E-Da Hospital

台灣產業的新契機–智慧醫療科技

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生物醫學工程學系
智慧醫療科技暨生物資訊碩士學程籌備主任

在地需求性

- **生醫領域專業知識、大數據演算或開發智慧醫療平台的專業人才**

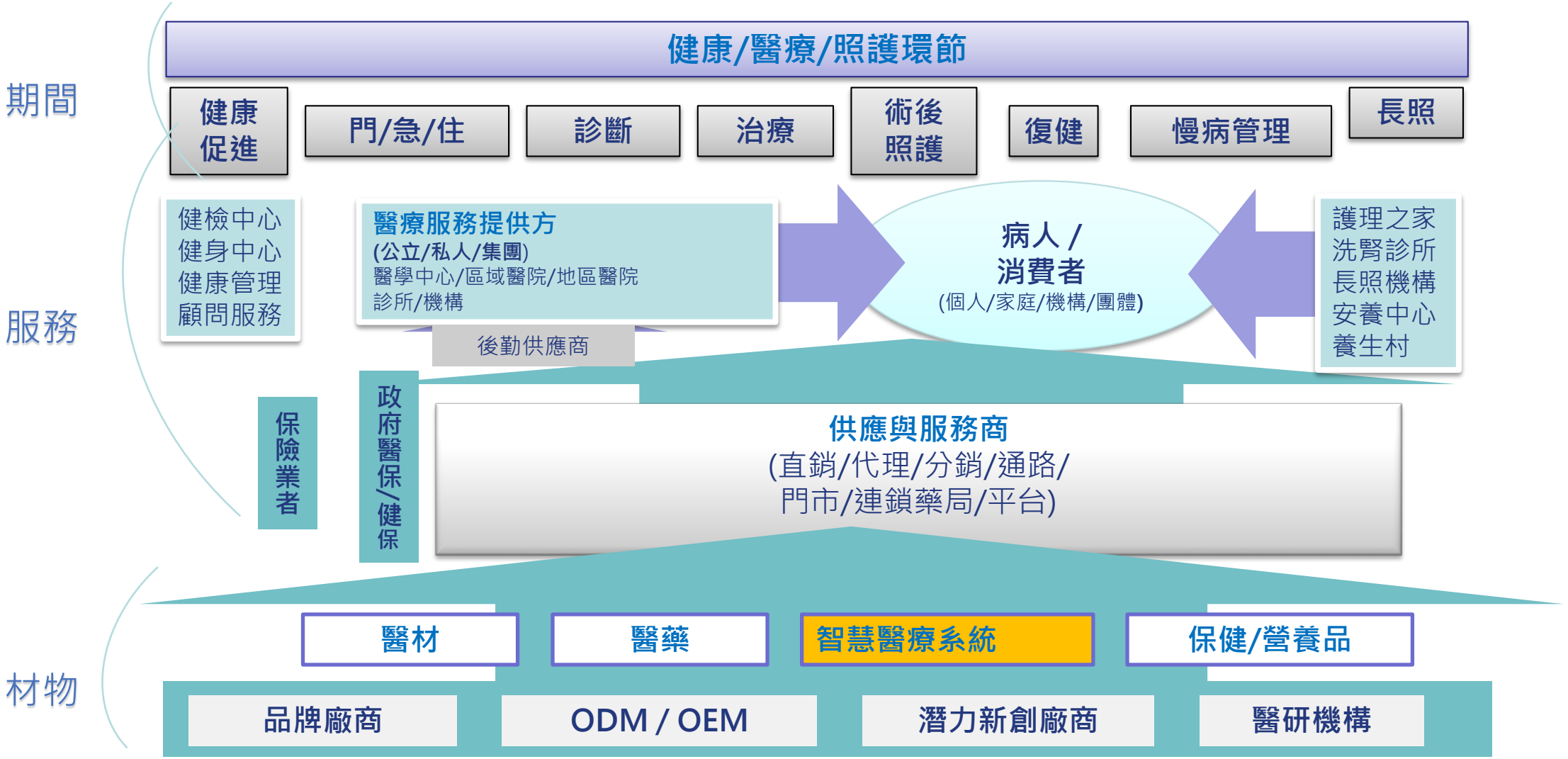
1. 醫療人力資源不足-人口老化、偏鄉資源不足、增加醫療安全維護需求增加
2. 臨床數據龐大-健康保健數據、體學發展快速(基因體、蛋白體、代謝體等)、精準醫療
3. 相關工作機會大幅提高-全球大數據演算及智慧醫療產業市值迅速增加
4. 國家政策以及WHO推廣

背景	1. 我國醫療器材 實施後，**醫** 2. **發展生醫產**
現況	1. 2014年我國生 2. 依據2015年生 億元，維持成 3. 在從業人數方 2,189人。
挑戰	1. 根據經濟部 職類出現人才 2. **研發(高階)**、

