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Texture Analysis of an Image using Scilab : An application of Signal and Image Processing Alternative Software

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Key Words: *Image Processing, Scilab, Software, GNU, MATLAB.*

Abstract: *There are many Softwares available for Signal and Image Processing Applications like MATLAB, CLAM, Xmath, O-Matrix[5], PV-WAVE are the Commercially available Softwares and SCILAB, GNU OCTAVE, FreeMat, Rlab, Sage, Jmath Lib are the non-Commercially available Softwares (Alternative Softwares) .MATLAB is a numerical computing environment and fourth generation programming language ,but it is costly(in lakhs).Price is the barrier between commercial software usage and common people.Knowledge is not restricted to particular section of people, who can spent lakhs of rupees to purchase softwares .To make common people work with freedom,we need to know[4] the available alternate softwares.Work[3] on the alternate softwares.We made an attempt to work on the alternate softwares of Signal and Image Processing Applications.Scilab can be better amonst the above alternatives. Texture has always been an important part of the visual world.A considerable part of human eyesight perception is based not only on the recognition of brightness,contrast,color of the image but also on detecting texture patterns.The proposed work deals with obtaining the texture characteristics of an image using scilab.We discuss different image manipulations on scilab tools such as SIP and SIVP.This work also deals with histogram equalization,which helps in comparison of images.*

1. Introduction:

Developed by The MathWorks, MATLAB allows matrix manipulation, plotting of functions and data, implementation of algorithms, creation of user interfaces,consists of many functions for signal and image processing and interfacing with programs in other languages. MATLAB has a number of competitors(Alternatives)[5].

Description of each Alternative:

Sage was mentioned on Slashdot a while back. I haven't had a chance to try it out yet, but it looks like it could be the new forerunner. It aims to bring together other Mathematics software and lets you program in Python rather than some obscure proprietary language. Definitely something is worth checking out.

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JMathLib is a Java clone of the above implementations. Again, I haven't really had a chance to take it out for a spin yet, but it does have the advantage of being runnable in applet form which makes it a nice choice for quick computations. RLaB is written by Ian Searle , is free software (in the GNU copyleft sense). Although RLaB is Matlab-like, the language is _not_ a clone of Matlab. The language has a more C-like syntax, strings, and N-dimensional associative arrays in addition to the standard Matlab-like matrices. The source code is mainly C, and has been ported to most all Unix platforms, DOS, OS/2, and Apple Macintosh. GNU Octave is written at the University of Texas. It has very Matlab-like syntax and runs many m-files without modification. The project was conceived [1] around 1988. At first it was intended to be a companion to a chemical reactor design course. Real development was started by John W. Eaton in 1992. The first alpha release dates back to January 4, 1993 and on February 17, 1994 version 1.0 was released. Version 3.0 was released on December 21, 2007.The program is named after Octave Levenspiel, a former professor of the principal author who was known for his ability to perform quick back-of-the-envelope calculations. Scilab is a numerical computational package developed since 1990 by researchers from the INRIA and the École nationale des ponts et chaussées (ENPC). Since the creation of the Scilab consortium in May

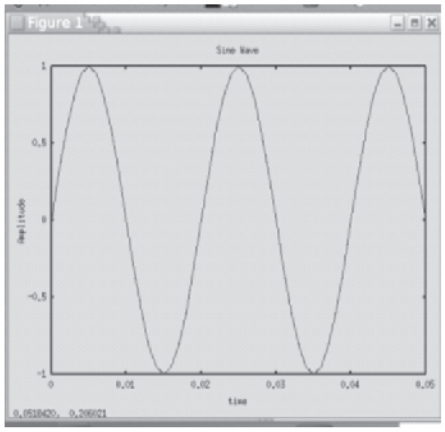
2003, it is developed and maintained by the INRIA. FreeMat is a great numerical analysis tool that's an excellent alternative to MATLAB if you don't have thousands of dollars to spend. It's still a work in progress, but it already has an impressive feature set: it can run most existing MATLAB scripts, plot figures (including 3D), PDF support, and more.

There are many Free & Open source alternatives to MATLAB, in[5] particular GNU Octave, FreeMat, and Scilab which are intended to be mostly compatible with the MATLAB language.

