

Introduction of Medical Imaging Processing and Analysis

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<http://www.csie.ntu.edu.tw/~rfchang/>

開授課程

醫學影像處理 (140.112)

醫學影像處理成績

多媒體資訊系統 (140.112)

多媒體資訊系統成績

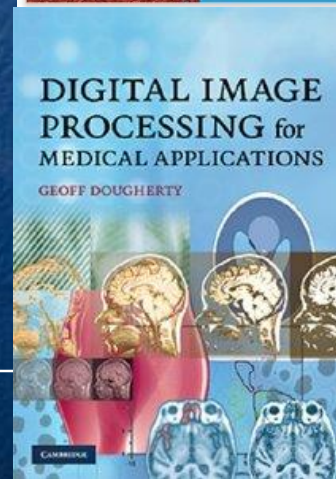
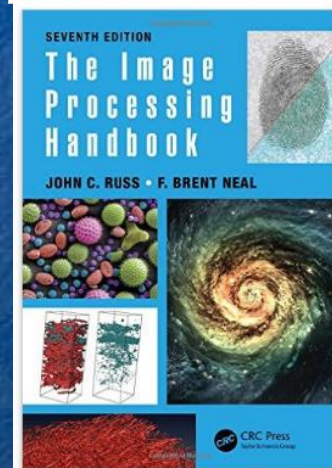
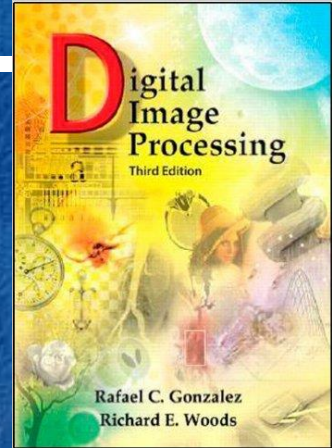
多媒體製作 (140.112)

多媒體製作成績

AIT (140.112)

- 一週涵蓋研究領域入門
 - MeVisLab
 - Fundamentals of digital image processing
 - Image enhancement in the spatial domain
- 一週深入教師研究專長
 - Computer-aided diagnosis and detection

- Digital Image Processing 3rd Edition, 2007
- The Image Processing Handbook, 7th Edition, 2015
 - <http://www.crcnetbase.com/doi/book/10.1201/b18983>
- Digital Image Processing for Medical Applications, 2009



Ebook

- ❑ [CRCnetBASE](#)
- ❑ [Springer](#)
- ❑ [Wiley Online Books](#)
- ❑ <http://books.google.com>

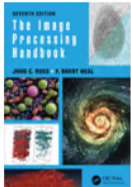
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The Image Processing Handbook, Seventh Edition

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AbstractDownload PDF (0.82 MB)

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AbstractDownload PDF (3.51 MB)

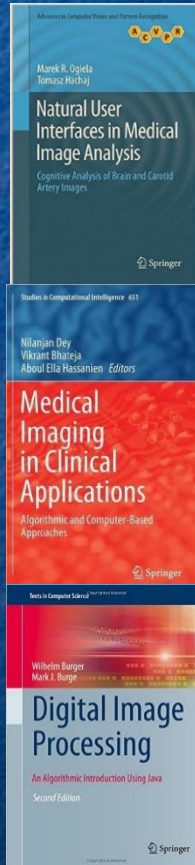
☐ ☒ 47 Chapter 2. Printing and Storage

Permalink



□ Reference textbooks (Springer Press)

- <http://link.springer.com/search?facet-content-type=%22Book%22&showAll=false>
- Learning Ultrasound Imaging, 2012
- Digital Signal Processing for Medical Imaging Using Matlab, 2013
- Computational Intelligence in Biomedical Imaging, 2014
- Natural User Interfaces in Medical Image Analysis: Cognitive Analysis of Brain and Carotid Artery Images, 2015
- Medical Imaging in Clinical Applications: Algorithmic and Computer-Based Approaches, 2016
- Digital Image Processing: An Algorithmic Introduction Using Java, 2016



作業一 熟悉醫學影像處理

□ <http://cad.csie.ntu.edu.tw/rfchang2/lab/ait.htm>

□ 作業說明

- 請下載課程所提供的MeVisLab軟體並安裝
(http://www.csie.ntu.edu.tw/~rfchang/MeVisLabSDK2.8.1_vc14-64.exe 1.11GB)
- 讀取MeVisLab中提供的影像檔Carotid1_MRA.small.dcm，並對其作處理，可試著使用MeVisLab中所提供的filter(像是smooth, resample, edge, ...)，並試著了解這些filter的功能，再將其結果顯示出來，如下圖所示

