FED – Fuzzy Edge Detector

Ver.: 1. 1

User manual

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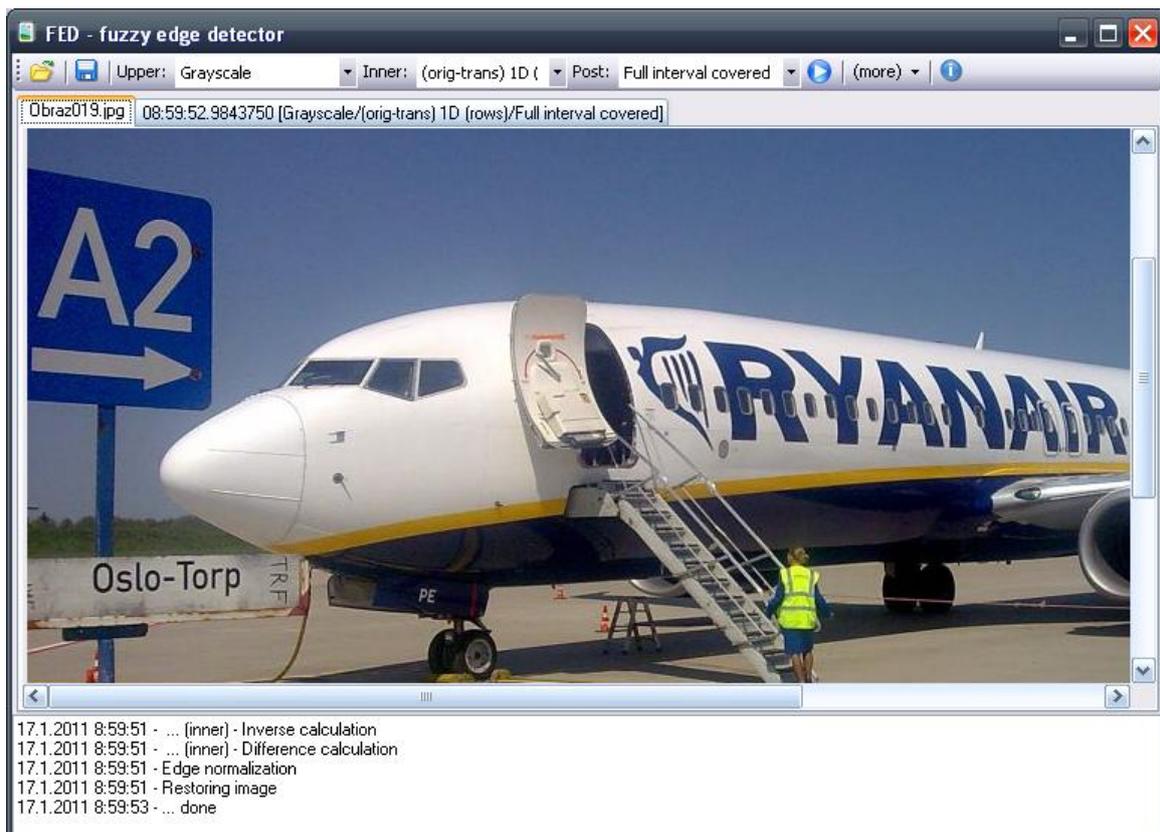
1   FED – fuzzy edge detector

Fuzzy   Edge   Detector   application   uses   fuzzy   transform   described   in
[http://irafm.osu.cz/en/c94_image-processing/] to edge detection in the selected image. It profits
from properties of fuzzy transform in the locations of color changes in the image and the behavior of
created components for those locations.

The application takes the selected image and settings as an input and generates the resulting image
containing detected edges as white places in black canvas.

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 3.5

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. The installer will automatically download and install all required missing
items.

3   FED application

FED application is executed by "FED.exe" file located in the target installation folder or ine start-
menu, if this option was selected during installation.