圖 2-9　2008~2017 年我國生技產業經營現況統計

資料來源：生技產業白皮書，經濟部生技醫藥產業發展推動小組整理，2018 年。

智慧科技在醫療策略夥伴生態圈經濟扮演關鍵角色



國內各大電子資訊廠商 積極跨入智慧醫療科技

切入IT+Medical 跨領域整合機會

生策會科技類理事當選名單(佔1/3)

姓名	單位
林百里	廣達電腦
林憲銘	緯創資通
童子賢	和碩聯合
洪水樹	可成科技
吳克襄	康聯生醫
郭智輝	崇越科技、安永生技
陳其宏	佳世達
黃崇仁	力晶科技
葉博仁	瑞昱半導體
劉克振	研華
簡立峰	美商科高（Google）

資料來源：生策會　　製表：杜蕙蓉

可成

"...悅康是可成在智慧醫療的第一支箭..."

仁寶

"...最近一年見的醫生比過去一輩子都多...Apple Watch 4

佳世達

"...佳世達陸續投資、併購臺灣醫療產業的隱形冠軍，組成醫療解決方案...."

廣達

"...要做「醫療AI」而不是「AI醫療」!...
....醫療AI 幫醫生診斷，成為醫生工具，幫醫生更聰明..."

華碩

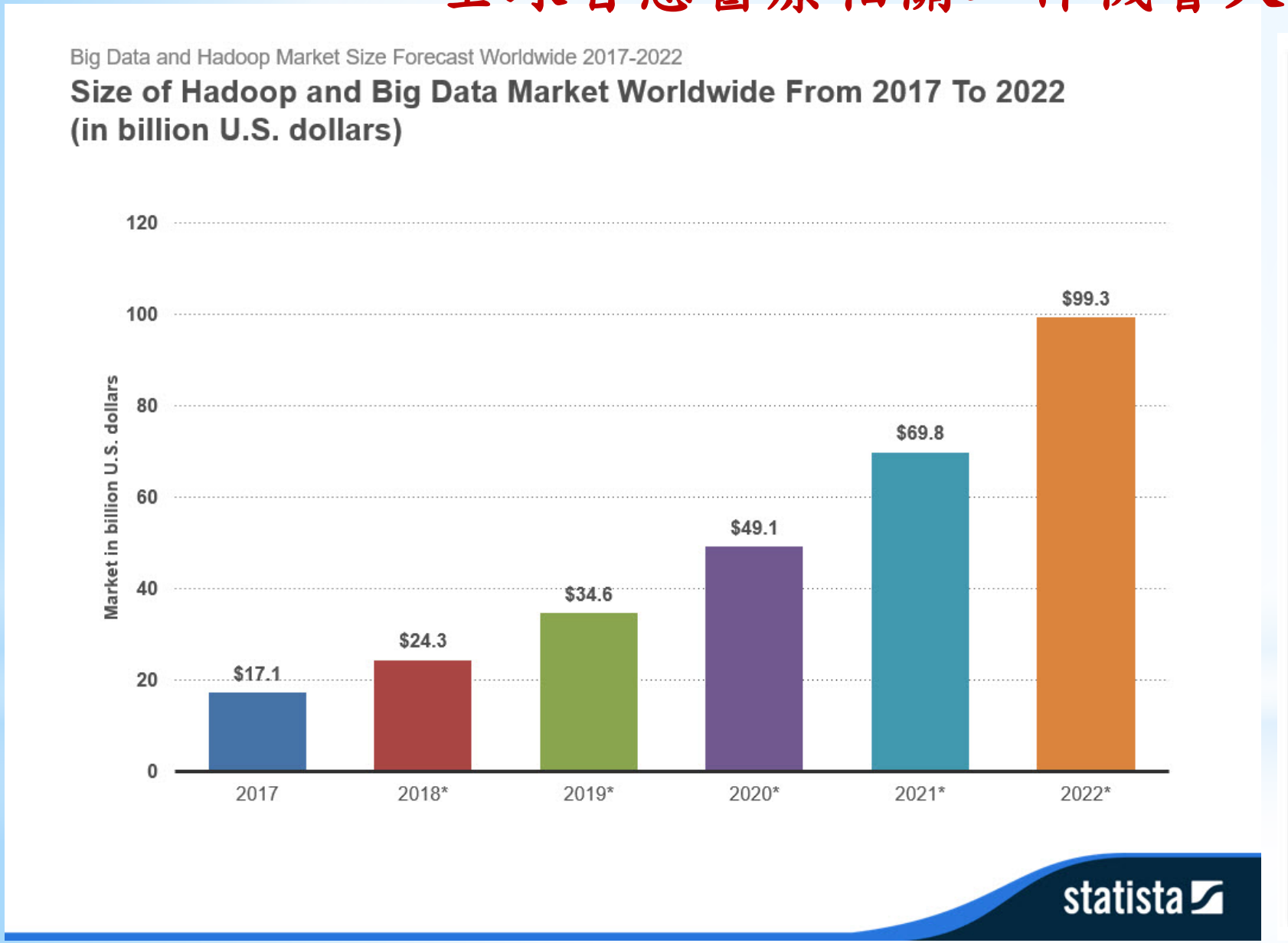
"...為增加新創醫材產業與醫院的合作機會，「Omnicare智慧醫材共享平台」，..."

