數位影像處理
(Digital Image Processing)

Prof. Chih-Hsien Hsia (夏至賢 教授)

Department of Computer Science and Information Engineering

National Ilan University

國立宜蘭大學 National Ilan University NIU

MIT Lab. Multimedia Intelligent Technical Laboratory

課程簡介
(Introduction to Course)

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About Me…

- Instructor:
  - ***Chih-Hsien Hsia* (夏至賢)** *Ph.D.*
    - ***Professor***, Department of Computer Science and Information Engineering, National Ilan University, Taiwan.
    - ***Chair***, Department of Computer Science and Information Engineering, National Ilan University, Taiwan.
    - ***Adjunct Professor***, Department of Electrical Engineering, National Taiwan University of Science and Technology, Taiwan.
    - ***Honorary Distinguished Professor***, Chaoyang University of Technology, Taiwan.
    - ***Chair***, IEEE Taipei Section Young Professionals Group.
    - ***Director***, IET Taipei Local Network.
    - ***Director***, Taiwan Consumer Electronics Society.
    - ***Executive Director***, Taiwan Society of Artificial Intelligence and Blockchain Association.
    - ***Deputy Secretary***, Computer Science ROC.

About Me…

- ***Consultant***, AI Big Data Intelligence Application Promotion Association, Information Service Industry Association.
- ***Youth Affairs of Expert Committee***, Department of Labour, Yilan County Government.
- ***Associate Editor***, Journal of Imaging Science and Technology (SCI)
- ***Associate Editor***, Journal of Computers (EI).

- Information:
  - https://sites.google.com/view/samhsia
  - Office: 格320
    - Lab.: 教414 (Multimedia & Technical Laboratory, MIT Lab.)
    - Email: chhsia625@gmail.com.
- Research Interests:
  - DSP IC design, Image Processing, Computer Vision, and Cognitive Learning

About TA…

- Teaching Assistant :
  - ***Hung-Tse Chan*** (詹宏澤) *M.S. student*.
    - Master Student, Department of Electronics and Computer Engineering, National Taiwan University of Science and Technology, Taiwan.
    - Research interests: Image Processing, Computer Vision , and Deep Learning.
    - Email: m11002113@gapps.ntust.edu.tw

Goal

- You Can Get the Ability to Walk
  - Information Literacy
  - Problem Base Leaning (PBL)
  - Multidisciplinary
  - Teamwork

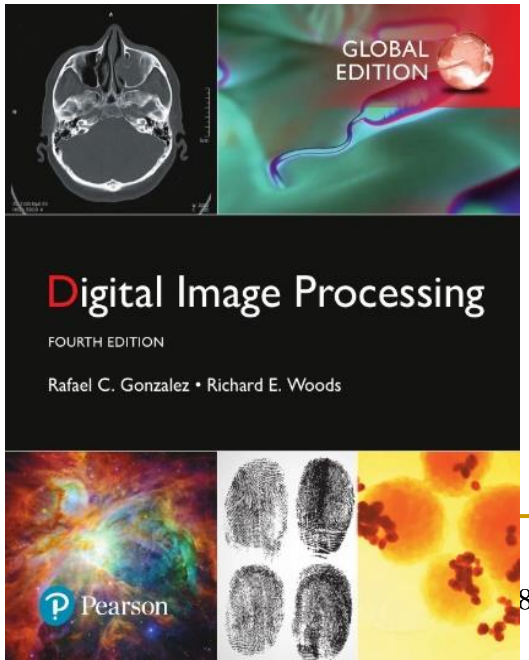
Outline

課程特色:
1、PBL學習
2、期末論文發表

週次	日期	內容	備註
1	9/5	課程介紹	
2	9/12	影像處理概論、體驗影像處理	
3	9/19	OpenCV安裝與範例	
4	9/26	校內會議調課乙次	補課至10/3下午
5	10/3	影像中物體的分割、影像輪廓的擷取	實驗1、實驗2
6	10/10	國慶日停課乙次	
7	10/17	去除雜訊干擾	實驗3
8	10/24	影像強化處理	實驗4
9	10/31	IEET認證評鑑調課乙次	補課至11/7下午
10	11/7	學期專題提案報告	
11	11/14	影像特徵的研究	實驗5
12	11/21	影像色彩的轉換與分析	實驗6
13	11/28	利用色彩分割影像	實驗7
14	12/5	影像形狀的轉換	實驗8
15	12/12	影像距離研究、影像接合拼貼	實驗9
16	12/19	學期專題作品發表	期末考週

Textbook

- 吳上立、林明德 編譯，C語言數位影像處理，2011年4月. (全華圖書)
- 張元翔 編著, 數位影像處理Python程式實作(第二版), 2020年7月. (全華圖書)
  - Rafael C. Gonzales and Richard E. Woods, Digital Image Processing, 4nd Ed., Prentice Hall, Inc., 2019年8月. (高立圖書)



