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**Department of Computer Science and Information Technology**

**College of Science**

**University of Salahaddin**

**Subject: Image Processing (IP)**

**Course Book – 4th Stage (Optional)**

**Lecturer's name Sangar Hasan Ismael**

**Academic Year: 2018/2019**

**Course Book**

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| **1. Course name** | Image Processing (IP) |
| **2. Lecturer in charge** | Sangar Hasan Ismael |
| **3. Department/ College** | Computer Science and Information Technology / Science |
| **4. Contact** | e-mail: Sangar.Ismael@su.edu.krd |
| **5. Time (in hours) per week**  | Theory: 2Practical: 2  |
| **6. Office hours** | Tuesday : 10:30 am -12:30 pmWednesday : 10:30 am – 12:30 pm  |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | **Teaching:*** Attended Computer Networks and Computer Science modules as a lecture in Hawler Instute Computer (HIC), 2007-209.
* Attended each of Computer Network and Database modules labs as a teaching assistant in Salahaddin University, College of Education-Computer Science Dept, 2009-201.
* Attended each of OOP and Information Security modules labs as a teaching assistant in Salahaddin University, College of Education-Computer Science Dept, 2010-2011.
* In 2013-2014, I taught the following modules in Salahaddin University, College of Education-Computer Science Dept:
1. Computer Science
2. Computer Networking
* In 2014-2015, teaching the following modules in Salahaddin University, College of Science-Computer Science Dept:
1. Wireless and Mobile Computing
2. Computer Networking
* In 2015-2016, teaching the following modules in Salahaddin University, College of Science-Computer Science Dept:
1. Wireless and Mobile Computing
2. Computer Network
* In 2016-2017, teaching the following modules in Salahaddin University, College of Science-Computer Science Dept:

 1. Wireless and Mobile Computing 2. Database 1* In 2017-2018, teaching the following modules in Salahaddin University, College of Science-Computer Science Dept:

 1. Wireless and Mobile Computing 2. Database 1**Research Interest**:My research interest is in the following topics:* Wireless connecting
* Computer networking
* Image Compression

**Supervision**:I am currently supervising two final year projects which are:1. Modified Embedded Zerotree Wavelet Transform
2. Online Shopping

**Past projects**: - My BSc project was about creating a database using Visual Basic.- My MSc project was focusing on Image compression by using Matlab. |
| **9. Keywords** |  |
| 10. **Course overview:** * Image processing plays an important role in many aspects of our life. Much of this information is represented by digital images. Since 1964 the advent of large - scale digital computers and the space program have made digital image processing one of the most rapidly growing fields in computer Science. Now image processing has found much more wide applications in the areas such as medicine, biology, industrial automation, astronomy, law enforcement, defence, and intelligence. With the progress made in multimedia these days, digital image processing finds more wide applications. This course is an introductory course to the fundamentals of digital image processing. It emphasizes general principles of image processing, rather than specific applications.
* The main idea of digital image compression is to reduce the number of bits required to store an image in computer memory and/or transmit it over a communication link while maintain an acceptable quality of image. Therefore many image compression schemes have been developed over the last two decades. The performance of these schemes is different from low to high compression ratios with low to high levels of reduction of the decompressed images, because the end users of decompressed image are usually human beings. As a result, it is normal that efforts should be made to include some of the human visual system properties in the encoding schemes to achieve even further compression with less noticeable reductions.
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| **11. Course objective** * The purpose of image processing is divided into five groups. They are:
* Visualization: Observe the objects that are not visible.
* Image sharpening and restoration: To create a better image.
* Image retrieval: Seek for the Image of interest.
* Measurement of pattern: Measures various objects in an image.
* Image recognition: Distinguish the objects in an image.
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| **12. Student's obligation** 1- Attendance 1. Assignment
2. Homework
3. Practical exam 23%
4. Theory exam 27%.
5. Final exam 50%.

