

**Image Registration Techniques**  
**Homework 4 - Ibáñez**  
**Due: Monday February 10 at 9:00pm EST**  
**Submission: via email**

This homework exercises the concepts presented in Lectures 6 and 7.

You are required to write code using the Insight Toolkit and run the corresponding executable using specific images as input. The material that you should return is composed of your source code and the output images generated from the execution of your program. Include your CMakeLists.txt files along with the source code.

This material should be sent electronically to the email address:

luis.ibanez@ieee.org

It is strongly recommended to start your work early so you have time to request help with any potential software problems you may encounter.

1. **(5 points)** Install the Insight Toolkit following the instructions presented in lecture 6. **IMPORTANT:** Use ITK 1.6. This is the version available in the CDs that you received. Whether you decide to download ITK from [www.itk.org](http://www.itk.org) or to use CVS, make sure that you download ITK Release 1.6. Do not enable TESTING nor EXAMPLES.
2. **(10 points)** Write a program that will read a 2D image from a file, apply a Gaussian smoothing and save the resulting image into a file. Execute this program using as input the image:

Insight/Examples/Data/BrainT1Slice.png

Run the program with Sigma=2 and Sigma=5. Return both output images as part of this assignment.

(Hint: A very similar program can be found in Insight/Examples/Filtering/SmoothingRecursiveGaussianImageFilter.cxx and it is described in the ItkSoftwareGuide.pdf document available in your CD and at [www.itk.org](http://www.itk.org)).

3. **(20 points)** Write a program that will read a 2D image from a file, apply a ResampleImageFilter and save the resulting image into a file. Execute

this program using as input the image:

Insight/Examples/Data/BrainProtonDensitySlice.png

Use the IdentityTransform as spatial transform, and a NearestNeighbor interpolator.

(Hint: A very similar program can be found in Insight/Examples/Filtering/ResampleImageFilter2.cxx, and it is described in the ItkSoftwareGuide.pdf document available in your CD and at [www.itk.org](http://www.itk.org)).

Execute this program for the following cases

- (a) Output image size equals Input image size, Output image pixel spacing equals Input pixel spacing, Output image origin equals central point of the Input image.
  - (b) Output image size equals half of Input image size, Output image pixel spacing equals double of the Input pixel spacing, Output image origin equals Input image origin.
  - (c) Output image size equals double of Input image size, Output image pixel spacing equals half of the Input pixel spacing, Output image origin equals Input image origin.
4. (**15 points**) Modify the program from the previous exercise in order to use a CenteredRigid2DTransform and a LinearInterpolator. Execute this program using as input the image:

Insight/Examples/Data/BrainProtonDensitySliceBorder20.png

Set the origin of the output image to  $(0,0)$ , the output pixel spacing equal to the input image pixel spacing, the output image size in pixels equal to the input image size in pixels.

Execute this program for the following cases

- (a) Set the rotation center of the transform to  $(0,0)$ , set the translation to  $(0,0)$  and the rotation angle to 10 degrees.
- (b) Set the rotation center of the transform to the middle point of the image, set the translation to  $(0,0)$  and the rotation angle to 10 degrees.
- (c) Set the rotation center of the transform to the middle point of the image, set the translation to  $(20,0)$  and the rotation angle to 10 degrees.