Grading

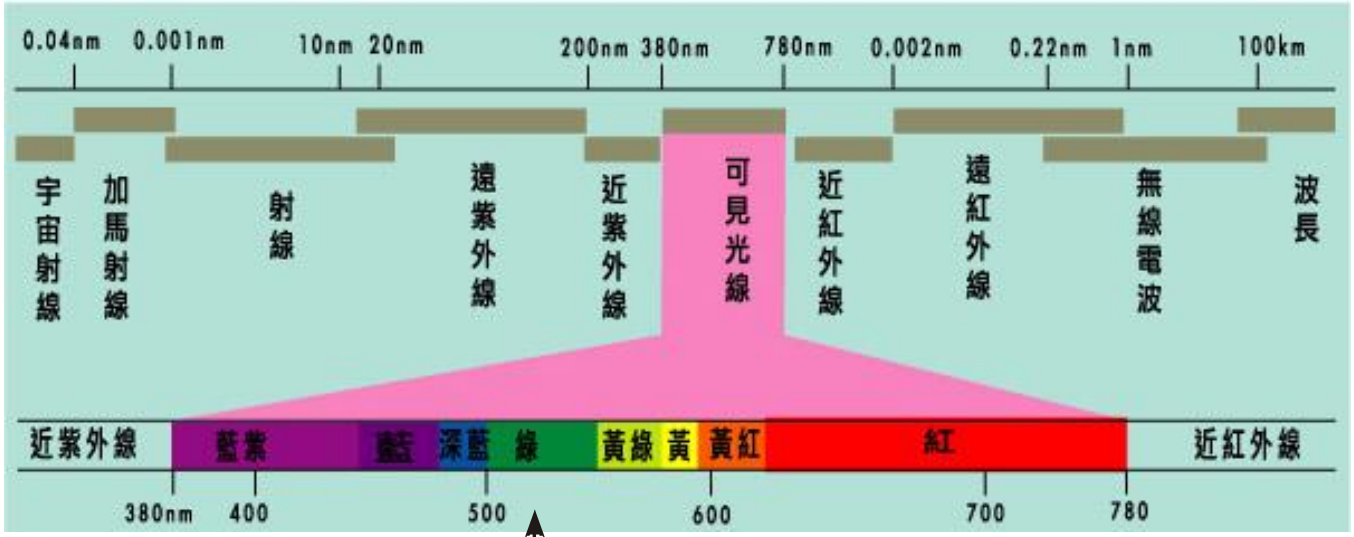
- In Class
  - Mid-term Exam: 20%
    - Oral presentation in proposal
  - Final-term Exam: 30%
    - Include as Oral, Report, Source code, and Demo
  - Lab. & Report: 50%
    - 9 times

