



Philadelphia University
Faculty of Information Technology
Department of Computer Science
----- Semester, 2007/2008

Course Syllabus

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| Course Title: Digital Image Processing | Course code: 750474 |
| Course Level: Fourth | Course prerequisite(s) and/or corequisite(s): 750322 |
| Lecture Time: | Credit hours: 3 |

Academic Staff Specifics

| Name | Rank | Office Number and Location | Office Hours | E-mail Address |
|-------------|-------------|---------------------------------------|-------------------------|-----------------------|
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Course Description:

In many business and industry application domains handling and processing of digital images is a basic and important component. This spans an extremely wide range of applications from digital content creation and management for web-based applications over medical imaging, digital photography, digital print and publishing to real-time 3D graphics in simulations and computer games.

Course Objectives:

The main objective of this module is to make it possible to effectively communicate visual results. This course prepares students in the fundamentals of digital image processing as used in various applications as outlined above and illustrates the various effects one can achieve with digital images and how to extract fundamental information.

Course Components

Image Sensing and Representation, Image Analysis, CVIPlab, Human Visual Perception, Image Enhancement, Image Transforms, Image Restoration, Image Compression, Edge Detection, Correlation and Feature Detection, Discrete Fourier Transform and its Properties, Digital Filtering and Noise Cleaning, Image Segmentation.

Textbooks:

Title: Computer Imaging: Digital Image Analysis and Processing , SE Umbaugh,
Publisher: CRC Press, 2005

Title: Digital imaging Digital techniques, Gonzalez,Rafael C. Woods,Richard E. Prentice-
Hall, 2002

Teaching Methods:

Duration: 16 weeks in first semester, 60 hours in total

Lectures: 32 hours (2 hours per week),

Tutorials: 13 hours, 1 per week,

Laboratories: 16 hours, 1 per week

Project Presentation: 3 hours

Learning Outcomes:

- **Knowledge and understanding**
 - Have a knowledge and understanding of the structure of an interactive image processing.
 - Have a knowledge and understanding of image transformations.
 - Have a knowledge and understanding of techniques for representing color/mono images.
 - Have a knowledge and understanding of interaction techniques.
- **Cognitive skills (thinking and analysis).**
 - Be able to create interactive image processing.
- **Communication skills (personal and academic).**
 - Use OOP to build image tools .
- **Practical and subject specific skills (Transferable Skills).**
 - Perform simple algorithms on images.

Assessment Instruments

| <u>Allocation of Marks</u> | |
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| Assessment Instruments | Mark |
| First examination | 15% |
| Second examination | 15% |
| Final Exam (written unseen exam) | 40 % |
| Final project (defended) | 10% |
| Reports, assignments, Quizzes, Home works, Tutorials | 20% |
| Total | 100% |

** Make-up exams will be offered for valid reasons only with consent of the Dean. Make-up exams may be different from regular exams in content and format.*

Practical Submissions

The assignments that have work to be assessed will be given to the students in separate documents including the due date and appropriate reading material.

Documentation and Academic Honesty

Submit your home work covered with a sheet containing your name, number, course title and number, and type and number of the home work (e.g. tutorial, assignment, and project).

Any completed homework must be handed in to my office (room IT ---) by 15:00 on the due date. After the deadline “zero” will be awarded. You must keep a duplicate copy of your work because it may be needed while the original is being marked.

You should hand in with your assignments:

- 1- A printed listing of your test programs.
- 2- A brief report to explain your findings.
- 3- Your solution of questions.

