MONASH University

FIT3081
Image processing

Unit Guide

Semester 2, 2009

The information contained in this unit guide is correct at time of publication. The University has the right to change any of the elements contained in this document at any time.

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Introduction

Welcome to FIT3081 Image Processing.

Please note that the sequence of lectures and topics implied through their inclusion in the weekly topic list in this unit guide may be varied during the semester at the discretion of the FIT3081 Chief Examiner, as long as such variation is judged by the FIT3081 Chief Examiner not to compromise the unit objectives.

Unit synopsis

This unit covers fundamental techniques in image processing. Topics include image representation and enhancement, thresh holding, image algebra, neighborhood operations on images, Fourier methods, edge detection, feature extraction and representation, shape, texture, segmentation, classification, restoration, image compression, and colour and multi-band image processing.

Learning outcomes

At the completion of this unit, students will be able to:

- Understand the processes of image formation, acquisition, processing and analysis;
- Develop programs for manipulating grey level, colour and multi-spectral images; and
- Use standard image processing software;
- Undertake computer analysis of medical, remotely-sensed, document, and other images.

At the completion of this unit, students will have attitudes that will allow them to:

- Understand the role of visual information processing and analysis; and
- Apply the theory and methods in practical problem solving.

At the completion of this unit, students will be able to:

- Write programs to carry out basic image processing tasks such as image denoising, image filtering and segmentation of an image in its constituent parts or objects;
- Write programs to carry out advanced image processing and analysis tasks such as image segmentation, image, image classification, image data mining, and robotic vision; and
- Build a software system for processing and analysis of image data.

At the completion of this unit, students will be able to:

- Function as an image processing specialist in a group which is involved in developing a major software system; and
- Produce appropriate documentation.

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Contact hours

4 hrs/week

Workload

- Two one-hour lectures per week,
- 12 one-hour tutorials starting week 2,
- 12 one-hour computer labs starting week 3.

Unit relationships

Prerequisites

FIT2004 (or CSE2304) and FIT2014 (or CSE2303)

Students are expected to have knowledge of

+ programming in C in a Linux environment
+ introductory knowledge of Mathematics in the areas of Calculus, Vectors and Matrices, and Probability and Statistics.

Prohibitions

CSC3140, CSE3314, PHS2431

Relationships

FIT3081 is an elective unit in Computer Science major of the degrees of Bachelor of Computer Science, Bachelor of Science and double degrees including Science/Computer Science, Science/Engineering, Arts/Computer Science and Computer Science/Education

It is a prerequisite/corequisite for Before attempting this unit you must have satisfactorily completed

FIT2004 or CSE2304 (or equivalent) and FIT2014 or CSE2303 (or equivalent).

, or equivalent. You should have knowledge of

Students are expected to have introductory knowledge of Mathematics in the areas of Calculus, Vectors and Matrices, and Probability and Statistics.

You may not study this unit and

CSC3140, CSE3314, PHS2431

in your degree.

Teaching and learning method

Timetable information

For information on timetabling for on-campus classes please refer to MUTTS, http://mutts.monash.edu.au/MUTTS/

Tutorial allocation

On-campus students should register for tutorials/laboratories using the Allocate+ system:
http://allocate.cc.monash.edu.au/

Unit Schedule

Week	Topic	Key dates
1	Image Processing Fundamentals; Arithmetic Operations on Images	
2	Introduction to Image Enhancement Techniques; Linear Stretching	
3	Spatial Filtering Methods; Sharpening Filters	
4	Histogram Equalization; Line and Edge Detection	
5	Image Thresholding; Image Segmentation Methods	
6	Clustering-Based Image Segmentation; Region Growing; Splitting and Merging	
7	Texture Characterization; Co-occurrence Matrices; Entropy-Based Thresholding	
8	Image Filtering in Frequency Domain	Assignment 1 Due Monday, 7 Sept.
9	Image Data Compression	
10	Image Representation and Description	
Mid semester break		
11	Image Recognition and Interpretation	
12	Colour and Multband Image Processing	Assignment 2 Due Monday 12 October
13	Revision; Teaching Evaluation	

Unit Resources

Prescribed text(s) and readings

Prescribed Text

R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall, 3rd Edition, 2008.

Text books are available from the Monash University Book Shops. Availability from other suppliers cannot be assured. The Bookshop orders texts in specifically for this unit. You are advised to purchase your text book early.