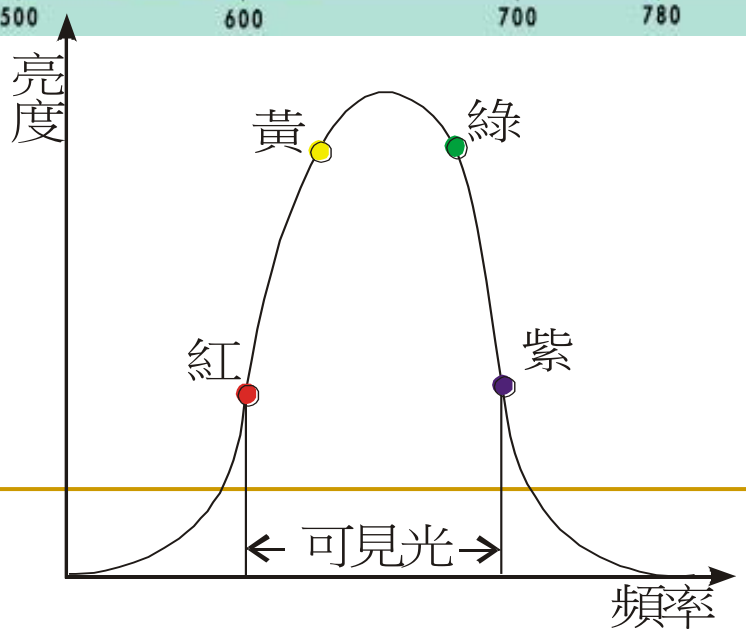
Motivation

- Product Distribution

Course

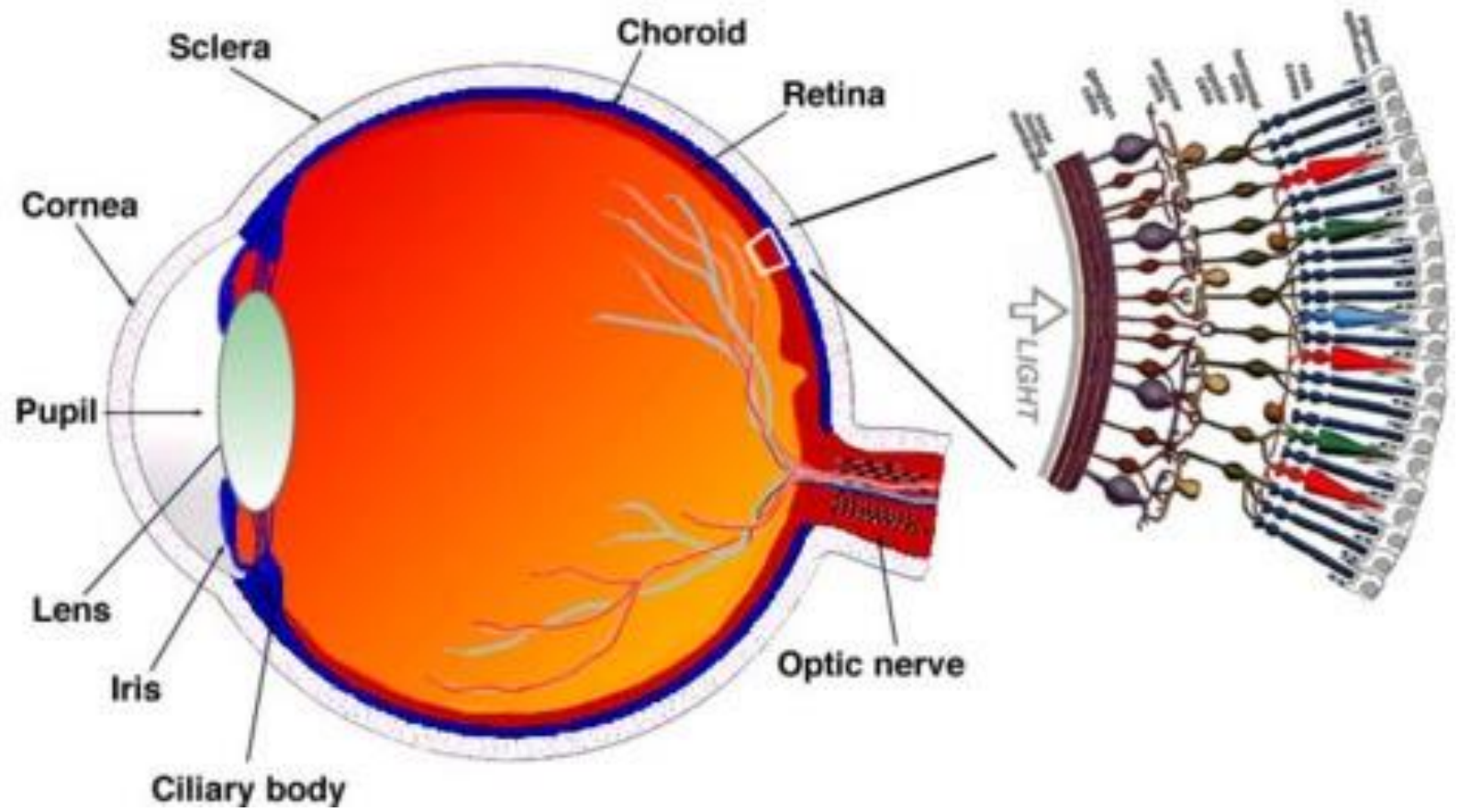
- Human/Computer Vision





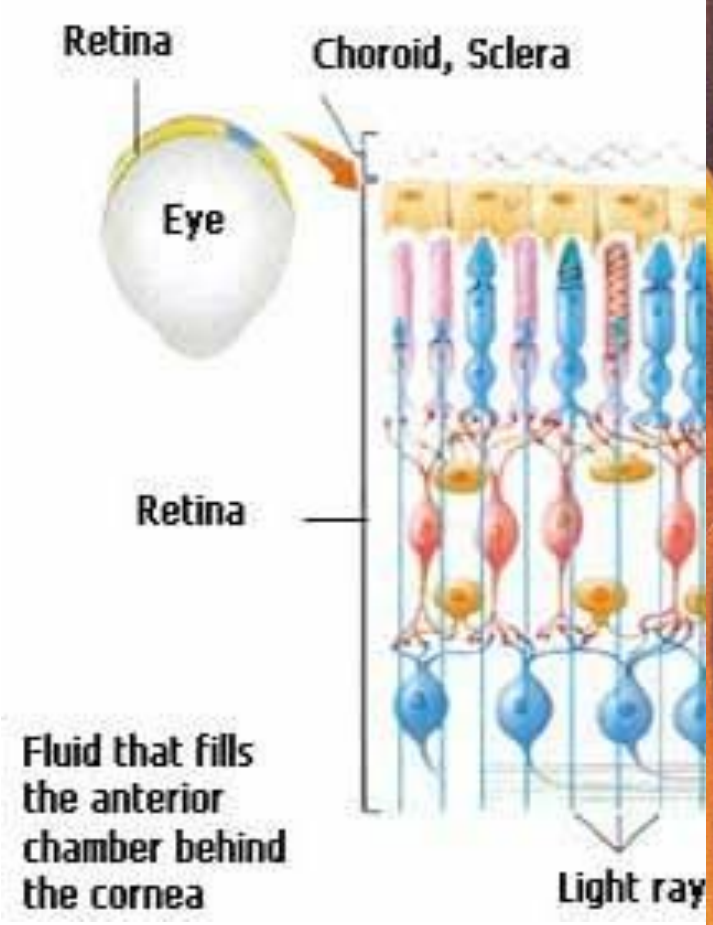
Course

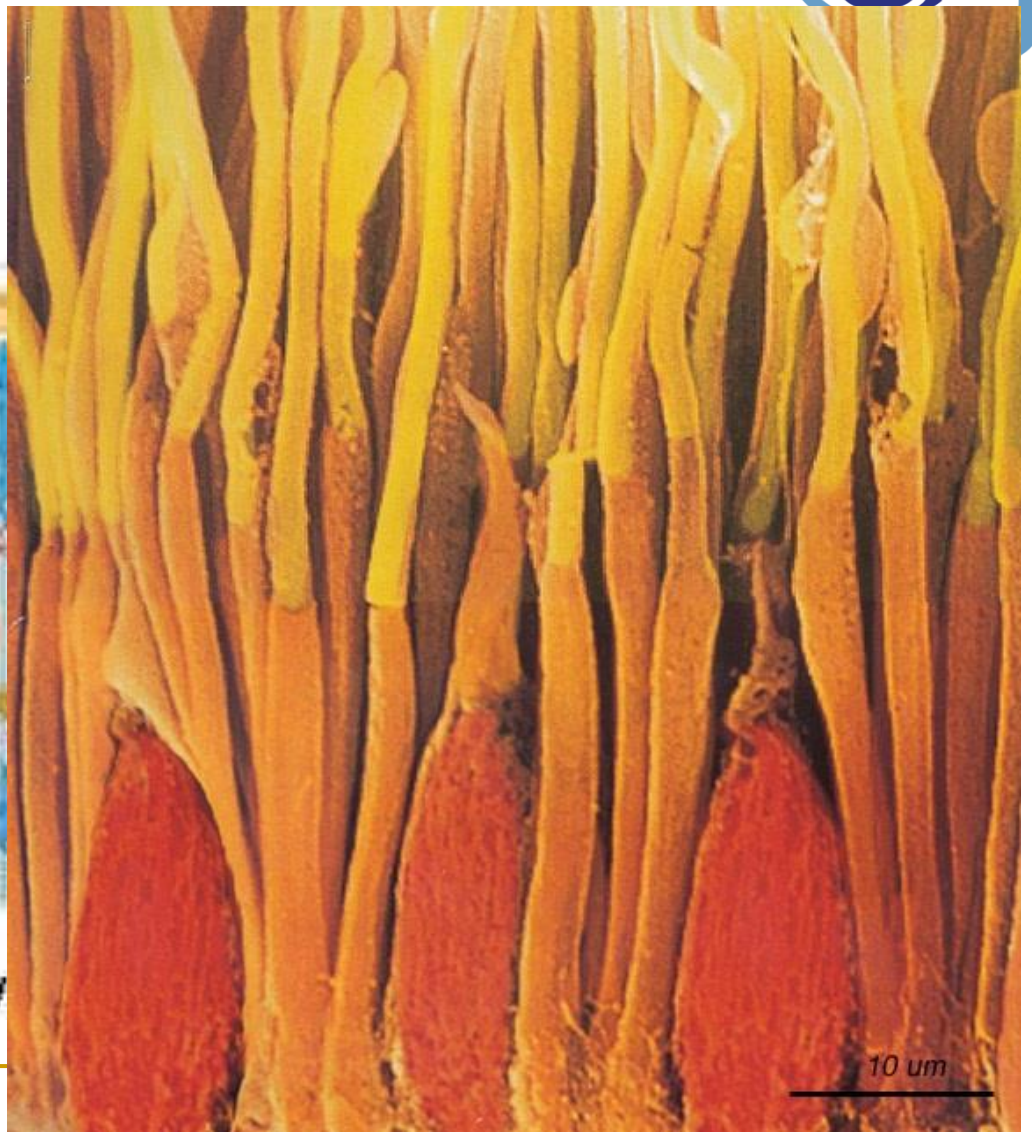
- Human Eyes



Course

