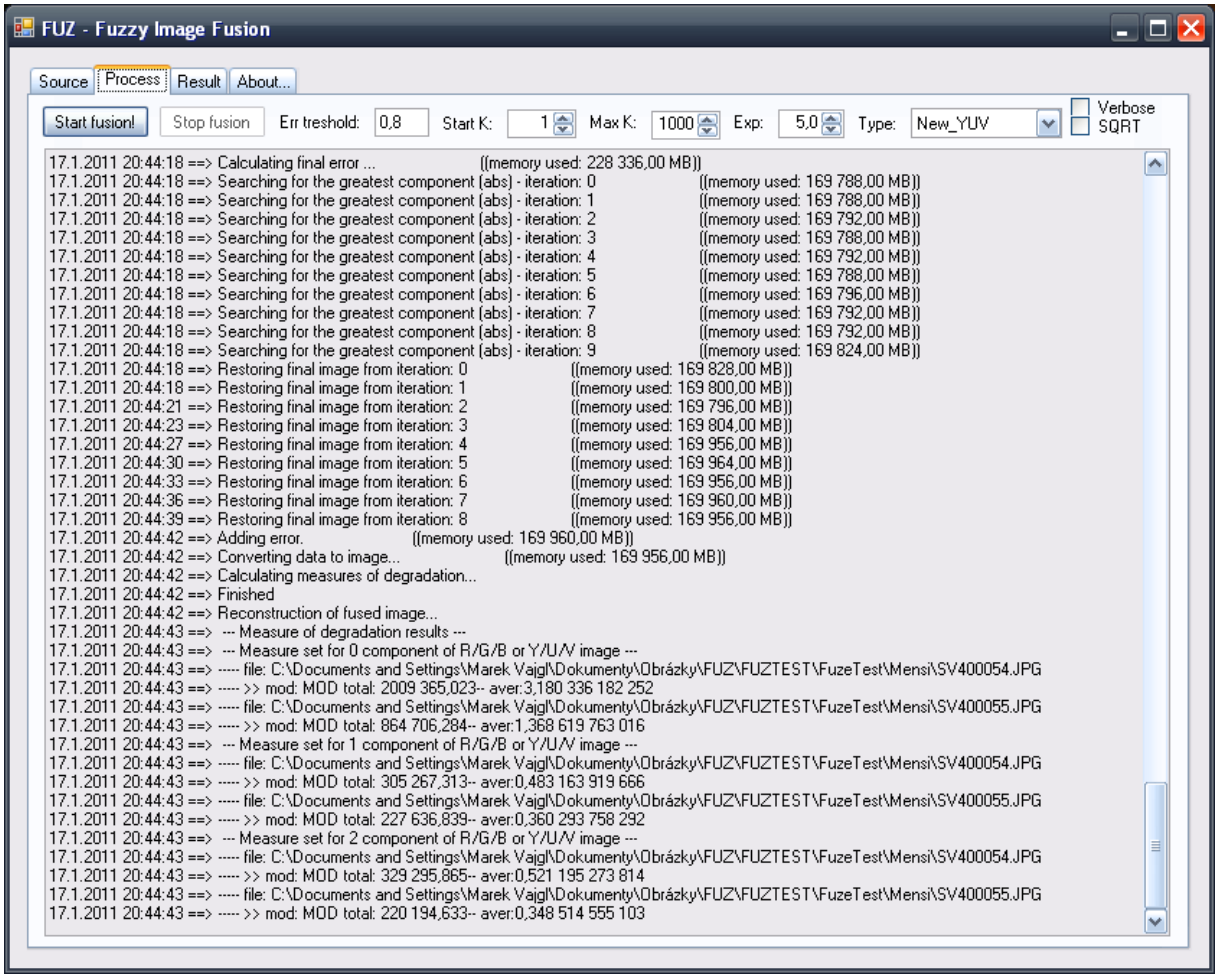
All images contained in the list of images are used as an input for the image fusion. A new image can be added by pressing “Add” button. The highlighted image can be removed from the list by pressing the “Remove” button. All images can be removed by pressing the “Clear” button.

Only BMP or JPG files can be opened by FUZ application. If necessary, other tools can be used to convert an image from other formats.

All input images should be aimed at the same position in the space, with the same zoom and other attributes – only the zoom distance may change. Otherwise the result is unexpected and may contain defects.

3.1.1 Process tab

Process tab defines all settings for the fusion algorithm execution. Settings are inserted into controls on the top part of the tab. After that, fusion can be started by pressing the *Start fusion!* button. The fusion can be interrupted by pressing the *Stop fusion* button.



There are several options, which can be adjusted:

- **Err threshold –** minimum error threshold, when next iteration of image analysis will be executed. The higher the value, the shorter time of algorithm run, but less quality result. Lower values will cause longer algorithm run time, but improve result quality. Error value (calculated for each iteration) is printed in the tab text area.
- **Start K –** initial value for iteration run. K value (in default) means the number of iteration. When the iteration number increases, the depth of the analysis of the images is raised (until threshold is achieved). In some cases it is required not to start from the first iteration. This case is covered by *Start K* parameter.
- **Max K –** sometimes can be error threshold value too low, or there is requirement to do finite number of iterations. *Max K* defines maximum K value for the last iteration; if iteration K value exceeds this option, next iterations are aborted. If *Err threshold* condition is fulfilled first, usage of this option is omitted.
- **Exp –** means exponent. This value adjusts the speed how fast the depth of analysis raises according to increasing number of iteration. High values cause enormous computational intensity and can easily lead to lack of memory or program freeze.
- **Type –** defines type and algorithm used for fusion. There are two main pairs of algorithms, a) without prefix and b) with prefix *New_*. Algorithms with prefix *New_* uses different memory management and may cause better performance experience on large images. Postfix *_NET* is used for algorithms which use only .NET platform (this may induce better processor usage on

