

Visilab Research Lab

University of Messina

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This is the SuperResolution Demo for Nanodesktop PSPE/PSP.

As we can read in Wikipedia, Super-resolution (SR) are techniques that in some way enhance the resolution of an imaging system. There are different views as to what is considered an SR-technique: some consider only techniques that break the diffraction-limit of systems, while others also consider techniques that merely break the limit of the digital imaging sensor as SR.

Filippo Battaglia at Visilab Research Center of the University of Messina has demonstrate the possibility of executing a SR algorithm on a simple embedded device as the Sony Playstation Portable. This result shall be possible through the use of *Nanodesktop*, a SDK dedicated to the development of applications for embedded systems:

<http://visilab.unime.it/~filippo/Nanodesktop/nanodesktop.htm>

This program uses the *SuperResolution algorithm* developed by Michael Smith at Carleton University (<http://www.engsoc.org/~michael/>). You can find more informations about the internal implementation of Smith's algorithm in the current *Nanodesktop distribution*, downloadable here:

http://visilab.unime.it/~filippo/Nanodesktop/PSP_PSPE/Downloads/Downloads.htm

in the file:

<ndenv folder>\PSP\ndSuperRes\superres.pdf

Installation

In this package you'll find 3 versions of the same program: the first binary is in the */pbp_for_pspe* folder and it is compiled to work under PSPE emulator

(<http://www.emulator-zone.com/doc.php/psp/pspe.html>)

The binary in the folder */pbp_for_psp* is designed to work under the real PSP using the PSP HAL (see *Nanodesktop user guide* for further details). Finally, the binary in the folder */pbp_for_cfw_psp* is designed to work using the PSP CFW HAL (the hardware abstraction layer for PSP custom firmware).

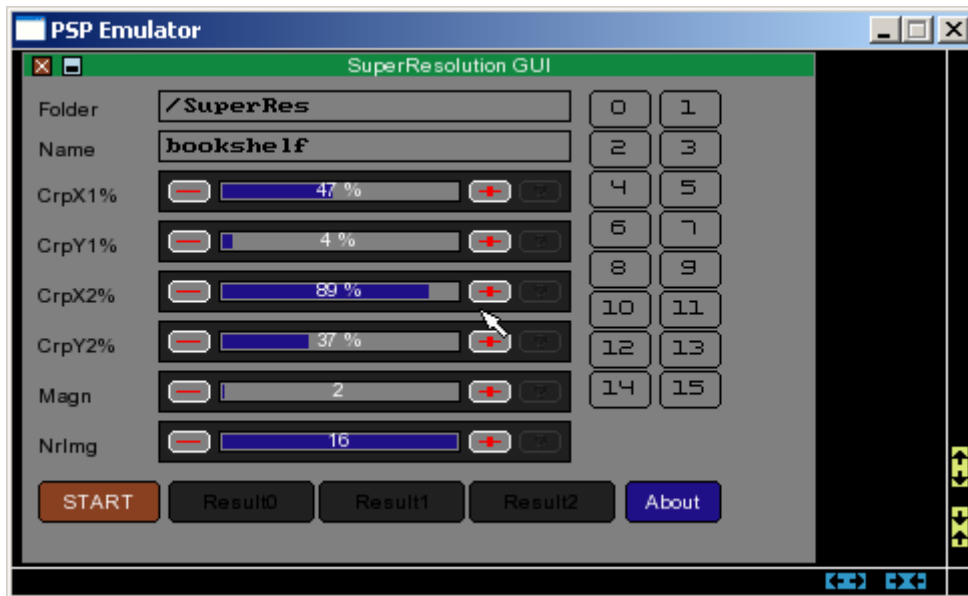
You can choose the binary that you want. Create a subfolder called */SuperRes* in */PSP/GAME* folder and copy the correct EBOOT.PBP into it.

If you're using the CFW version of the EBOOT.PBP, you must copy into the root directory of your memory stick the file *ndKrnExtender.Prx* (the kernel extender) otherwise the program will signal its missing at the boot. The file is included in this package and it can be downloaded from Visilab website.

After copying the binary, copy the subfolder *\$SuperRes* in the root folder of the memory stick **and rename it in *SuperRes***. This is very important because this directory contains some files that are required for a correct working of the program.

Start the program

Go into the PSP dashboard and select the program *SuperResolution GUI*. It will be started and you'll see this interface:



The textbox *Folder* defines the directory where the *partial frames* are stored. Smith's superresolution algorithm creates a high resolution image starting from *n* low resolution frames (*partial frames*) that are stored in the memory stick.

The textbox called *Name*, defines the name of the partial frames. The images must be stored in *png format* and they must be named in progressive order: in this case, they must be called *bookshelf-00.png*, *bookshelf-01.png*, *bookshelf-02.png*, *bookshelf-03.png* and so on...

The number of frames that will be used is defined by the last trackbar, called *NrImg*: the default value is 16, but it can be lower if you want to increase the speed of elaboration.

The *Magn* trackbar defines the magnitude factor that shall be used for the orizzontal and vertical dimension of the image. In this example, the final vertical and horizontal dimension will be multiplied by 2X in the final result.