For the research project, you are required to write a report similar to a research paper. It should include:

- **Abstract:** It describes the main synopsis of your paper.
- **Introduction:** It provides background information necessary to understand the research and getting readers interested in your subject. The introduction is where you put your problem in context and is likely where the bulk of your sources will appear.
- **Methods (Algorithms and Implementation):** Describe your methods here. Summarize the algorithms generally, highlight features relevant to your project, and refer readers to your references for further details.
- **Results and Discussion (Benchmarking and Analysis):** This section is the most important part of your paper. It is here that you demonstrate the work you have accomplished on this project and explain its significance. The quality of your analysis will impact your final grade more than any other component on the paper. You should therefore plan to spend the bulk of your project time not just gathering data, but determining what it ultimately means and deciding how best to showcase these findings.
- **Conclusion:** The conclusion should give your reader the points to “take home” from your paper. It should state clearly what your results demonstrate about the problem you were tackling in the paper. It should also generalize your findings, putting them into a useful context that can be built upon. All generalizations should be supported by your data, however; the discussion should prove these points, so that when the reader gets to the conclusion, the statements are logical and seem self-evident.
- **Bibliography:** Refer to any reference that you used in your assignment. Citations in the body of the paper should refer to a bibliography at the end of the paper.

• Protection by Copyright

1. Coursework, laboratory exercises, reports, and essays submitted for assessment must be your own work, unless in the case of group projects a joint effort is expected and is indicated as such.
2. Use of quotations or data from the work of others is entirely acceptable, and is often very valuable provided that the source of the quotation or data is given. Failure to provide a source or put quotation marks around material that is taken from elsewhere gives the appearance that the comments are ostensibly your own. When quoting word-for-word from the work of another person quotation marks or indenting (setting the quotation in from the margin) must be used and the source of the quoted material must be acknowledged.
3. Sources of quotations used should be listed in full in a bibliography at the end of your piece of work.

• **Avoiding Plagiarism.**

1. Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called plagiarism and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.
2. Paraphrasing, when the original statement is still identifiable and has no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.
3. Direct quotations from an earlier piece of your own work, if not attributed, suggest that your work is original, when in fact it is not. The direct copying of one's own writings qualifies as plagiarism if the fact that the work has been or is to be presented elsewhere is not acknowledged.
4. Plagiarism is a serious offence and will always result in imposition of a penalty. In deciding upon the penalty the Department will take into account factors such as the year of study, the extent and proportion of the work that has been plagiarized, and the apparent intent of the student. The penalties that can be imposed range from a minimum of a zero mark for the work (without allowing resubmission) through caution to disciplinary measures (such as suspension or expulsion).

| WEEK | TOPICS | HOMEWORK & LAB |
|------|---|---|
| 1 | Overview, Computer imaging systems | Chap 1: 1,2,3,4,5,6 Chap 2: 1,4,19,20,21,22,23,27 |
| 2 | Image analysis, preprocessing, | Chap 3: 1,2,4,8,9,11,13,16 Program: 2.7.1 |
| 3 | Human visual system, image model | Chap 7: 1-9, 11, 14,16,18,19 Program: 3.6.1, parts 1, 2 (zero-order only), 3, 5 |
| 4 | Image enhancement, gray scale modes, histogram mode | Chap 8: 1-7,10,14,16,20,21,22 Program: 8.7.4, parts 1,2 |
| 5 | Discrete transforms, fourier | Chap 5: 1-8, 11,12,13,21 Program: 5.11.2 |
| 6 | Review , Study Guide, First Exam | |
| 7 | discrete cosine, walsh-hadamard, Haar, PCT, filtering | Chap 5: 14-18,20 Program: 5.11.3, 5.11.4, 5.11.5 |
| 8 | filtering, wavelet transform, pseudocolor | Chap 5: 9,10,19,24-27,30-36 Chap 8: 23,25,27 <i>Not collected due to test</i> |
| 9 | Image enhancement, sharpening, smoothing | Chap 8: 28-40 Program: 8.7.9, part 1. You can use CVIPtools functions such as: hist_stretch, subtract_image, specify_filter, convolve_filter, mean_filter, smooth_filter |

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| | | You CANNOT use unsharp_filter |
| 10 | Image restoration, overview, system model, noise <i>Project Proposal Due</i> | Chap. 9: 1-10 Program: 9.9.2, part 1 |
| 11 | Image restoration: noise removal, degradation model, inverse filter | Chap 9: 11-17 Project |
| 12 | Review, Study Guide, Second Exam | |
| 13 | Freq. filters, geometric transforms | Chap 9: 18-21,23,27,28,32 Project |
| 14 | image compression: system model, lossless methods | Chap 10: 1-6,10-13 Project |
| 15 | image compression: lossy methods, work on project | Chap 10: 17-21 <i>Not collected due to test</i> Project |
| 16 | Show demo term project <i>Project Paper Due</i> | |

Expected Workload:

On average students need to spend 2 hours of study and preparation for each 50-minute lecture/tutorial.