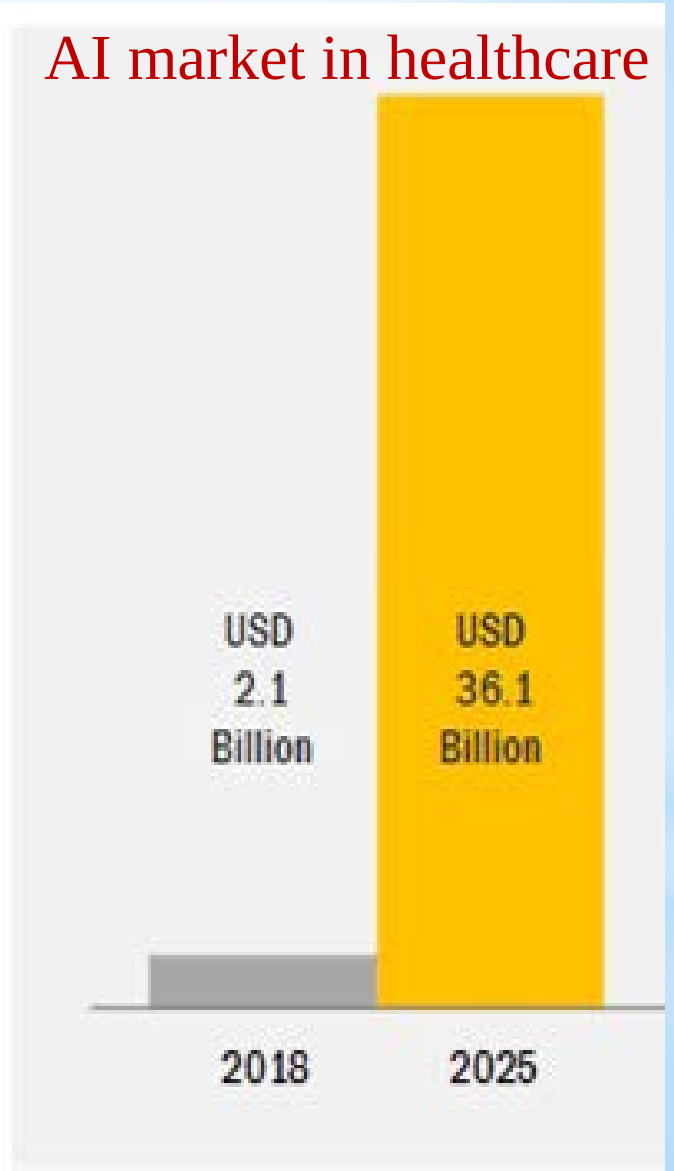
研華

"...臺灣在智慧工廠、智慧醫院與智慧零售三大垂直領域有大好機會..."