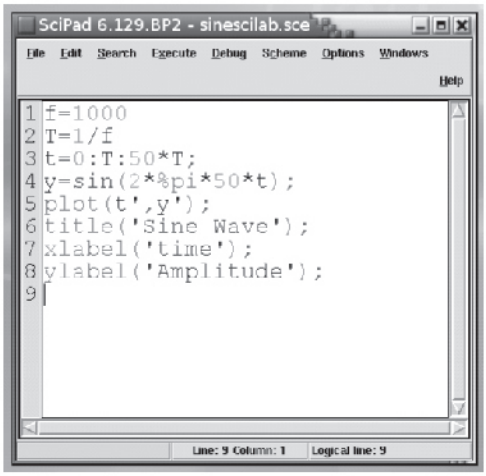
2. Comparision between the Softwares

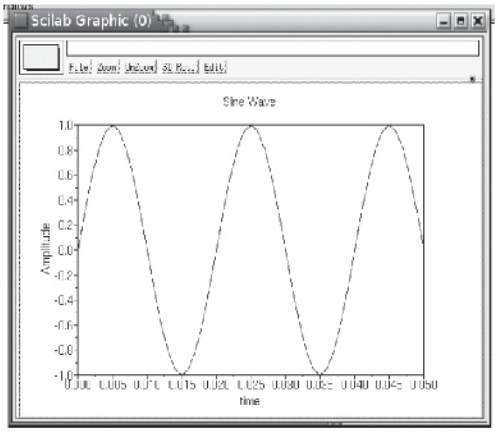
The Image processing toolbox is primarily used by Engineering students and professionals In MATLAB the implementation of Image processing applications is quite simple but lacks some of the ready made functions.For a long time there was criticism that because MATLAB[7] is a proprietary product of The MathWorks, users are subject to vendor lock-in.Sine Wave Generation,a simple Signal Processing application was tried in both GNU Octave and SCILAB.

GNU OCTAVE:



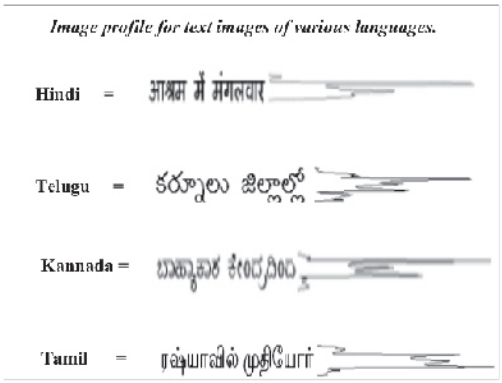
SCILAB features:





In SCILAB the implementation of Image processing applications is again quite simple and ready made functions are available. Even multiple instances run quite well. As the syntax of Scilab is similar to MATLAB, Scilab includes a source code translator for assisting the conversion of code from MATLAB to Scilab. Scilab is available free of cost under an open source license. Due to the open source nature of the software, some user contributions have been integrated into the main program.Scilab family 5 is distributed under the GPL-compatible CeCILL license.

Scilab consists of mainly two Tool Boxes (SIP&SIVP) for Image Processing applications. The SIP (Signal and Image Processing) toolbox intends to do imaging tasks such as filtering, blurring, edge detection[2], thresholding, histogram manipulation, segmentation, mathematical morphology, color image processing, etc. These operations are useful for problem solving in real-world applications ranging from car motion planning to automatic diagnosis of medical images.



SIVP(Scilab Image & Video Processing) Toolbox designed for academic researchers.SIVP is a free software and licensed under GPL (GNU General Public License).SIVP has been accepted by Debian. Debian users can install SIVP by a simple command **"apt-get install sivp ".** Features of SIVP are Image I/O (Supported format: BMP, PNG, JPEG, TIFF, PBM, PGM, PPM, SR),Video I/O, camera read, Image type conversion, Spatial trasformation functions, Image analysis and statistics functions, Image arithmetic functions, Linear Filtering, Morphological operations and Color space conversions. SIVP 0.5.0 is improved greatly compared with the previous versions. Some advanced computer vision algorithms, such as face detection, eye detection, foreground detection, object tracking, have been added to this release. By using these Alternative Softwares Academicians can freely update their knowledge and also they can add new functions.

3. Algorithm

1. Read the input image.
2. Generate Gabor mask using SIP Toolbox.
3. Convolution of mask with input image using SIP Toolbox.
4. Save the output image.
5. Plot the Histogram of saved image SIVP Toolbox.
6. Now give the saved output as input and repeat steps 3,4,5,6.
7. Continue the above process till we get the Histogram equalization

Generation of Gabor mask:

We develop a code to generate a mask using gabor filter. Gabor filter is a frequency and orientation selective Guassian envelope. The set of scale channels can be configured to capture a specific band of frequency components from an image. The set of orientational channels are used to extract directional features. The number of multichannels or called filters is the product of number of scales and number of orientations. The generated gabor mask is of order 3*3 and is given by[9]

gb1= [-3.358D-08 0.0008446 0.0088959
0.0204123 1 0.0204123
0.0088959 0.0008446 -3.358D-08];

Convolution of mask with input image:

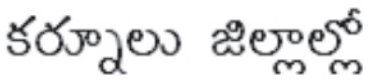
By using imconv function we can change the input image to the texture based image with the help of Gabor mask[10].

Histogram equilization:

Histogram equalization often produces unrealistic effects in photographs; however it is very useful for scientific images like thermal satellite or x-ray images, often the same class of images that user would apply false color to. Also histogram equalization can produce undesirable effects (like visible image gradient) when applied to images with low color depth. For example if applied to 8-bit image displayed with 8-bit gray-scale palette it will further reduce color depth (number of unique shades of gray) of the image. Histogram equalization will work the best when applied to images with much higher color depth than palette size, like continuous data or 16-bit gray-scale images. So we plot the histograms to show its equalization over the gray scale.