The application window can be divided vertically into three main parts:

- ➢ Upper part with menu – this part contains menu with text and icons to control the
  application behavior;
- ➢ Middle part with tabs – this part shows images and generated results, where each image is
  shown as a special tab; name of the image or description of the result defines the label of the
  tab;
- ➢ Bottom part with text area – this area shows information about the algorithm progress in
  a text format. The area is output only.

3.1   Application menu

There are several text labels and icons representing the menu defined in the application menu at the
top part of the application window:

- ➢ Open image icon;
- ➢ Save current image icon;

- ➢ "Upper" label and combo box with options;
- ➢ "Middle" label and combo box with options;
- ➢ "Post" label and combo box with options;
- ➢ Run arrow icon;
- ➢ (more) combo box with other actions;
- ➢ Information icon with "About …" dialog.

Description of these items follows.

3.1.1 Open image

Open image icon is represented by the yellow folder with a gray arrow icon. This menu item is used to select and open image into the FED application. The selected image is opened and shown as a new tab in the middle part.

The application now supports only BMP, JPG and PNG files, as they are the most commonly used. If necessary, other tools can be used to convert image from other formats.

Every image can be opened multiple times if necessary.

3.1.2 Save current image

Save image icon is displayed as a blue diskette. This menu item is used to save the currently selected tab image into the standard image file format. For now, output as a BMP file is supported only, because any losing compression can damage the output – generated edges.

3.1.3 Upper type selection

Upper (or "pre") selection chooses the input behavior from the selected image. This item specifies how the input image will be processed into the detection algorithm. There are three main methods:

- ➢ Grayscale – this option should be selected for grayscale images. It is a bit faster than other options, but for color images the result is unpredictable.
- ➢ RGB-mean – this option sends as input for edge detection the mean of the red, green and blue values of the RGB model representation of the image.
- ➢ Y (from YUV) – this option sends as input for edge detection the Y part of the Y-U-V color model representation of the image.

3.1.4 Inner type selection

This option is used to choose the algorithm used to detect edge from the input image. Again, there are three options to choose from:

- ➢ (orig-trans) 1D (rows) – this algorithm will process the input image using the one dimensional default fuzzy transformation algorithm with input image matrix processed by rows.
- ➢ (orig trans) 2D – this algorithm will process the input image using the two dimensional default fuzzy transformation algorithm with input image matrix as a source.
- ➢ Complex diff (2D – 2x1D) – this algorithm will process the input image using the two dimensional default fuzzy transformation with input image matrix as a source. Then, the result is combined with two one-dimensional fuzzy transformations, one by rows and the

other by columns). This method achieves better behavior in case of horizontal or vertical edges.

3.1.5 Post type selection

This option is used to choose the behavior of the result visualization. This option is used to select how many significant edges and how they will be drawn in the result canvas. There are several options:

- ➢ Absolute values – output pixels (representing detected eges) are directly represented in black-white range (0-255). Negative values are changed to positive ones.
- ➢ Edges' squares –each pixel of detected edge is raised by 2 and represented in the interval >0-255>. Exceeding values are truncated.
- ➢ Full interval covered – the whole pixel set is processed by linear transformation to adjust the set range to interval <0, 255>.
- ➢ Full interval covered by squares – combination of the two previous options.
- ➢ Threshold in percentage – only most significant percentage of edges are shown in the result. The percentage value is entered during the transformation process. This value is entered in the dialog box shown at the end of detection process.