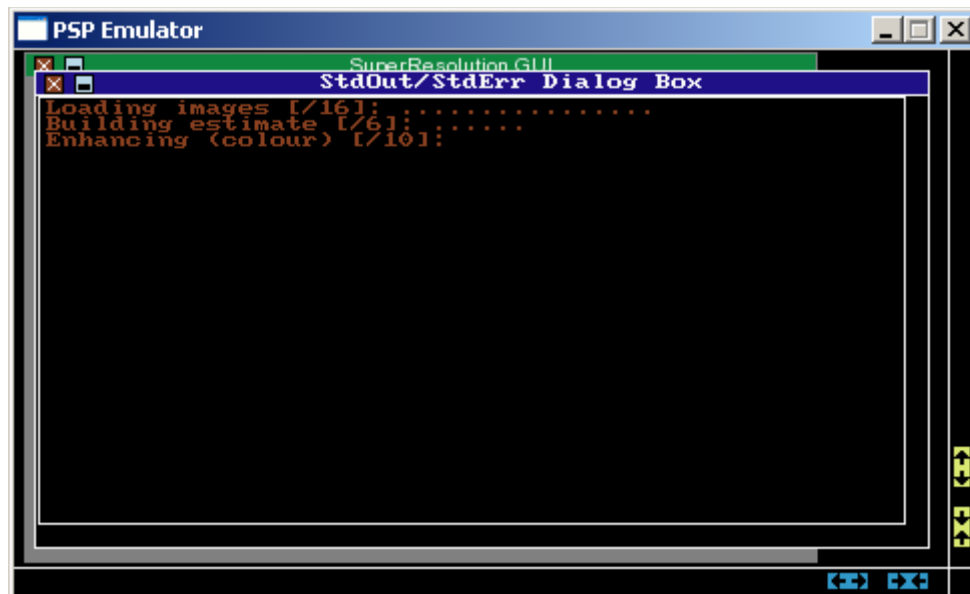
Finally, the trackbars *CropX1*, *CropY1*, *CropX2*, *CropY2*, define the dimension of the area where the software shall operate. In fact, the execution of the SR algorithm is very expensive and so we prefer, usually, operate on a single particular of the original image.

The coordinates of the region of interest is expressed using *relative coordinates*: the usual absolute coordinates can be obtained multiplying the percentages for the width or the height of the image. For example, if you want to operate on the entire image, set the trackbars to these values: (0, 0, 100%, 100%).

The two columns of buttons at the right side of the screen, allows to the user the visualization of the single input partial frames. Using these buttons, you can see each single input image that shall be used.

Ok, set the correct values for the desired region of interest and click on START to run the algorithm.

You will see this screen:



Be patient. The execution shall require a lot of minutes. The time is influenced by the number of partial frames and by the magnitude factor.

Note: if the PSP crashes, try to operate on smaller pieces of the image (the crash means that the RAM is not sufficient). This program can work under PSP-1000 (PSP FAT) or under PSP-2000 (PSP SLIM), but the last is surely better, because it integrates a larger amount of ram.

The algorithm shall create 3 high resolution image, using the algorithm in a recursive way. Each image should show more and more detailed elements.

If you want to see each of the output images, you must press one of the buttons in the bottom of the window.

The results

Now, we can see some results of the algorithm. In our tests, we've used 16 images of 135x111 dimensions. The multiplication factor was 2x. This image shows the result:



At the left you can see one of the 16 input partial frames. In the right side, instead, we can see the output image after the elaboration.

Note that, despite the output image is of 270x222 pixels (2x larger in width and height), it appears to have a better resolution than the input one.

LICENSE

The program *SuperResolution GUI* has been created by Filippo Battaglia (pegasus2000@email.it) at the Visilab Research Center of the University of Messina – Italy.

The usage of this program, and of the following versions, is totally free.

Since Michael Smith's SuperResolution algorithm is released under *General Public License 2 (GPL 2)*, also this program is released under the same license.

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This is a list of the libraries that are integrated in this program.

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Motion2D Free Edition (INRIA)

Copyright (c) 1995-2005 by INRIA.
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SuperResolution library

Copyright 2004-2005 Michael Smith
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MPEG2 Decoder

Copyright (c) 1996 MPEG Software Group

ndImageMagick

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ndDevIL

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ndFreeType library

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ndSuperResolution GUI source code

As you can see, this program includes code coming from the free version of Motion2D.

Motion2D is a software developed by INRIA (see <http://www.irisa.fr/vista/Motion2D>). The free version is released under *Q Public License* and can be redistributed in the original and modified form.

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Campus Universitaire de Beaulieu
35042 Rennes Cedex

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a) All recipients of this program are able to receive and use the complete machine-readable source code without any charge: in fact, the source code is enclosed in this package and, in any case, it can be found in the current Nanodesktop distribution, in the folder:

<ndenv folder>\PSP\ndSuperRes\ndapps\SuperResolution GUI

Nanodesktop distribution can be downloaded from Visilab website:

http://visilab.unime.it/~filippo/Nanodesktop/PSP_PSPE/Downloads/Downloads.htm

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c) If INRIA should ask a copy of *SuperResolution* program for PSP, we are ready to supply one, without any charges.

Further informations

For further information, you can write to pegasus2000@email.it