□ 報告需要說明所採用filter的功能，並比較處理前後的差異，以及在此作業中的心得



□ 繳交方式

- 請將MeVisLab檔(*.mlab)及心得報告壓縮並繳交至課程ftp中HW1目錄中, 檔案命名格式請壓縮成, 學號_
_HW1.rar

□ ftp://cad.csie.ntu.edu.tw/

- user: ait
- password: ait

□ 也可利用網頁直接上傳

□ http://cad.csie.ntu.edu.tw:7000/

- user: ait
- password: ait

Technology Development Program for Academic (TDPA, 學界科專)

- This TDPA project was supported by the Ministry of Economic Affairs (MOEA) to develop
 - a **CADe** system for **ABUS**
 - a **CADx** system for **B-mode US/elastography**
 - breast US **GPS/recoding** System
- The Co-PIs are **Dr. Chou** from **VGH**, **Dr. Huang**, and **Dr. Chang** from **NTUH**.
- **8 PhD students** worked on this project.

Technology Development Program for Academic (TDPA, 學界科專)

- Two patents have been applied.
 - Breast Ultrasound **Scanning** and **Diagnosis** Aid System
 - Ultrasound Imaging Breast Tumor **Detection** and Diagnostic System and Method
- 25 international journals and 12 international conference papers
 - **Three IEEE Trans. MI papers** have been published.
- The CAdE and CAdx systems have been transferred to TaiHao Medical Inc.
(<http://taihaomed.com/>)

CADx for TDPA



NTU CADx
Diagnosis

Patient

Select Patient

Date: 2011/11/22

ID: 12345678

Name:

Age: 50

Image

1-20 21-40 41-60

B D E EC AI

AQ

Auto Select Slice

Select Slice

Diagnose Tumor

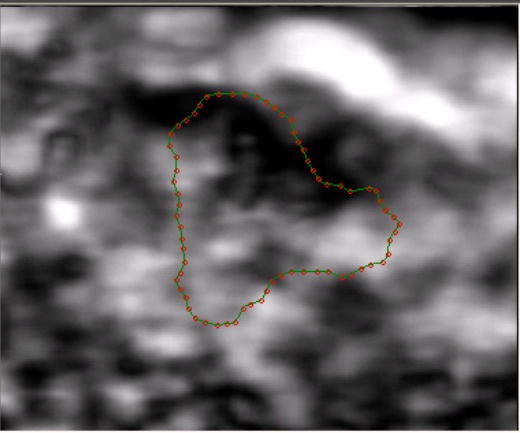
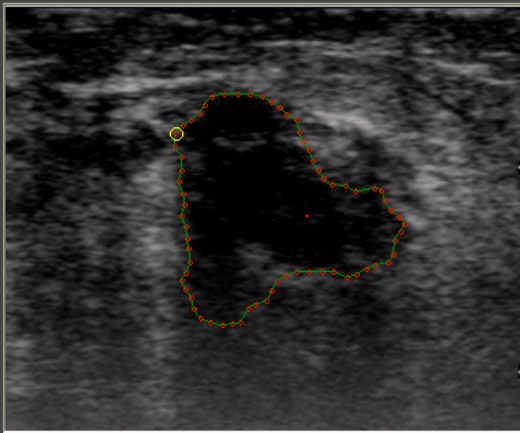
Segment Clear Seeds

Diagnose

Tumor

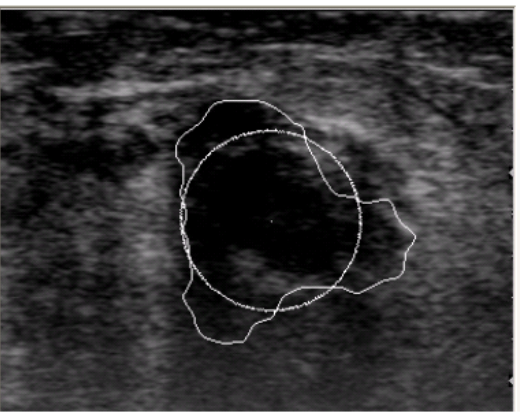
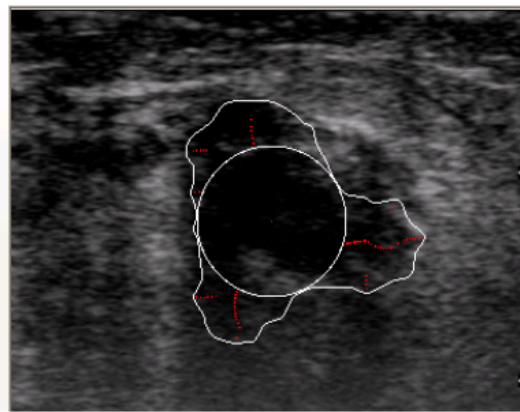
Location:

