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| INFORMACIÓN BÁSICA | |
| NOMBRE DE LA PRÁCTICA: **Laboratorio: Introducción al procesamiento con Matlab de imágenes** | PRÁCTICA No.:1 |
| **ASIGNATURA:**  *Digital image processing* | |
| **TEMA DE LA PRÁCTICA:**  *Introduction to digital image processing* | |
| LABORATORIO A UTILIZAR:Laboratorio de informática | |
| **CONTENIDO DE LA GUÍA**  *(Para elaborar por el Docente)* | |
| **OBJETIVES.**   * *To understand the basic concepts of image representation.* * *To apply the color space modeling.* * *To apply and manage concepts of linear algebra and their relation with image processing.* | |
| **INTRODUCTION.**  The Biomedical engineering provides assist for medical diagnosis techniques based on medical information from different modalities like medical images.  The medical Images are defined as the set of techniques and process to obtain human body images with clinical relevancy. Different types of diseases are only revealed to medic when he analyze the information from a clinical image, but some signs of illness are difficult to see or need a especial processing to reveal the relevant information. | |
| **THEORETICAL FRAMEWORK**  An Image can be defined as a two dimensional function f(x,y) or matrix denoted as I(m,n), the minimum element which compose the image is called Pixel and stores an intensity value that represents the captured value of the real world.  In general terms there are 3 types of Image intensity representation:   * Black and white is represented in plane R and its pixel values are logical between (0 ,1). * Gray scale is represented in plane R and its pixel values are in range between (0, 2^bit depth). * Color is represented in 3 planes R, Depending on the color model used, each plane has with values between (0, 2^bit depth).   Medical Image Formats  In medical and clinical applications factors like compression, privacy of data and quality are common factors to take to account. The principal formats used are:  BMP  Is RAW format without compression popularized by the windows OS, main advantage of this is the independency of the display device.  PNG  Is a raster graphics file format that supports lossless data compression. This format was created as an improved, for GIF format, and its widely used in lossless image compression format on the Internet.  PNG supports palettes of 24-bit or 32-bit RGB color images, grayscale images with or without alpha channel, this format was designed for transferring images to the Internet, does not support non-RGB color spaces such as CMYK model.  JPG  A commonly used method for lossy compression for digital images, produced by digital photography. The degree of compression can be adjusted, allowing a selectable tradeoff between storage size and image quality.  JPEG or JPG specifies the codec that defines how an image is compressed into a stream of bytes and decompressed back into an image. In other words this type of format indexes an image to compress it.  TIFF  Is a raster image format, in the beginning, TIFF was only a binary image format, because that was all that desktop scanners could handle. As scanners became more powerful, and as desktop computer disk space became more plentiful, TIFF grew to accommodate grayscale and color images. Currently, TIFF, along with JPEG and PNG, is a popular format for high color-depth images.  DICOM  It is a standard for manage, store, print, and transmit information in medical imaging. It includes a file format definition and a network communications protocol. The communication protocol uses a TCP/IP to communicate between systems. DICOM files can be exchanged between two entities that are capable of receiving image and patient data in DICOM format.  INTENSITY  Is a value that has been scaled to represent the light strength in a single point on the image matrix, the scale corresponds to the bit depth for example if the matrix contains intensity values of uint 8 class the intensity range are from [0 - 255].  CONTRAST  Is the difference in luminance or color that makes an object (or its representation in an image or display) distinguishable. In higher luminance variance it is called high contrast, when the changes in luminance are low it is called low contrast. The human visual system is more sensitive to contrast than luminance, we can perceive the world similarly regardless of the huge changes in illumination over the day or from place to place. The maximum *contrast* of an image is the contrast ratio or dynamic range.  HISTOGRAM OF AN IMAGE  A histogram is a graph that shows the probability distribution of luminance intensity in the image.  Spatial Resolution  Spatial resolution refers to the number of pixels used in construction of a digital image. Images having better spatial resolution are composed with a higher number of pixels than those of lower spatial resolution; this affects directly the quality and the appearance of the image.  Gray Resolution  It is the change in shades or levels of gray in an image. Gray level *K* corresponds to the number of pixels that represents all possible values of gray in the image. In short gray level resolution is equal to the number of bits per pixel. | |