資料來源:工商時報2019/11/14新聞

全球智慧醫療相關工作機會大幅提高





MarketsandMarkets Research Private Ltd

世界趨勢

台灣精品 TAIWAN EXCELLENCE 創新臺灣 精彩世界

行動裝置與穿戴式裝置延伸醫院範圍並改變醫病互動

病歷與健康資料雲端化

海量資料協助提供個人化醫療

利用網路與社群改變醫療照護的模式

物聯網 → 增加效率
感測技術

大數據 → 減少人為錯誤
增加決策正確性

人工智慧 → 降低營運成本

行動平台 → 提升醫療品質
連接醫院與家庭

*了解需求

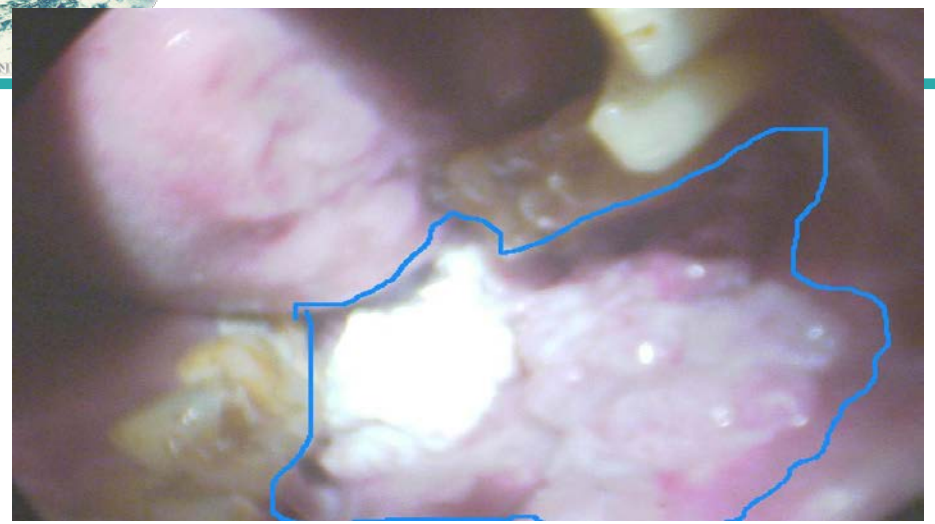
醫療診斷輔助範例

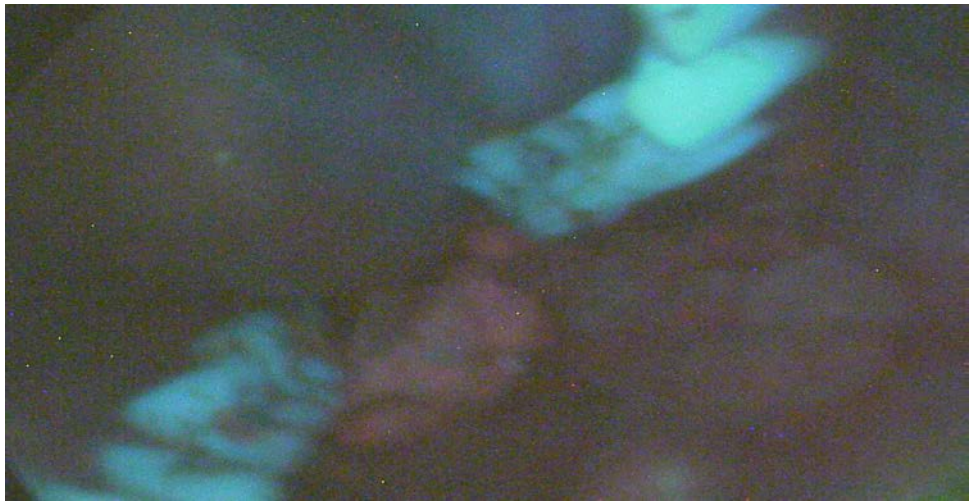
個人研究介紹

研究方向

1. 螢光影像診斷口腔病變輔助系統
2. 放射治療(2D)影像對位系統
3. 腦影像(3D)對位系統 + applications
4. 放射治療模擬系統 +VR cognition
5. **肌電訊號分析**
6. **幹細胞影像追蹤與分析**
7. **以環境感測建置個人行為的Biomatrics**