Size:



36

Shape Margin Echo Posterior



Shape

☒ Oval ☐ Round ☐ Irregular

Orientation

☒ Paralell ☐ Not parallel

Margin

☒ Circumscribed ☐ Not circumscribed

☐ Indistinct ☐ Angular

☐ Microlobulated ☐ Spiculated

Lesion Boundary

☒ Abrupt interface ☐ Echogenic halo

Echo Pattern

☐ Anechoic ☐ Hyperechoic

☐ Complex ☐ Hypoechoic

☐ Isoechoic

Posterior Acoustic Features

☐ No posterior acoustic features

☐ Enhancement ☐ Shadowing

☐ Combined pattern

Elasticity Score

☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5

BI-RADS

☐ 0 ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6

ABUS CADe



NTU
CAD
Dawson

Patient

Select Patient

DATE

ID

Name

Age

View

RAP RLA L MED LAP

LLAT LMED

Lesions Sorted by

☒ Slice ☐ Clock

☐ Size ☐ BI-RADS

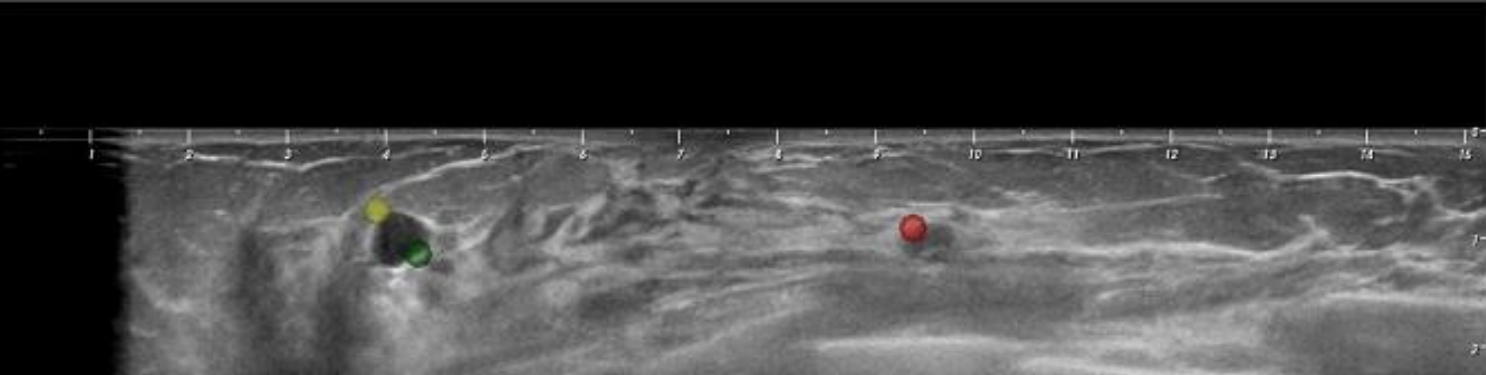
Lesion No.