| **PREVIOUS KNOWLEDGE**   1. *Read how matlab manage matrix positions and modify its values.* 2. *Read about the* correct way to traverse an array with repetitive cycles in matlab. 3. *Reading an image depending of format file as an array in matlab.* 4. *Commands to shown an image in matlab.* 5. *Command to extract complete image information from the image file.* 6. *How to reduce the spatial resolution of an image.* 7. *Bitplane slicing algorithm.* 8. *Rotation transformation array.* | |
| **METHODOLOGY**   1. *Read an image.* 2. *Extract information from the image.* 3. *Showing an image.* 4. *Spatial and Gray Resolution.* 5. *Point to point transformations.* | |
| **MATERIALS AND EQUIPMENT**   |  |  |  | | --- | --- | --- | | **Materials** | **Reactivos** | **Materiales Estudiante** | | **Matlab** |  |  | | **Image procesing toolbox** |  |  | |  |  |  | | |
| **PRECAUTIONS AND MATERIAL MANAGEMENT.**  **- Please take care of the computer assigned to you.**  **- Please do not enter food an liquids.**  **- Please do not enter your bagpack.** | |
| **PROCEDURE**  *PART ONE (basis of image processing in matlab)*   1. *Read the sample image (cell.tif) in matlab and assign it to variable.* 2. *Extract all the information and separate in variables the Width, Height and Bitdepth of the image.* 3. *Create a new figure and show the original image.*   *Exercises:*   1. *Reduce the Image spatial resolution by a factor of 2, 3 and 4 without using matlab image processing functions. Show each result in a different figure.* 2. *Expand the image spatial resolution by a factor of 2, 3 and 4 without using matla image processing functions.* 3. *Reduce the original gray Resolution by factor K= 6 and show the result.* 4. *Expand the original gray resolution by a factor of K=12 and show the result.*   *Part Two (point to point transformations)*   1. *Read the image sample (rice.png) assign it to a variable, extract the main information of the image.* 2. *Implement an algorithm with repetitive cycles to go through the matrix.* 3. *Implement an algorithm to overlap a boundary window with the original image to extract information from it.*   *Exercises*   1. *Reduce the image by a factor of 2 with a mean value obtained from the boundary window.* 2. *From the reduced image binarize the image using only conditional sentences according in where is the most part of information according to the histogram.* 3. *Apply the bitplane slicing technique to binarize each bit present in the image show in separate figures.* 4. *Create an empty matrix 4 times the dimensions of the original image, using the rotation transformation matrix rotate the original image inside the empty matrix 90, 75, 47 and 137 degrees.* 5. *Create an empty matrix fill this matrix with the mirror of the original image don’t use matlab functions.* | |
| **BIBLIOGRAPHY.**  Application of Fourier analysis to the visibility of gratings.  Campbell, F. W. & Robson, J. G. (1968).. Journal of Physiology **197** (3): 551–566.  Digital Image Processing  Rafael C. Gonzales, Richard E. Woods. Third edition, Prentice Hall, Pearson. 2008.  *The Image Processing Handbook*  *Jhon C. Russ. Sixth Edition, CRC press,2011.* *Digital Image Processing Using MATLAB* Rafael C. Gonzales, Richard E. Woods. Second edition, Gatesmark Publishing; 2009.  *-----------------------------------------------------------------------------------------------------------------------------*  *Tutorials Point simple easy learning, Digital image processing, Pagina web, <http://www.tutorialspoint.com/dip/index.htm>, seeing 22/06/16* | |
| |  |  |  | | --- | --- | --- | | **ELABORÓ**  ***(Personas que elaboraron la guía)*** | **REVISÓ**  ***(Director de Programa o Área)*** | **APROBÓ**  ***(Laboratorios)*** | | Firma  Nombre : Jorge Andres Alvarez Triana  Fecha: 06/12/2016 | Firma  Nombre : Diana Paola Ovies Bernal  Fecha: 06/12/2016 | Firma  Nombre :  Fecha: | | |
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| **INFORME DE LABORATORIO**  (*Para elaborar por el Estudiante)* | |
| ESTUDIANTES: | **GRUPO:** |
| **NOTA:** |
| CARRERA: | |
| **MAKE 3 OBJETIVES RELATED TO THE PRACTICE.**  *El estudiante formulará desde su conocimiento los objetivos para la realización de la práctica* | |
| **Develop a conceptual map of the subject matter in the lab.** | |
| **RESULTS**  Please include all the images obtained with their respect matlab code and the flow chart. | |
| **QUESTIONARY**   1. Justify the algorithm used to rotate the matrix image. 2. Justify the algorithm to apply bitslicing. 3. Justify the algorithm to reduce the spatial resolution. | |
| **PRINCIPAL SOURCES OF ERROR AND HOW TO IMPROVE THE CODE:** | |
| **CONCLUSIONS** | |
| **EXAMPLES OF PROFESSIONAL APPLICATIONS OF THE SUBJECT THEMES USED IN THIS GUIDE:** | |
| **BIBLIOGRAPHY USED:** | |