1. 螢光影像診斷口腔病變輔助系統



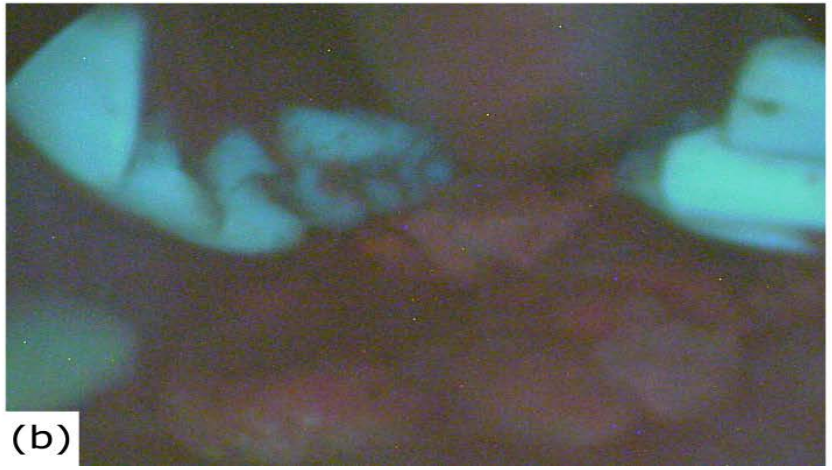


醫師所勾勒的病變區域

螢光檢測反應的區域

原始螢光影像


(a)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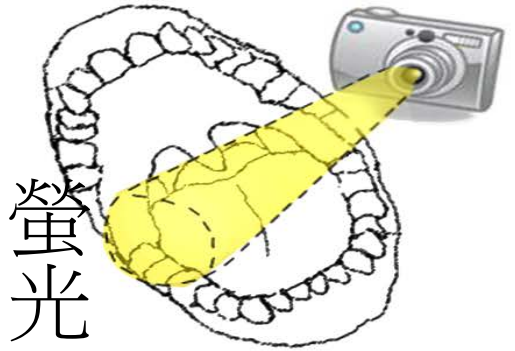
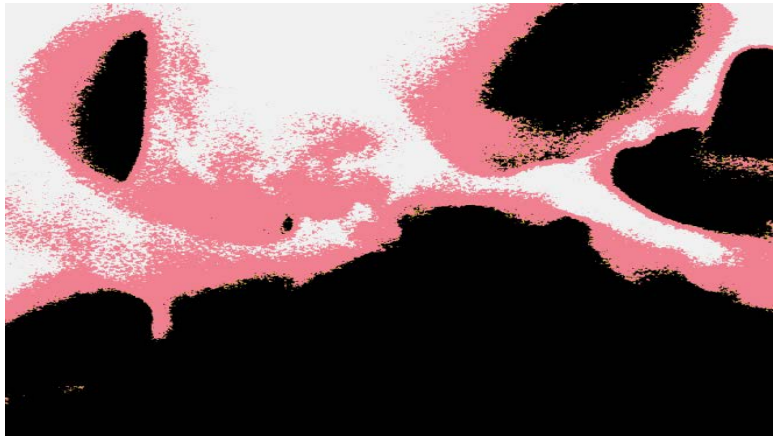
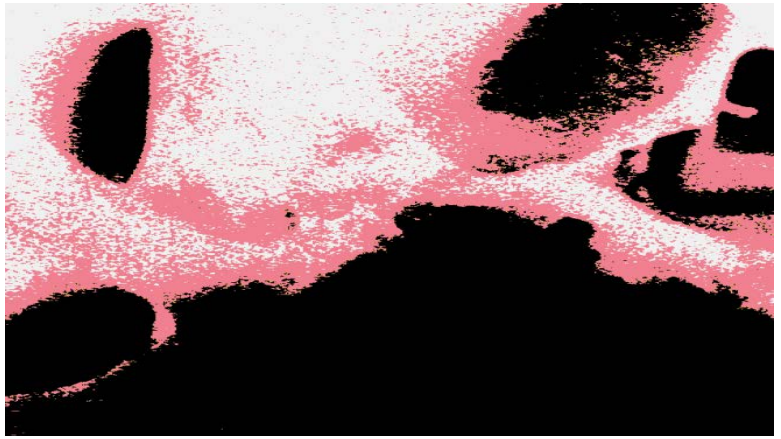
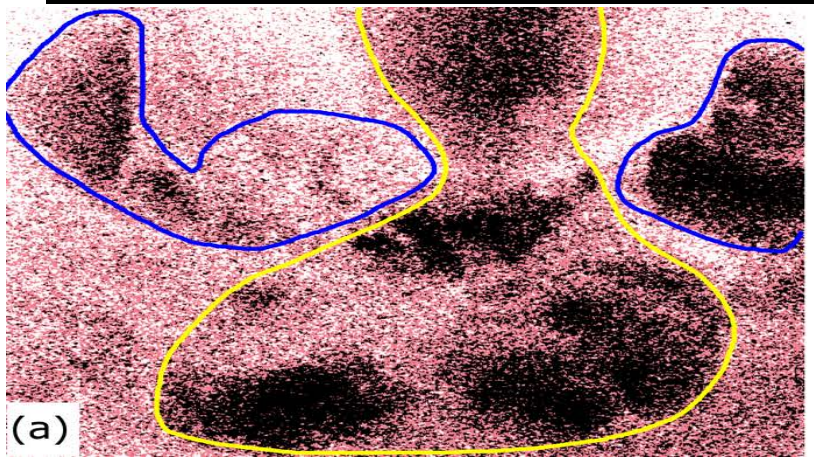
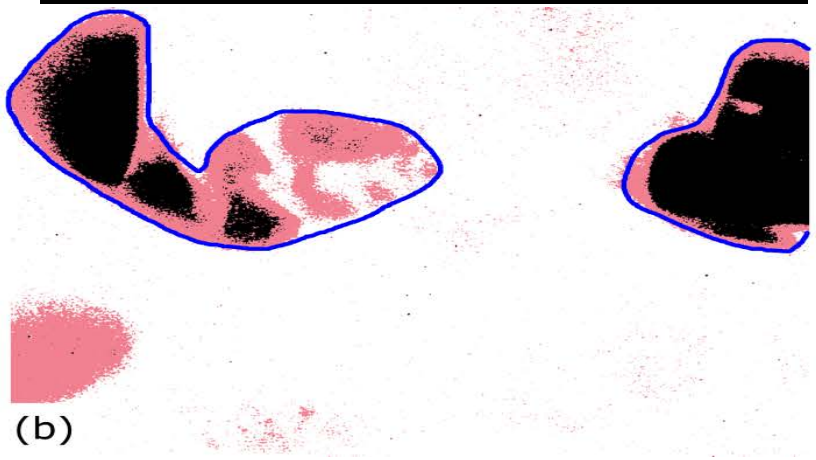


