

自動化光學檢測原理與應用

114-2 開課

♡ 收藏

加入預選

流水號
16875

課號
<> ME5245

課程識別碼
IIII 522 U5320

無分班

3 學分

選修
機械工程學系 / 工學院院學士學位 / 奈米工程與科學碩士學位學程 / 奈米工程與科學博士學位學程 / 機械工程學研...

陳亮嘉

二 7, 8, 9

綜402

2 類

修課總人數 30 人
本校 30 人

3 個領域專長

英文授課

NTU COOL

核心能力與課程規劃關聯圖

機械系、奈米工科碩士、奈米工科博士 本課程以英語授課。機械系系定選修。1.領域專長-先進製造模組。2.領域專長-機械與機電量測實務模組。

工學院院學士、機械所 本課程以英語授課。

↗ 本校選課狀況

已選上	剩餘名額	已登記
21 / ₃₀	9	0

目 課程概述

Objectives: This subject is arranged to introduce the theory and techniques required in Automatic Optical Inspection (AOI) as well as its applications in various industries. The subject mainly includes the following subtopics: introduction to precision metrology and machine vision, the measurement & detection principles and methods used in the 2D AOI, the detection & measurement principles and techniques used in the 3D AOI, image processing and algorithm methods used in automatic inspection, special topic from experts from industries, system instrumentation, factory visit, and lab practice work.

Important notes for the perspective students:

- 1) The class will be mainly conducted in English.
- 2) Extra lecturing videos in Chinese will be provided in NTU Cool a week before every section is delivered, so the students with Chinese background can pre-study the topics.
- 3) The students can use Chinese or English for their exams, tests, and homework.
- 4) If requested, some extra time of lecturing can be arranged for the students with Chinese background for their best learning.

🕒 課程目標

1. To familiarize with fundamentals, theories and techniques required in AOI technology.
2. To understand key issues in system design and operations in AOI.
3. To establish the fundamentals of instrumentation needed in AOI.
4. To establish basic hands-on skills of AOI, such as programming in digital imaging processing.
5. To understand the developing trend of AOI industries and its applications.

≡ 課程要求

Science or Engineering background is desirable.

Class grading:

1. Middle examination (30%);
 2. Homework & labwork report & Tour report (20%);
 3. Final student presentation and report (50%)
 4. Class participation (+-0~10%)
-

🕒 預期每週課前或/與課後學習時數

🕒 Office Hour

📖 指定閱讀

📖 參考書目

AOI References for reading and study:

Definition of Machine vision: [1, 2]

Image formation and sensing: [3, 4]

Sensors: [5, 6]

Types of lenses and geometrical optics: [4]

Optical Resolution: [7, 8]

CCD Size specification: [9]

Important parameters of CCD and Imaging: [10]

Image format and transform: [11]

Fundamental's parameters of an Imaging system: [10, 12, 13]

MTF: [10]

Telecentric lenses: [14, 15]

Light source and characteristics: [16, 17]

Color Rendering Index: [18]

Light projection method: [19, 20]

LED light source: [21]

Basics of Image Segmentation:[22-24]

Camera calibration: [25-27]

Autofocusing algorithms: [28-30]

Fourier transform: [31-33]

Note:

These topics have been taken from Prop. Chen's sir AOI classroom. The primary sources of these topics are from AOI class presentation taught by Prop. Liang-Chia Chen's sir.