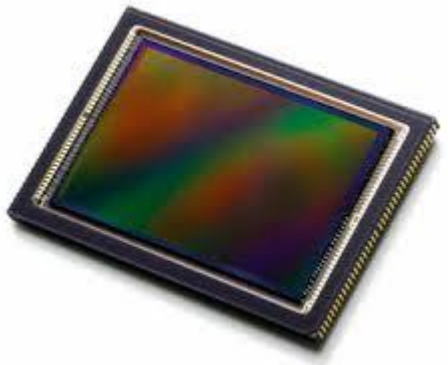
- Rod Cell and Cone Cell

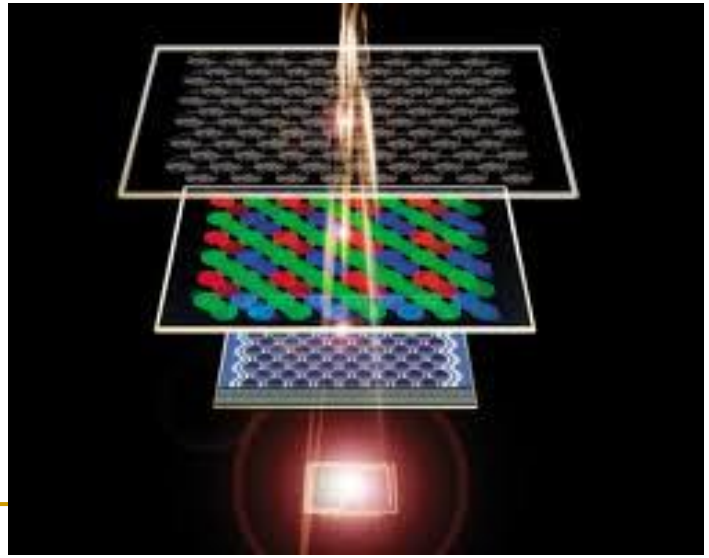




Course

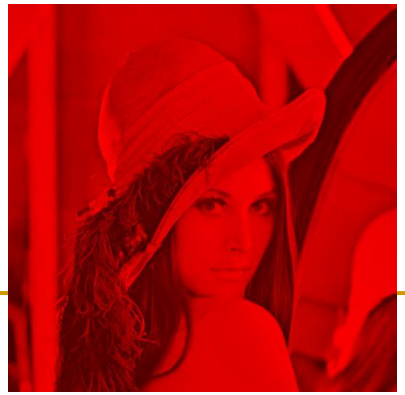
- Camera like a Human Eyes

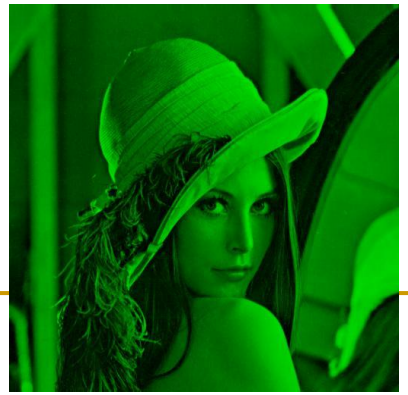




Course

- Color Image or RGB Image (1 pixel = 24 bits = 3 byte)