(c)






(a)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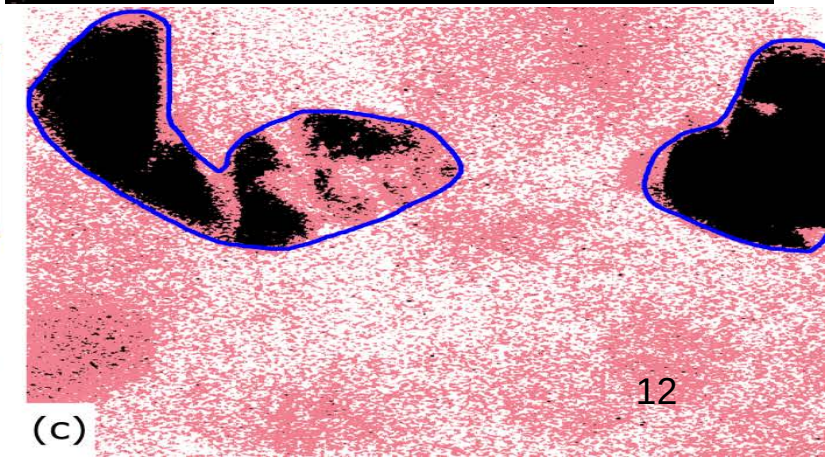
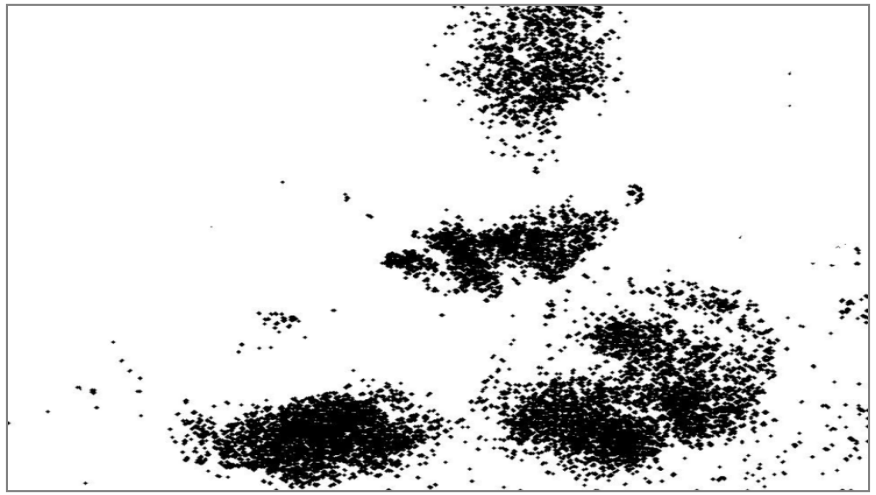

(c)