Comment: The threshold in the percentage dialog asks for the cut percentage value (with postfix %) or for the cut value. The corresponding pairs "cut percentages – cut values" follow, so the user can imagine the ratio for a concrete image. The cut percentage defines the ratio of discarded detected edge pixels (all pixels = 100%). The cut value represents the maximum difference (that is edge importance) to discard the edge at pixel). The pair values differ for each image.
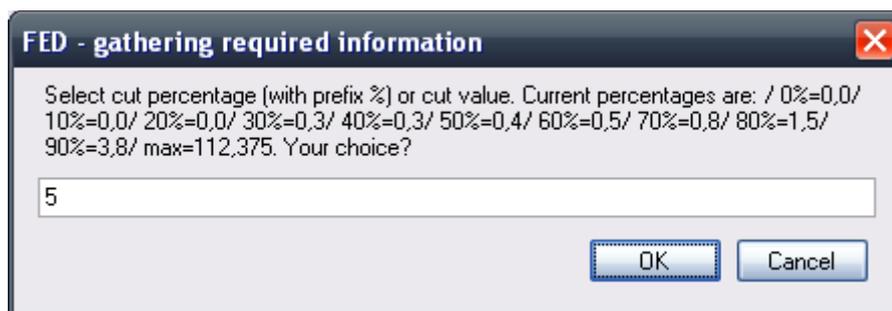
3.1.6 Run detection

Run detection icon is represented as an icon with the white arrow in the blue circle. This menu item realizes the process of edge detection by selected algorithm and settings. The process of detection is shown in the following figure (simplified):

```
┌─────────────────────────┐
│      Source image       │
└─────────────────────────┘
            │
            ▼
      ╭───────────────╮
      │ Upper transform │
      ╰───────────────╯
            │
            ▼
      ╭───────────────╮
      │ Inner transform │
      ╰───────────────╯
            │
            ▼
      ╭───────────────╮
      │  Post transform │
      ╰───────────────╯
            │
            ▼
┌─────────────────────────┐
│      Result image       │
└─────────────────────────┘
```
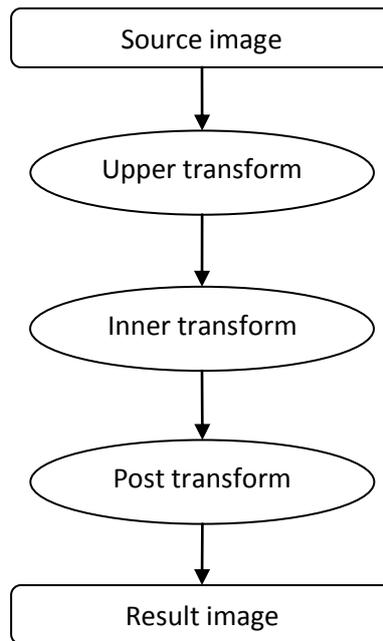
The currently selected tab is taken as a source image. If this tab has already generated the result of the preceding edge detection, the application will show the dialog to confirm the execution. The information about the process is shown at the bottom of the application window in the text area.

After the execution the application asks for *points-per-base*. This value defines the size of the basis function. The common value for most case are 3-5; higher value may improve results for noisy images.

3.1.7   (more) menu items

This combo box contains other supporting functions for image processing. Selectable items are:

➢ Difference – this item calculates the difference for each pixel between two images. The difference is calculated on R-G-B model. After selection, the application asks for two images to compare (both have to be opened or generated in current application tabs) and then calculates the result image into a new tab.

➢ 1D Grayscale FFT – application applies forward and inverse one-dimensional fuzzy transformation over grayscale image. The additional dialog asks for input PPB.

➢ 2D Grayscale FFT – application applies forward and inverse two-dimensional fuzzy transformation over grayscale image. The additional dialog asks for input PPB.

➢ Calculate simple/square sum of B/W pixels – calculates sum of pixel values / square of values (where 0 = black; 255 = white).

3.2   Common usage

To detect edges in an image, execute the FED application – *fed.exe* file. Open the considered image using the *Open image* icon (top left icon with yellow folder). Change the drop-down settings if necessary (see explanation above). Next process the execution by pressing *Run detection* icon (blue circle with white arrow). The application asks for *points-per-base*. This value defines the size of the

basis function. The common value for most case are 3-5; higher value may improve results for noisy images. The current phrases are displayed at the bottom of the application window. Result can be saved using *Save current image* icon (blue diskette).

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 does not store any user information in the user profile, so no files are needed to be deleted from there.

5   Other information

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

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