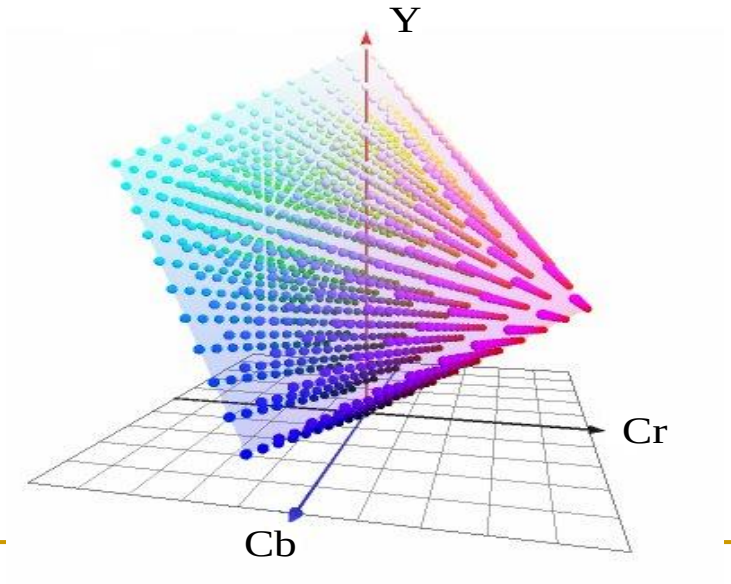
Course

- Gray Image (1 pixel = 8 bits = 1 byte)

$$\begin{bmatrix} Y \\ Cb \\ Cr \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.144 \\ -0.159 & -0.332 & 0.050 \\ 0.500 & -0.419 & -0.081 \end{bmatrix} x \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

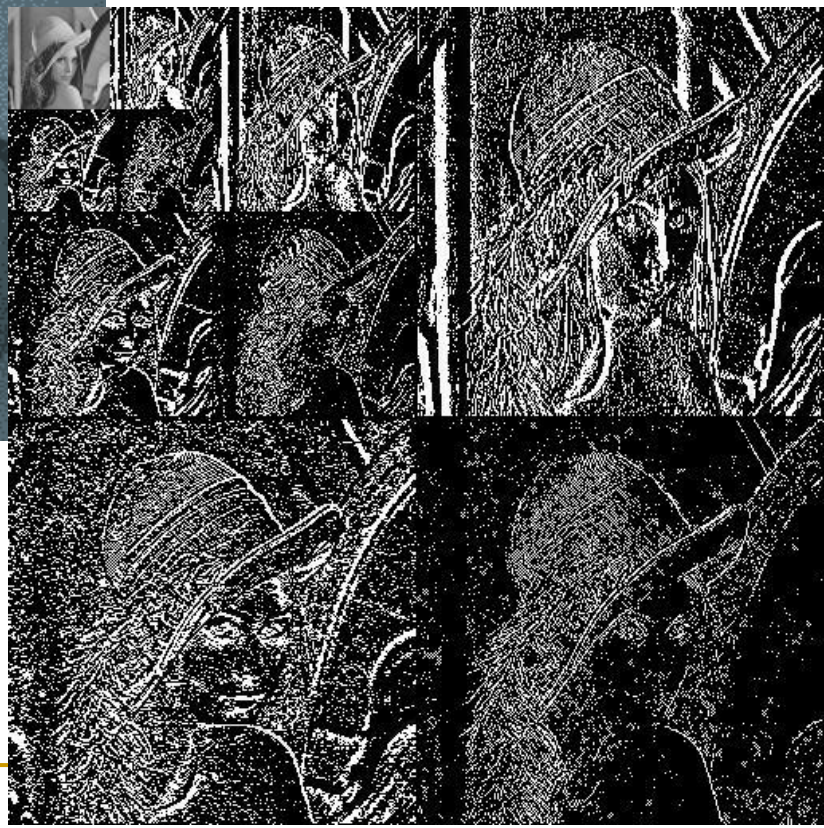
Course

- Image Processing for Human Eyes



Course

- Image Processing for Image/Video Communications



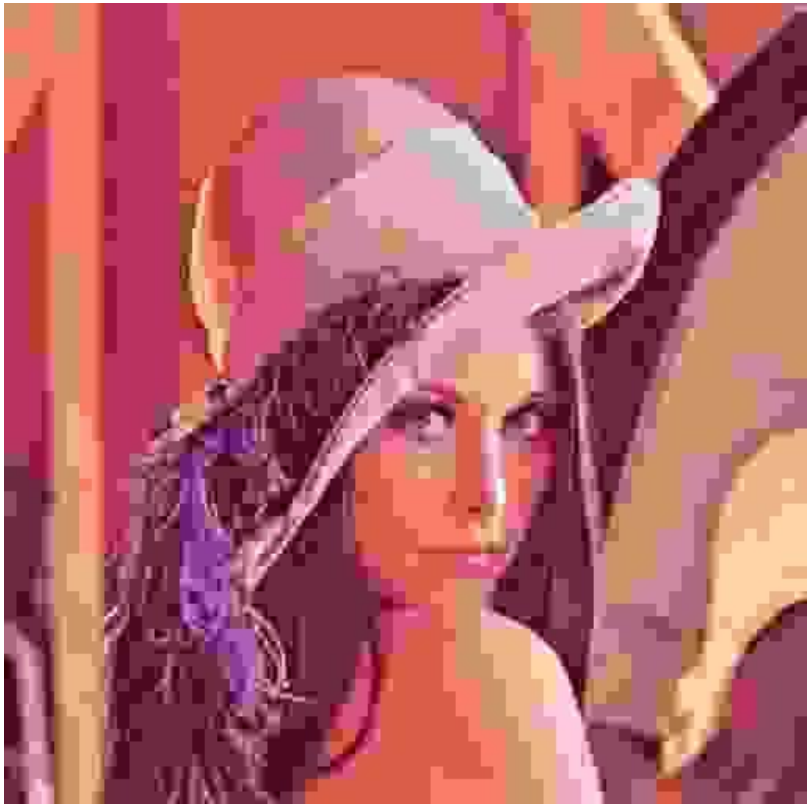
Course

- Image Processing for Image/Video Compression

  - 1920 × 1080 × 3 × 8 × 30 = 1492992000 bits/sec.