☒ 1-10 ☐ 11-20 ☐ 21-30

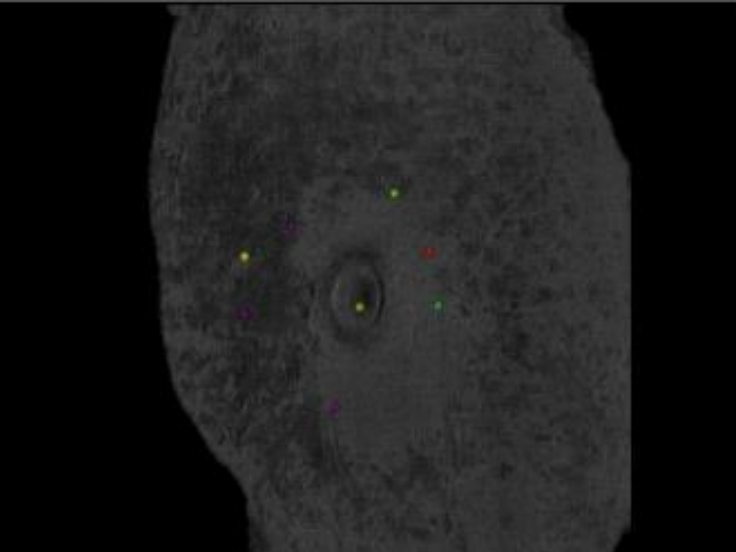
3	(414,145,207), 12/6
	(268,263,189), 12/8
6	(463,254,175), 12/1
2	(217,216,175), 12/10
4	(199,270,172), 12/1
1	(466,288,145), 12/9
	(197,182,140), 12/10
	(333,243,89), 12/2

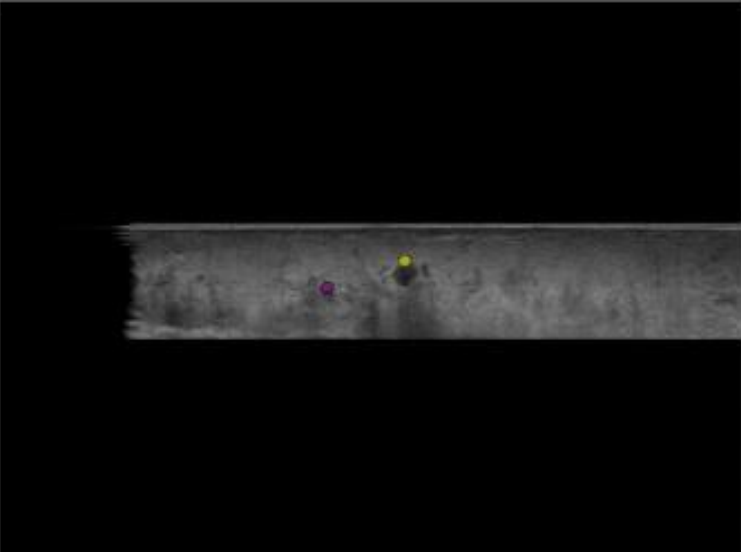
BI-RADS

W U 0 1 2 3 4 5 6



(40, 14, 93)

