Computer Vision – Algorithms and Systems

Subject Review & Final Exam

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Subject Learning Outcomes

On successful completion of this subject, students are expected to:

- Understand the principle of digital image and video cameras.
- Use image enhancement techniques.
- Use object detection and recognition techniques.
- Use video processing techniques to detect moving objects.
- Design and implement basic computer vision systems for real applications.

Topics Covered in the Subject

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- Photometry and colourimetry
  - light, colour perception and colour spaces
- Image acquisition
  - Optical system, image sensors, single sensor based digital camera, colour processing chain
- Image quality & enhancement
  - Criteria of quality, sharpness, low- & high-pass filter in spatial and frequency domain, enhancement, noise, image spectrum and pyramids
- Edge detection
  - Gradient, edge detection operators, zero-crossing, LoG, DoG, Canny edge detector
- Key point detection
  - Harris corner detection, SIFT interest points and descriptors, BoW, image similarity

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Topics Covered in the Subject

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- Shape detection
  - Hough transform, circle detection
- Image segmentation
  - Visual features, visual grouping, thresholding (heuristic & Otsu's), clustering-based (k-means, mean-shift)
- Binary image processing
  - Binary morphology, connected component analysis
- CD and background modelling
  - Robust CD, Background modelling (running average/median/Gaussian GMM)
- Object detection
  - General framework (detection as classification), sliding window vs. reginal proposal (selective search), skin-colour based face detection, AdaBoost (Viola & Jones detector), HoG for detection of humen and faces

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Topics Covered in the Subject

▶ Image classification and object recognition

- General framework, human perception of faces, face recognition system, normalization of faces, eigenfaces, LBP-based face recognition

▶ Motion estimation

- Optical flow, HS method, LK method, global motion, motion analysis and its applications

▶ Convolitional Neural Networks (ConvNets)

- Linear classifier, softmax classifiers, optimization, multiple layer perceptron (fully connected layers), gradient backpropagation, convolutional layers, learning ConvNet parameters (mini-batch SGD, batch normalization), hyper-parameters, regularization and dropout, data augmentation, typical ConvNets for CV

Subject Materials for Review

▶ Lecture slides
  ▪ Available on the subject Moodle.

▶ Recommended books:
  ▪ D. Forsyth, J. Ponce. Computer Vision a Modern Approach, Prentice Hall, 2012 (2ⁿᵈ ed.)
  ▪ E. R Davies, Computer and machine vision: theory, algorithms and practicalities, Academic Press; 4th edition; 2012
  ▪ Stanford's course Convolutional Neural Networks for Visual Recognition http://cs231n.stanford.edu/

▶ Assignments

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Assessments 程序代写代做 CS编程辅导

▶ Assignments (60% in total)
- 3x Coding projects 3 = 60%

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▶ Final Exam (40%) Assignment Project Exam Help

- Minimum requirement 40% = 16 marks
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Final Examination

‣ Materials and Allowed
  ▪ Open book

‣ Exam Structure
  ▪ Problem solving and discussion
  ▪ 4 questions, 10% each
  ▪ Each question has multiple sub-questions

‣ This exam will run via Moodle

Final Examination...

程序代写代做 CS编程辅导

- Exam Date & Starting time
  - **13:30 (Sydney Time) Monday 15 November 2021**
  - **Please check SOLS**

- Exam Duration
  - 2 hours

- **Grace Period**
  - 30 minutes for preparing and submitting answer sheets in a single pdf file

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Final Examination - Instructions

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▶ Have a set of A4 blank paper ready

▶ On the first page

  ▪ Your full name, Student Number & UOW login name

▶ Answer each question on a separate page clearly

  ▪ either handwriting or using suitable editing software at your own choice

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▶ Scan or take photos of your answer sheets and convert them into one single pdf file (<200MB)

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▶ Name the pdf file as

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  ▪ <your login name>.pdf

▶ Submit the pdf file via Moodle

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  ▪ See the next slide on how to scan/convert your hand-write answer sheets into a single pdf file using your mobile

How to create one pdf file

▸ **Important:** Be prepared by knowing how to create one pdf file from your working s...

▸ There is freely avail... ...ware that can be used to scan your answer sheets and convert them into a single pdf file. These links may be of assistance.

▸ **Android**

https://www.youtube.com/watch?v=BCccqxhPyJw (Scan documents)

https://www.youtube.com/watch?v=1clWftSgIM (Convert image to pdf)

▸ **iPhone**

https://www.idownloadblog.com/2017/05/12/how-to-save-photos-pdf-iphone-ipad/

https://www.igeeksblog.com/how-to-convert-photos-to-pdf-on-iphone-ipad/

Example Problems

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▶ Disclaimer

  ▪ *This is not an exclusive list of problems that may appear in the final exam, they are just examples*

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Example Problems

▸ Single sensor cameras and image processing

- Key components
- How each component affects quality of images
- Noise propagation
- How to enhance images with low visual quality
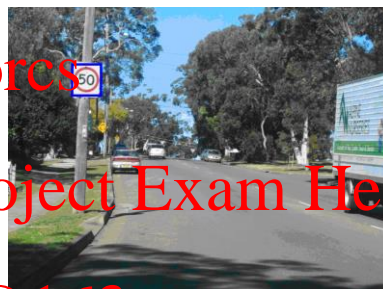
Example Problems

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- ▸ Automatic Re... on of the following road sign in images

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- ▸ Automatic counting the number of balls
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Example Problems

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- People Counting
- Detection of registration
- Classification of vehicles
- Detection of hands
- Problems in assignments

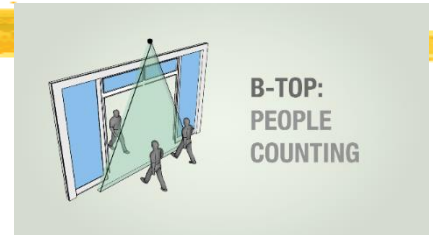WeChat: cstutorcs

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Types of Possible Questions

▸ How will you classify the problem with regards to computer vision problems you have learnt in the class?

▸ Propose a solution to the problem. Divide the solution into components and describe the solution using a block diagram or flowchart. Explain the function, input and output of each components.

▸ For each component in the solution, choose suitable algorithms and briefly describe how the algorithms works.

▸ Describe how you would test your solution and measure its performance.

▸ Discuss whether your algorithm would work in "certain" conditions, Explain why it works or why it does not work.

▸ What are the possible factors that may affect the accuracy of your system?

How to contact me

▸ Consultation

- Monday 15:30 – 17:30
- Wednesday 16:30 – 18:30

▸ Email

- Set the subject of the email as
  ○ CSCI435 or CSCI935; (topic of the email)
- Will be responded as soon as possible

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Good Luck !

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