Recommended text(s) and readings

Recommended Reading

R. C. Gonzalez and R. E. Woods, Digital Image Processing using MATLAB, Prentice Hall, 2004. A. K. Jain, Fundamentals of Digital Image Processing, Prentice-Hall, 1990. W. Niblack, An Introduction to Digital Image Processing, PHI, 1986. D. H. Ballard and C. M. Brown, Computer Vision, Prentice-Hall, 1982. M. D. Levine, Vision in Man and Machine, McGraw?-Hill, 1995. R. Jain, R. Kasturi, and B. G. Schunck, Machine Vision, McGraw?-Hill, 1995. C. Watkins, A. Sadun, and S. S. Marenka, Modern Image Processing: Warping, Morphing, and Classical Techniques, Academic Press, 1993. H. R. Myer and A. R. Weeks, The Pocket Handbook of Image Processing Algorithms in C, Prentice-Hall, 1993. S. E. Umbaugh, Computer Vision and Image Processing: a practical approach using CVIPtools, Prentice Hall PTR, 1998.

Required software and/or hardware

Monash Image Library

MATLAB

Equipment and consumables required or provided

Students studying off-campus are required to have the minimum system configuration specified by the Faculty as a condition of accepting admission, and regular Internet access. On-campus students, and those studying at supported study locations may use the facilities available in the computing labs. Information about computer use for students is available from the ITS Student Resource Guide in the Monash University Handbook. You will need to allocate up to 6 hours per week for use of a computer, including time for newsgroups/discussion groups.

Study resources

Study resources we will provide for your study are:

Assessment

Overview

Examination (3 hours): 70%; Assignments 30%

Faculty assessment policy

To pass a unit which includes an examination as part of the assessment a student must obtain:

- 40% or more in the unit's examination, and
- 40% or more in the unit's total non-examination assessment, and
- an overall unit mark of 50% or more.

If a student does not achieve 40% or more in the unit examination or the unit non-examination total assessment, and the total mark for the unit is greater than 44% then a mark of no greater than 44-N will be recorded for the unit.

To pass this unit, a student must obtain :

* 40% or more in the unit's examination,

* 40% or more in the unit's non-examination assessment, and

* an overall unit mark of 50% or more.

If a student does not achieve 40% or more in the unit examination or the unit non-examination assessment then a mark of no greater than 44-N will be recorded for the unit.

Assignment tasks

Assignment coversheets

Assignment coversheets are available via "Student Forms" on the Faculty website:
http://www.infotech.monash.edu.au/resources/student/forms/
You MUST submit a completed coversheet with all assignments, ensuring that the plagiarism declaration section is signed.

Assignment submission and return procedures, and assessment criteria will be specified with each assignment.

- **Assignment task 1**

  Title:
  Assignment 1
  Description:
  Programming and Analysis for Image Processing Tasks
  Weighting:
  15%
  Due date:
  7 September 2009

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- **Assignment task 2**

  Title:
  > Assignment 2

  Description:
  > Programming and Analysis for Image Processing Tasks

  Weighting:
  > 15%

  Due date:
  > 12 October 2009

Examination

- **Weighting:** 70%
  Length: 3 hours
  Type (open/closed book): Closed book

See Appendix for End of semester special consideration / deferred exams process.

Due dates and extensions

Please make every effort to submit work by the due dates. It is your responsibility to structure your study program around assignment deadlines, family, work and other commitments. Factors such as normal work pressures, vacations, etc. are not regarded as appropriate reasons for granting extensions. Students are advised to NOT assume that granting of an extension is a matter of course.

Students requesting an extension for any assessment during semester (eg. Assignments, tests or presentations) are required to submit a Special Consideration application form (in-semester exam/assessment task), along with original copies of supporting documentation, directly to their lecturer within two working days before the assessment submission deadline. Lecturers will provide specific outcomes directly to students via email within 2 working days. The lecturer reserves the right to refuse late applications.

A copy of the email or other written communication of an extension must be attached to the assignment submission.

Refer to the Faculty Special consideration webpage or further details and to access application forms: http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html

Late assignment

Assignments received after the due date will be subject to a penalty of 10% per day including weekends. Assignments received later than one week (seven days) after the due date will not normally be accepted.

Return dates

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later.

Appendix

Please visit the following URL: http://www.infotech.monash.edu.au/units/appendix.html for further information about:

- Continuous improvement
- Unit evaluations
- Communication, participation and feedback
- Library access
- Monash University Studies Online (MUSO)
- Plagiarism, cheating and collusion
- Register of counselling about plagiarism
- Non-discriminatory language
- Students with disability
- End of semester special consideration / deferred exams