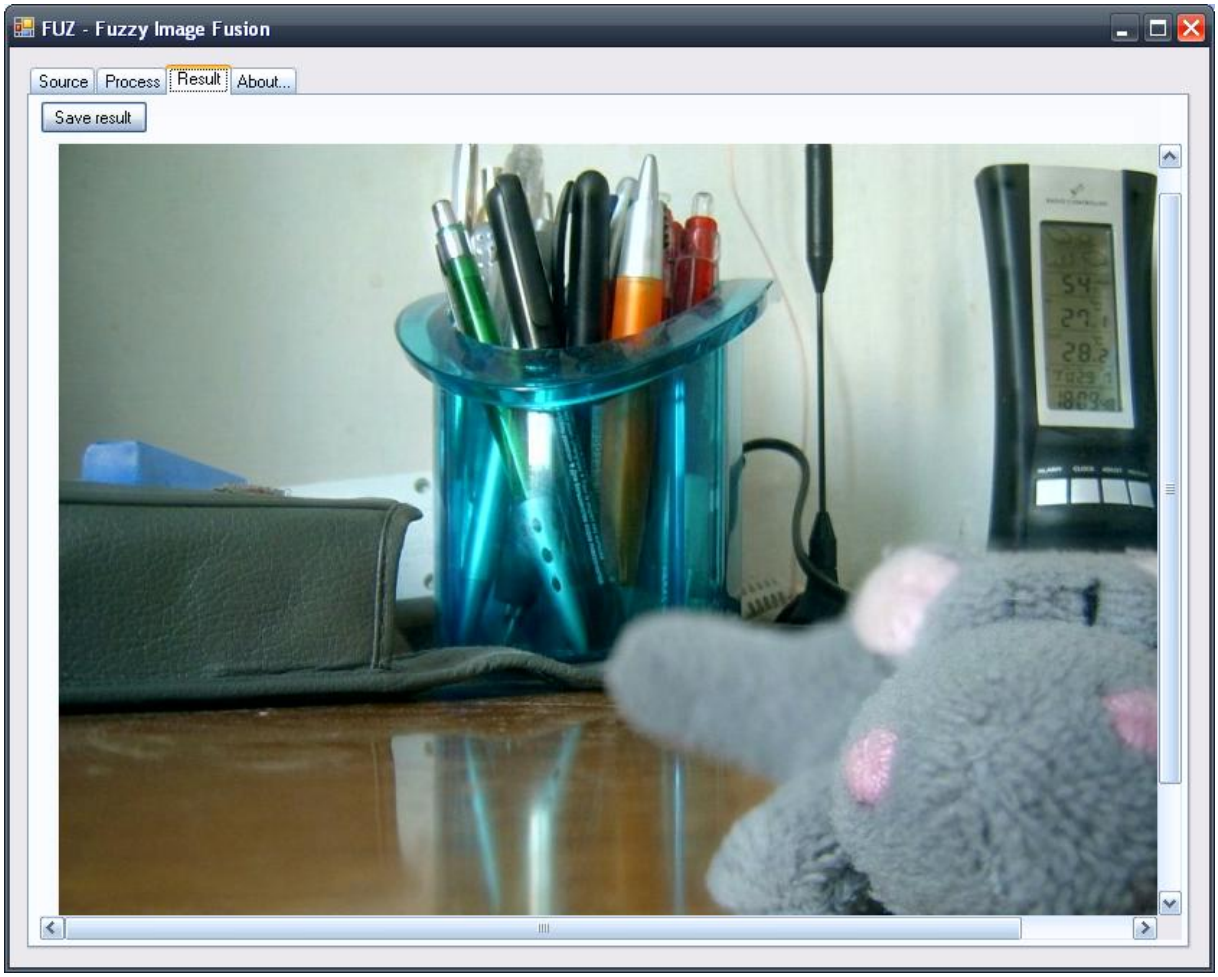
some computers). Available types may differ according to the installed libraries. The base types of algorithm are:

- Grayscale – image is taken as grayscale image for the analysis.
- RGB – color model R-G-B is used for the source image analysis.
- YUV – color model Y-U-V is used for the source image analysis.
- Y – only brightness part of image is used as a source for the fusion.
- OneStep – one iteration only is done and created fusion is based on this iteration. This usage is commonly used together with setting *Start K* option.

- **Verbose –** this checkbox enables verbose algorithm info printed in the text area of the tab.
- **SQRT –** if checked, the final number of components (= the deep of analysis) is extracted of the origin value. This increases the number of iterations (so the result quality may be improved) but extends the algorithm run.

3.1.2 Result tab

Result tab contains (when fusion did finish successfully) fused image. There is one button, *Save result*, on the tab, which enables to save the image into a classic image file on the disc. Bitmap format only is supported.



3.1.3 About tab

About tab shows dialog with information about product and version.

4 Uninstallation

The uninstaller of the application will remove all application files. It will not remove installed .NET framework because it can be used by other application. To remove .NET framework, do it manually via “Add or remove programs” dialog in the “Control panel”.

The application store user settings in the user application folder (typically located at %USER_HOME_FOLDER%\Application Data\FUZ\. This file may be deleted during uninstallation (on request), or it can be deleted manually.

5 Other information

According to continuous research in this area, the newer version of this or similar software may be available. For any further information or comments contact IRAFM staff.

Software has been developed as part of the project “Data-Algorithms-Decision making” supported by IAA1187301 of the GA AV ČR.

6 Contact

Institute for Research and Applications of Fuzzy Modeling

University of Ostrava in Ostrava

30. dubna 22

701 03 Ostrava 1

Czech Republic

http://irafm.osu.cz