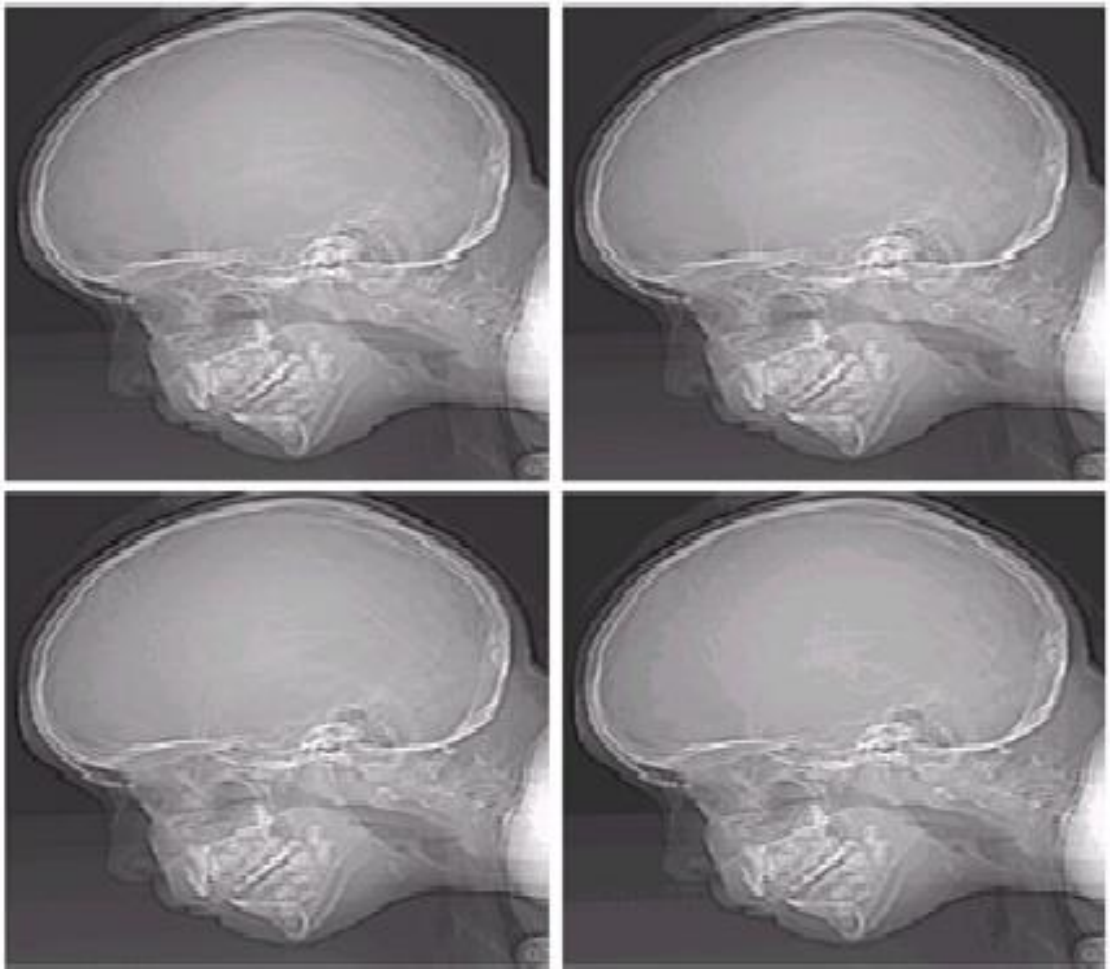
Course

- JPEG v.s. JPEG2000 (C.R. = 187:1)