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| **13. Forms of teaching**1- data show 2- whiteboard  |
| **14. Assessment scheme** 1- Attendance 2%1. Assignment :5%
2. Homework :3%
3. Practical exam 20%
4. Theory exam 20%.
5. Final exam 50%.
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| **15. Student learning outcome:\*\*&%%RSHTRE&** |
| **16. Course Reading List and References‌:*** Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, 2nd edition, Prentice Hall, 2002.
* Data Compression: The Complete Reference, David Salomon, 4th edition, Springer, 2007.
* Digital Signal Processing Techniques and Applications in Radar Image Processing, Bu-Chin Wang, Wiley, 2008.
* I. E. G. Richardson, Video Codec Design, John Wiley & Sons, 2002.
* I.E.G. Richardson, "H.264 and MPEG-4 Video Compression", John Wiley & Sons, ISBN 0-470-84837-5, August 2003
* I.E.G. Richardson, “Video Codec Design: Developing Image and Video Compression Systems, John Wiley & Sons, ISBN 0-470-84837-5, August 2003
* R.J. Clarke, “Image and Video Compression: A SCCCPdiVl102032 Survey, CCC Proceedings, Vol. 10 pp. 20 –32, 1990
* Y.Wang, J.Osternmann, Y.Zhang, “Video Processing and Communications, Prentice Hall, ISBN0130175471 ISBN 0-13-017547-1.
* The paper “Overview of the Scalable Video Coding Extension of the H.264/AVC Standard” by Heiko Schwarz, Detlev Marpe and Thomas Wiegand, published in pages 1103—1120 of IEEE Transactions on Circuits and Systems for Video Technology, vol. 17, no. 9, September 2007 is a very thorough treatment of the SVC standard, though it has rather too much detail to absorb
* <http://www.radvision.com/Visual-Communications/VideoCommunications-Technology/Scalable-Video-Coding>
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| **17. C ourse Outline of Topics\Expected Time Frame (30 weeks)** |
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| **Week(s)** | **Basic Tutorial Subject to be covered** | **Lab(Practical)** |
| 1-2 | **Introduction to digital image processing**: History, Fundamental Steps, Levels of DIP, Major topic for image processing | Review to matlab program, Matrix and writing program in matlab, subplot. |
| 3-4 | **DIP fundamental**: Representation files type & Size, Some basic relationships between pixels, Type of digital image, Binary Image, Gray Image, Color Image, HSL, Digital Image File Format, Spatial Domain, Frequency Domain, Region of interest image geometry (enlarge , shrinking), Zoom algorithm, Zero order hold, First order hold, Convolution. | Introduction to DIP toolbox in matlab, read and show image, resize image, type of image in matlab, image information, convert image types. |
| 5-6 | **Image Analysis**: Preprocessing, Data reduction, Feature Analysis, Image algebra operation, Arithmetic operation, Logical operation.  | Arithmetic operation on Image: Add, Subtract two image, Divide, Multiply two images, Apply AND, OR, NOT operations on image |
|  7-8 | **Image Enhancement in spatial Domain**: Noise and its type, Linear & non Linear Filter, Negative transformation, Mean & Median Filter, Histogram (histogram modification, Histogram Equalization) | Add noise on image, Enhance image using mean, median filters, and Apply Histogram Equalization on image. |
| 9-10 | Image Enhancement in frequency Domain: Fourier transformation, ideal, Butterworth | Applying Fourier transformation on image. |
| 11-12 | **Image segmentation**: Edge Detection, Line Detection, Sobel, prewitt, Canny operators, Threshold. | Apply Sobel, Prewitt, and Canny Filters to detect Edges. |
| 13-14 | **Morphological Processing**: Dilation & Erosion. | Applying Morphological operation on image, Dilation & Eroision |
| 15 | **First Mid Exam**  |  |
| 16-17 | **Digital video:** Digital Video Applications, Colour Spaces, Chrominance Sampling, Digital Video Formats, Digital Video Quality and Peak Signal to Noise Ratio (PSNR)  | Negative image |
| 18-20 | **Image Compression:** Lossless and Lossy Coding, Transform Coding , Quantisation, Entropy Coding and Image Decoding  | change the rotate of the image |
| 21-22 | **Image Compression**: DCT, DWT, zigzag and Morton Scan. | Apply DCT , Wavelet Transform for image |
| 23-25 | **Video Compression:** Video Coding Concepts, Video Frame Coding , Frame Differencing, Transform, Quantisation & Entropy Coding and Decoding  | Cropping image for several pieces |
| 26-27 | **Coding Standards &H.264AVC:** ITU -T coding Standards, ISO Coding Standards, H.264/AVC –Baseline Profile, H.264/AVC –Main Profile, H.264/AVC – Extended Profile and H.264/AVC Coded Video Format | Drawing all shapes (Circle, Square, Diamond and Stair) |
| 28-29 | **Scalable Video Coding:** Video Frame Coding, Intra frame coding, Inter frame coding, Base layer, Enhancement layers, Temporal layer dependencies, Temporal scalability, Spatial scalability and Quality scalability | drawing all shapes together |
| 30 | **Second Mid Exam** |  |

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