Attendance Policy:

Absence from lectures and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

Module References

Students will be expected to give the same attention to these references as given to the Module textbook(s)

- The Scientist and Engineer's Guide to Digital Signal Processing, Steven W. Smith
- Digital Image Processing: 3rd Edition, William K. Pratt
- 1a. Computer Vision and Image Processing: A Practical Approach Using CVIPtools - S. E Umbaugh, Prentice Hall PTR, Upper Saddle, NJ, 1998
- Digital Image Processing - R.C.Gonzalez & P.Wintz
- Robot Vision - B.K.P.Horn
- Computer Vision - D.H.Ballard & C.M.Brown

- Syntactic Pattern Recognition : An introduction -R.C.Gonzalez and M.G.Thomason
- Pattern Recognition - A Statistical Approach - P.A. Devijver and J. Kittler
- Digital Image Processing - W. K. Pratt
- Fundamentals of Digital Image Processing - A.K. Jain
- Digital Picture Processing - A. Rosenfeld and A.C. Kak
- Pattern Classification and Scene Analysis - R.O. Duda and P.E. Hart
- Object Recognition by Computer - W.E.L. Grimson
- Digital Pictures - A.N. Netravali and B.G. Haskell
- Vision in Man and Machine - M.D. Levine
- Pattern Recognition Statistical, Structural and Neural Approaches, R.J Schalkoff, John Wiley & Sons NY
- Digital Image Processing and Computer Vision, R.J. Schalkoff, Wiley
- Artificial Intelligence: An Engineering Approach, R.J. Schalkoff, McGraw-Hill
- Algorithms for Graphics and Image Processing, Theo Pavlidis, Computer Science Press, call no.: T385.P381982
- Handbook of Pattern Recognition and Image Processing, K.S. Fu and T.Y. Young, Academic Press
- The Image Processing Handbook, John C. Russ, CRC Press SIUE Library call #: TA1632.R881992 (reference)

Journals

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Computers
- Pattern Recognition
- Computer Vision, Graphics and Image Processing
- IEEE Transactions on Medical Imaging
- Computerized Medical Imaging and Graphics
- IEEE Transactions on Image Processing
- IEEE Engineering in Medicine and Biology
- IEEE Transactions on Signal Processing
- IEEE Transactions on Neural Networks
- IEEE Transactions on Geoscience and Remote Sensing
- Photogrammetric Engineering and Remote Sensing
- International Journal of Remote Sensing
- Journal of Visual Communication and Image Representation

Website(s):

- www.cee.hw.zc.uk/~pjbk/pathways/cpp1/cpp1.html
- www.edm2.com/0507/introcpp1.html
- www.doc.ic.ac.uk/~wjk/C++intro
- www.cprogramming.com/tutorial.html
- www.cs.umd.edu/users/cml/cstyle/ellemtel-rules.html
- www.deakin.edu.au/~agoodman/Ctutorial.html
- www.tldp.org/howto/c++programming.howto.html
- www.vb-bookmark.com/cpptutorial.html

Digital Image Processing PowerPoint Lecture Slides

[CVIPbook_PPLec\Chapter1.ppt](#)

[CVIPbook_PPLec\Chapter2.ppt](#)

[CVIPbook_PPLec\Chapter3a.ppt](#)

[CVIPbook_PPLec\Chapter7.ppt](#)

[CVIPbook_PPLec\Chapter8.ppt](#)

[CVIPbook_PPLec\Chapter5.ppt](#)

[CVIPbook_PPLec\Chapter9.ppt](#)

[CVIPbook_PPLec\Chapter10_439.ppt](#)