4. Results:

We should read an image using Scilab and the input text image is shown as in figure 1.



We also plot histogram to show gray level variations of the images over the scale. Histogram plot of input image is shown in figure 1.

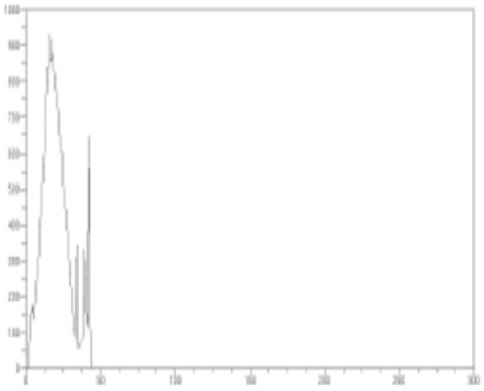


Figure 1 Histogram Plot of Input text image

Then we apply Gabor mask generated to the input image by means of convolution. The output obtained is as shown in figure 2. Histogram plot of output image is shown in figure 2.

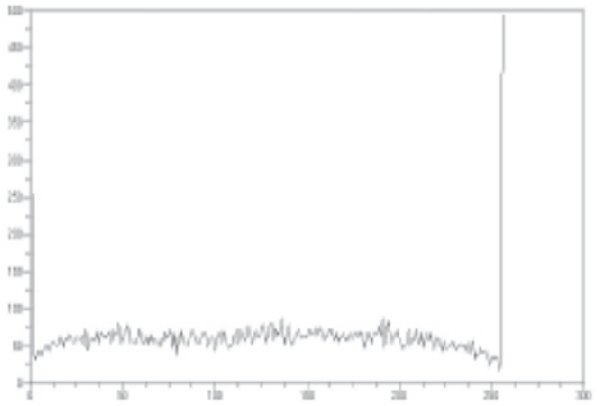


Fig 2 Histogram Plot of output image after applying gabor mask

Now we take the output image after convolution as the input and apply the above mentioned process. So we do it for number of iterations. We took output after 7th iteration and shown in Figure 3.

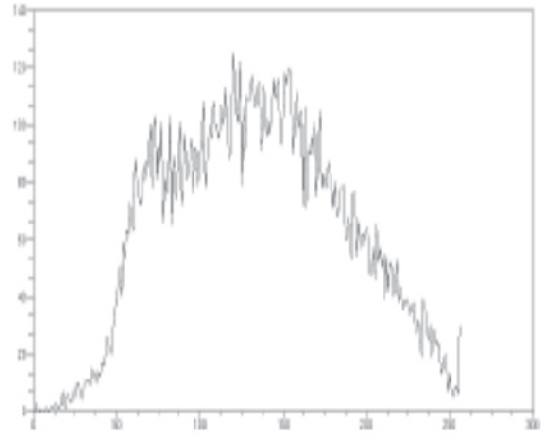


Fig 3 Histogram Plot of O/P image after 7th iteration of gabor mask

Histogram equalization is achieved by applying Gabor filter which is used for Texture Analysis.

5. Conclusion:

The success of an effective and efficient texture image retrieval using Gabor filters depends essentially on the proper choice of A suitable filter mask size, and An appropriate number of filters with proper combination of number of scales and orientations. we discuss about the design of gabor filter to obtain the mask. Then usage of convolution function on input image to get the texture characteristics of an image. Finally we plot histograms of these images to show the normalisation over the gray scale, which will help in comparing different number of images.

6. References:

1. GNU Octave Manual Version3 by John W. Eaton, David Bateman, Søren Hauberg.
2. "SCILAB Consortium launched", 2003 http://www.ercim.org/publication/Ercim_News/enw54/gomez.html
3. Holopainen, Timo (2000). "Modelling and simulation of multitechnological machine systems". http : //www.vtt.fi /inf/pdf/sympo siums /2001 /S209.pdf..
4. Eben Moglen,"Anarchism triumphant: Free software and the death of copyright",First Monday, Volume 4, Number 8 - 2 August 1999.
5. Srikanth S V,"COMPARATIVE STUDY OF MATLAB AND ITS OPEN SOURCE ALTERNATIVE SCILAB", OSSRC TECHNICAL REPORT OSS 0601,National Institute of Technology, Calicut
6. Prahalad, C.K., (2004) The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits, Wharton School Publishing.
7. Prahalad, C.K., and Hart, S., (2002). 'The Fortune at the Bottom of the Pyramid', Strategy+Business, Issue 26.
8. Ballard, D.H. and Brown, C.M. "Computer Vision", Prentice-Hall, 1982, ISBN: 0-13-165316-4
9. Lu, S., Hernandez, J.E., Clark, G.A. "Texture Segmentation by Clustering of Gabor Feature Vectors", IEEE Proc. of the Int. Conf. on Artificial Neural Networks I, 683-687, 1991.
10. Bovik, A. C., Clark, M. and Geisler, W.S. "Multichannel Texture Analysis Using Localized Spatial Filters", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 12, No. 1, pp. 55-73, 1990.