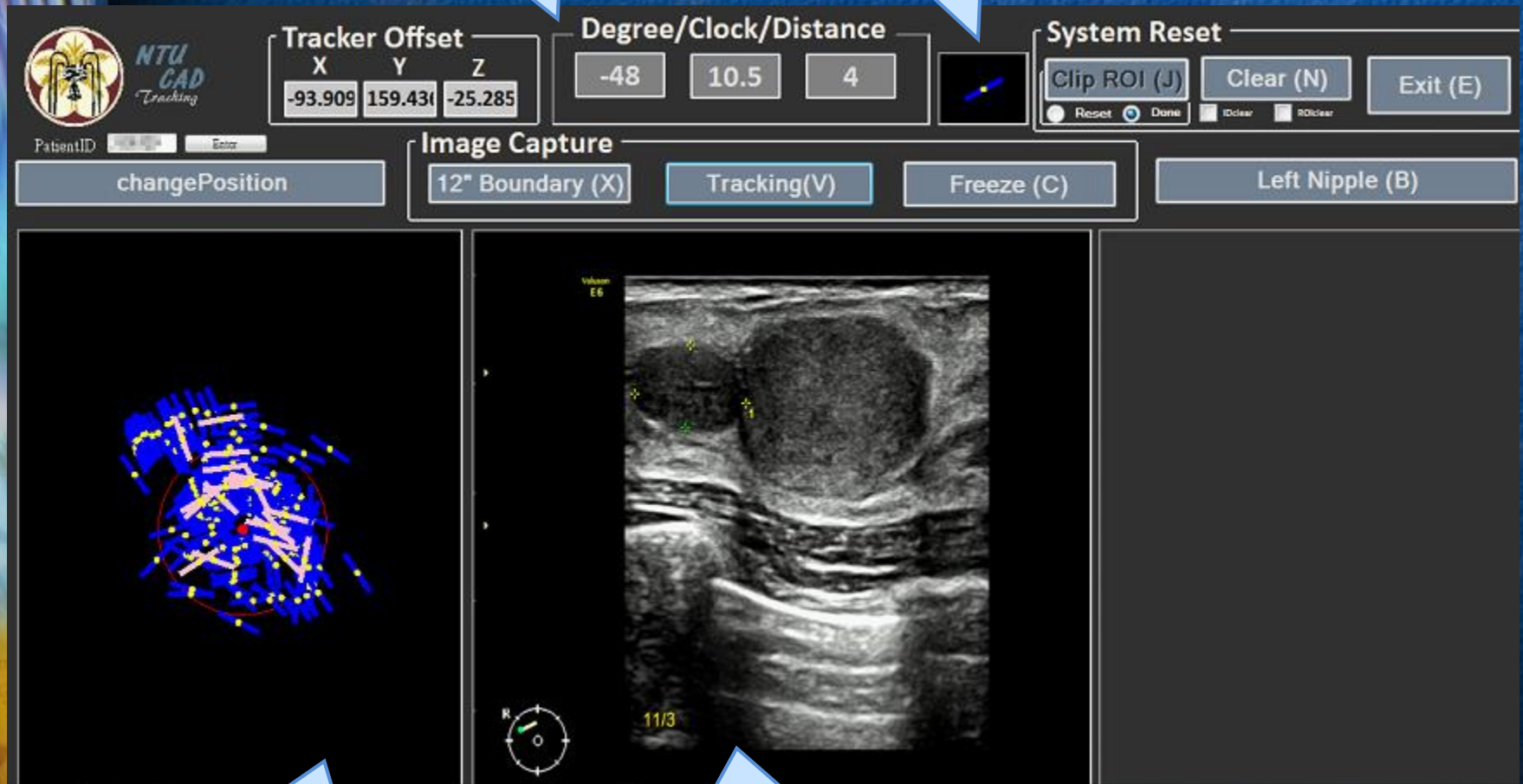




Breast US GPS/Recoding System

Tumor
location

Probe
direction



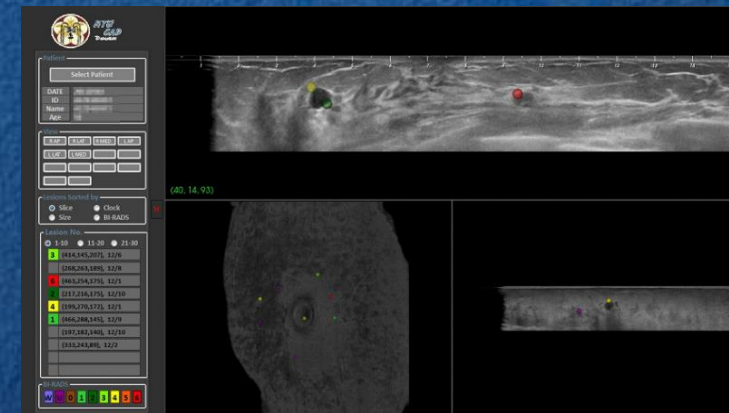
Tracking map

Captured US video

ABVS Viewer

□ Our ABVS view system has been transferred to TaiHao Medical Inc, Taiwan.

- BR-ABVS Viewer 1.0
- FDA cleared, 2016.01
- <http://taihaomed.com/>



Device Classification Name	System, Image Processing, Radiological
510(K) Number	K151075
Device Name	BR-ABVS Viewer 1.0
Applicant	TAIHAO MEDICAL INC. 7f., No.410, Sec.5m Zhongxiao E. Rd., Xinyi Dist. Taipei, TW

	DEPARTMENT OF HEALTH & HUMAN SERVICES	Public Health Service
	Food and Drug Administration 10903 New Hampshire Avenue Document Control Center - WO66-G609 Silver Spring, MD 20993-0002	
TaiHao Medical, Inc. % Chiu S. Lin, Ph.D. President LIN & ASSOCIATES, LLC 9223 Cambridge Manor Court POTOMAC MD 20854		January 15, 2016
Re: K151075 Trade/Device Name: BR-ABVS Viewer 1.0 Regulation Number: 21 CFR 892.2050 Regulation Name: Picture archiving and communications system Regulatory Class: II Product Code: LLZ Dated: December 15, 2015 Received: December 15, 2015		
Dear Dr. Lin:		

ABVS Viewer (2)

- Our ABVS view system is applied for a ABUS system from a Taiwan company.



- The probe is rotated to obtain a whole breast image in only one scanning.
 - Begin **clinical trials** in NTUH and other hospitals
-
- Cooperation with China company for **CFDA**