- [1] M. vision. [Online]. Available: <https://cortexrobotics.my/machine-vision/>.
- [2] Microscan. [Online]. Available: <https://www.microscan.com/en-us/resources>.
- [3] I. f. a. sensing. [Online]. Available:
<https://www.cse.unr.edu/~bebis/CS791E/Notes/ImageFormation.pdf>.
- [4] D. B. Murphy, "Fundamentals of Light Microscopy and Electronic Imaging, 2nd Edition" Vol. Image formation, pp. Chapter-4-5.
- [5] R. W. Rafeel Gonzalez, "Digital Image Processing," pp. Chapter1-2.
- [6] S. E. umbaugh, "Digital Image processing," pp. chapter-1.
- [7] r. criterion. [Online]. Available: <http://hyperphysics.phy-astr.gsu.edu/hbase/phyopt/Raylei.html>.
- [8] Edmund, "Optical resolution." [Online]. Available:
<https://www.edmundoptics.com.tw/knowledge-center/application-notes/imaging/resolution/>.
- [9] Edmund, "CCD camera specification." [Online]. Available:
<https://www.edmundoptics.com.tw/knowledge-center/application-notes/imaging/understanding-camera-sensors-for-machine-vision-applications/>.
- [10] Edmund, "Important parameters of CCD and Imaging ". [Online]. Available: Important parameters of CCD and Imaging
- [11] D. B. Murphy, "Fundamentals of light Microscopy and electronic imaging."
- [12] E. Hecht, "Optics," pp. Chapter-5(Geomtrical optics).
- [13] edmund, "depth of field." [Online]. Available:
<https://www.edmundoptics.com/resource-page/application-notes/imaging/depth-of-field-and-depth-of-focus/#:~:text=The%20DOF%20of%20a%20lens,the%20plane%20of%20best%20focus.>
- [14] Edmund, "Telecentric lens video." [Online]. Available:
<https://www.youtube.com/watch?v=O-NeZcmYyJ4>.
- [15] v. system, "Telecentric lenses." [Online]. Available: <https://www.vision-systems.com/factory/manufacturing/article/16737545/telecentric-lenses-focus-on-machine-vision>.
- [16] D. B. MURPHY, "Fundamentals of light microscopy and electronic imaging."

- [17] R. E. F. B. T.-G. P. R. Yoder, "Optical System Design," pp. Chapter-14.
- [18] Wikki, "Color rendering index." [Online]. Available:
https://en.wikipedia.org/wiki/Color_rendering_index.
- [19] S. robotics, "light projection method." [Online]. Available:
https://www.robotics.hiroshima-u.ac.jp/researches/researches_single/851/.
- [20] it, "light projection method." [Online]. Available:
<http://www.it.hiof.no/~borres/j3d/explain/shadow/p-shadow.html>.
- [21] T. lab, "LED light." [Online]. Available:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=2615.
- [22] D. B.MURPHY, "Fundamentals of light microsocpy " pp. Chapter15-16.
- [23] A. labs, "Image segmentation." [Online]. Available:
<https://www.analytixlabs.co.in/blog/what-is-image-segmentation/>.
- [24] cse, "Image filter." [Online]. Available:
https://www.cse.usf.edu/~r1k/MachineVisionBook/MachineVision.files/MachineVision_Chapter4.pdf.
- [25] prateekjoshi, "Cmaera callibration." [Online]. Available:
<https://prateekvjoshi.com/2014/05/31/understanding-camera-calibration/>.
- [26] sites, "camera callibration." [Online]. Available:
https://sites.google.com/site/hyowoncv/ha_iccv15.
- [27] Matlab, "Camera callibration." [Online]. Available:
<https://www.mathworks.com/help/vision/ug/camera-calibration.html>.
- [28] stvision, "Autofocussing algorithm." [Online]. Available:
<https://www.1stvision.com/machine-vision-solutions/tag/autofocus>.
- [29] G. Fu, "A fast auto-focusing method of microscopic imaging based on an improved MCS algorithm." [Online]. Available:
https://www.researchgate.net/publication/280172987_A_fast_auto-focusing_method_of_microscopic_imaging_based_on_an_improved_MCS_algorithm.
- [30] J. m. mateos-perez, "Comparative evaluation of autofocus algorithms for a real-time system for automatic detection of Mycobacterium tuberculosis." [Online]. Available:
<https://onlinelibrary.wiley.com/doi/full/10.1002/cyto.a.22020>.
- [31] E. Hect, "OPTICS 5e."
- [32] t. fourier, "fourier transform." [Online]. Available:
<https://www.thefouriertransform.com/>.
- [33] Matlab, "fourier transform." [Online]. Available:
<https://www.mathworks.com/help/matlab/math/fourier-transforms.html#:~:text=The%20fft%20function%20in%20MATLAB,a%20period%20of%2010%20seconds>.
-

評量方式

1. 本校尚無訂定 A+ 比例上限。
2. 本校採用等第制評定成績，學生成績評量辦法中的百分制分數區間與單科成績對照表僅供參考，授課教師可依等第定義調整分數區間。詳見 [學習評量專區](#)。

針對學生困難提供學生調整方式

調整方式	說明
A2	以錄影輔助 Assisted by video
D1	由師生雙方議定 Negotiated by both teachers and students

補課資訊

課程進度

特別贊助 |  華南銀行
HUA NAN BANK

臺大課程網

[國立臺灣大學首頁](#) | [教務處首頁](#)

Copyright © 2025 國立臺灣大學教務處 版權所有 v3.2.8

[用戶協議](#) | [隱私權保護政策](#)