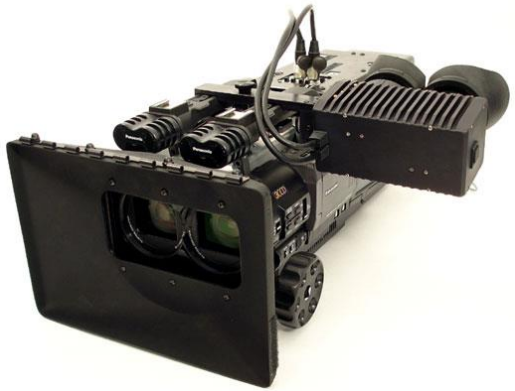
Course

- Medical system



Course

- 3-D Image Processing For Human Eyes Communications
  - Stereo camera for eyes

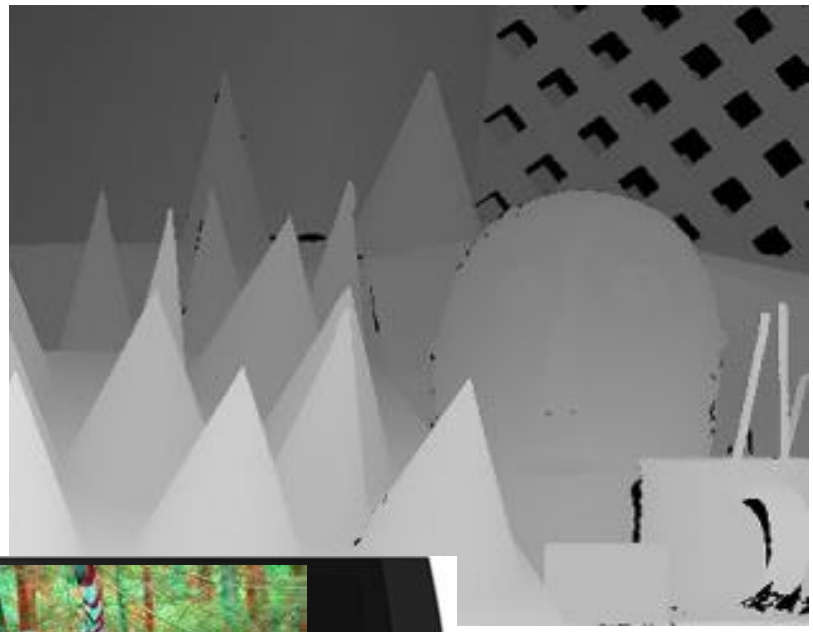


Course

- Kinect sensor for body

Course

- Time of flight (2-D to 3-D) method

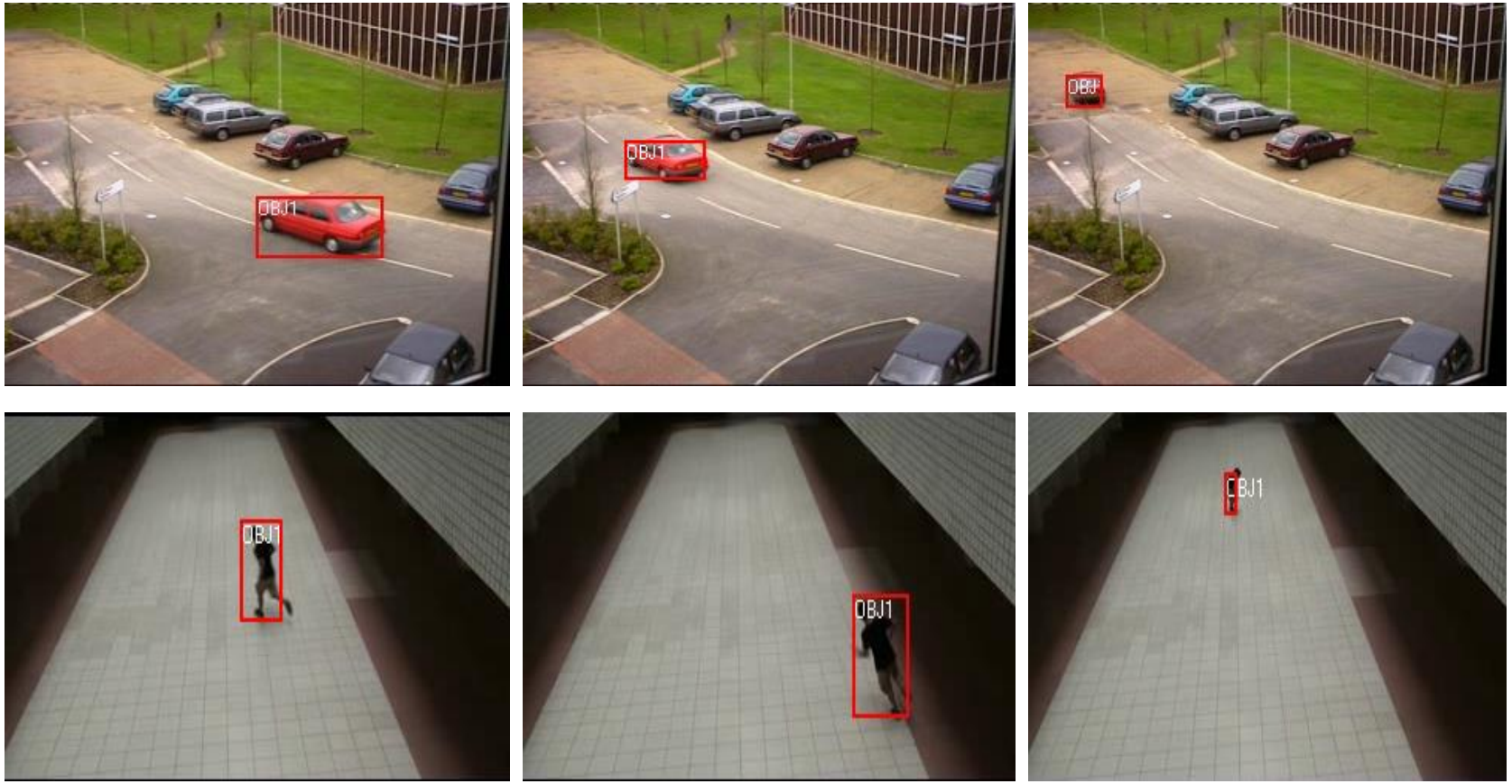


Course

- Optical Device for Human Eyes

Course