point-to- point based registration



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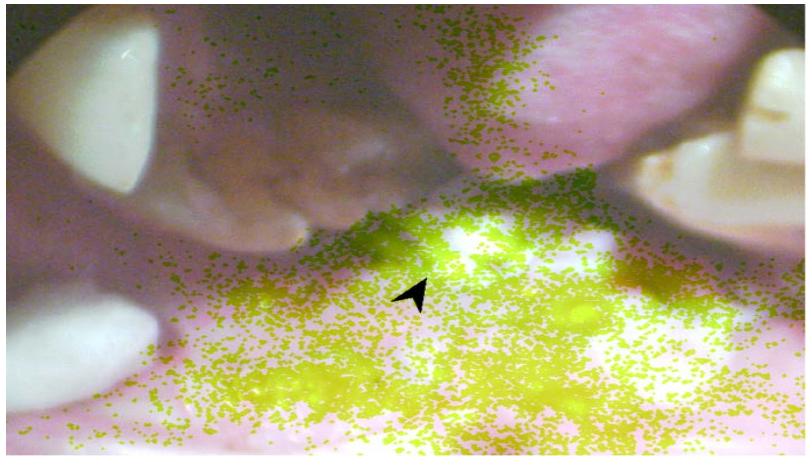
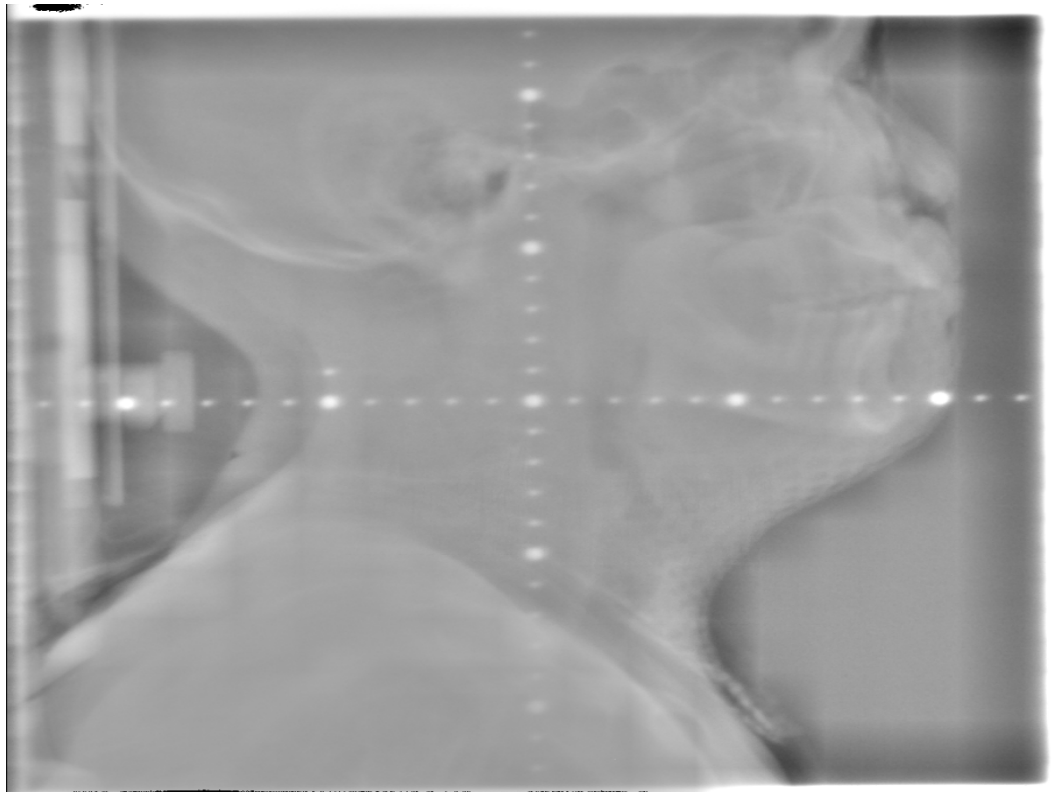
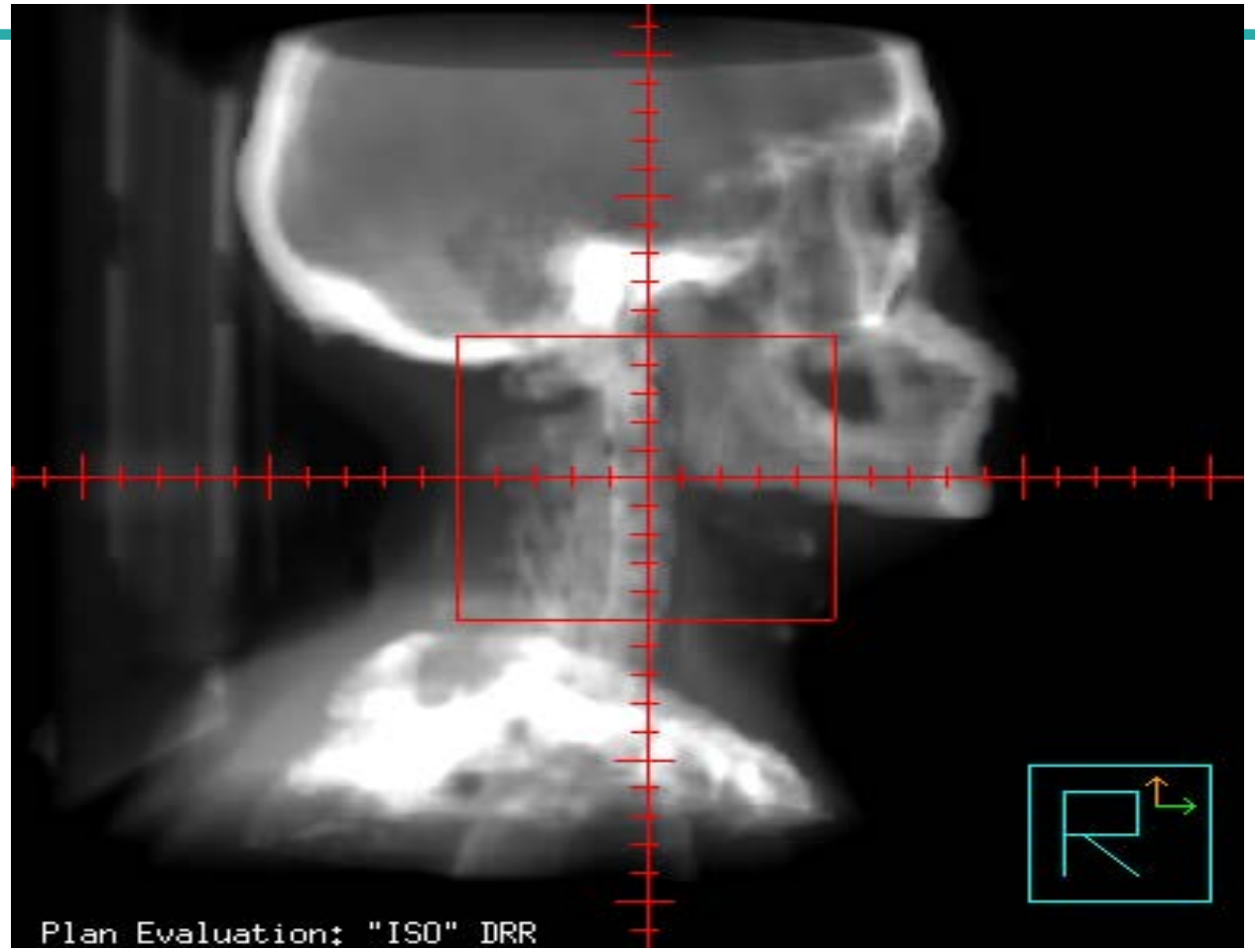