- Computer Vision for Objet Detection



Course

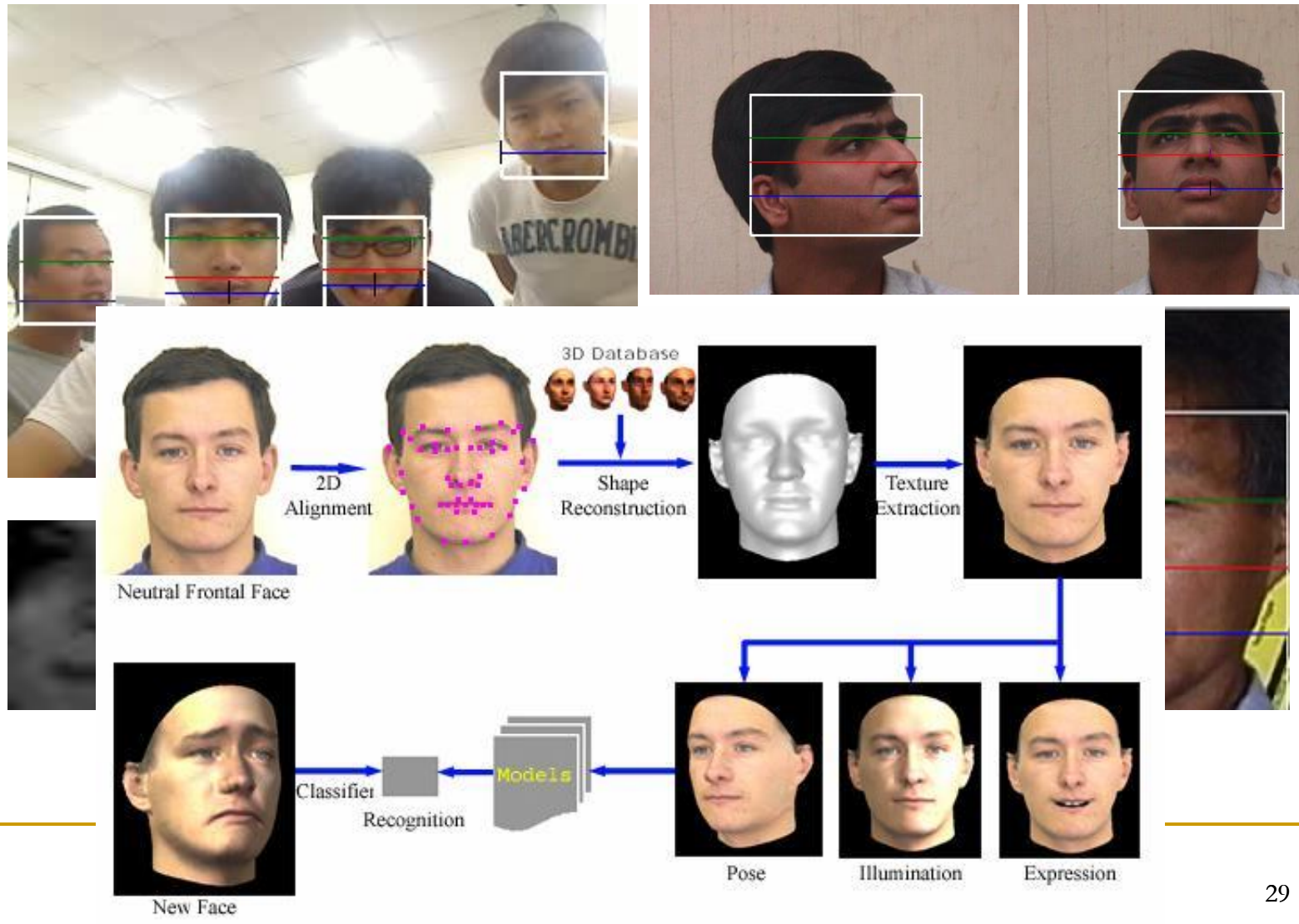
- Computer Vision for Biometric Information
  - Finger vein recognition

Course

- Hard palm recognition

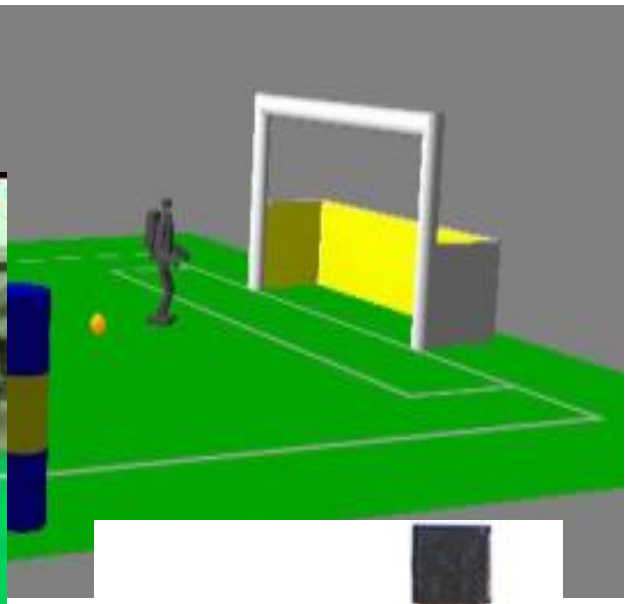
Course

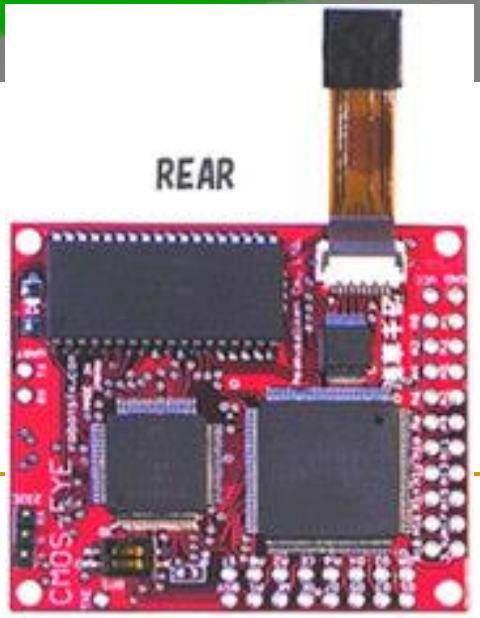
- Face recognition



Course

- Humanoid Robot of RoboCup






Thank You for Your Attention !!