2. 放射治療影像對位系統





Background

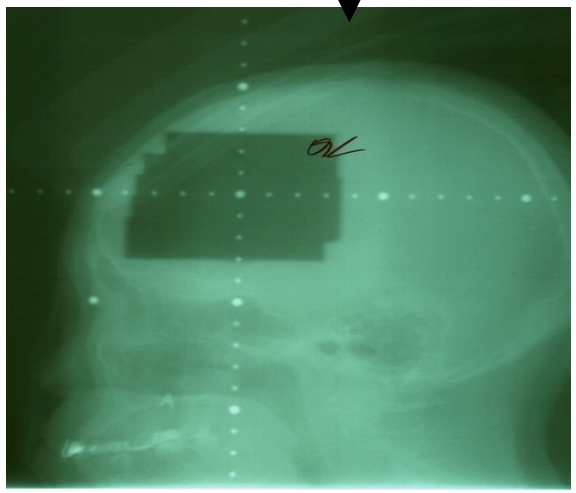
Positioning Verification

Linear accelerator

Conventional
2D treatment planning

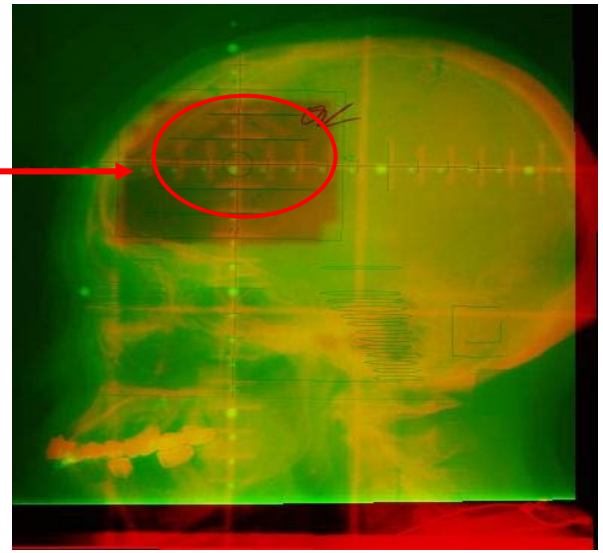
Adjust setup

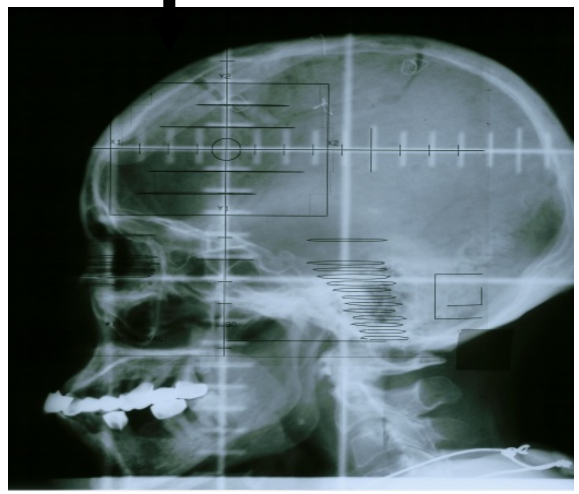
X-ray projection simulator



Portal film

Indicate setup error



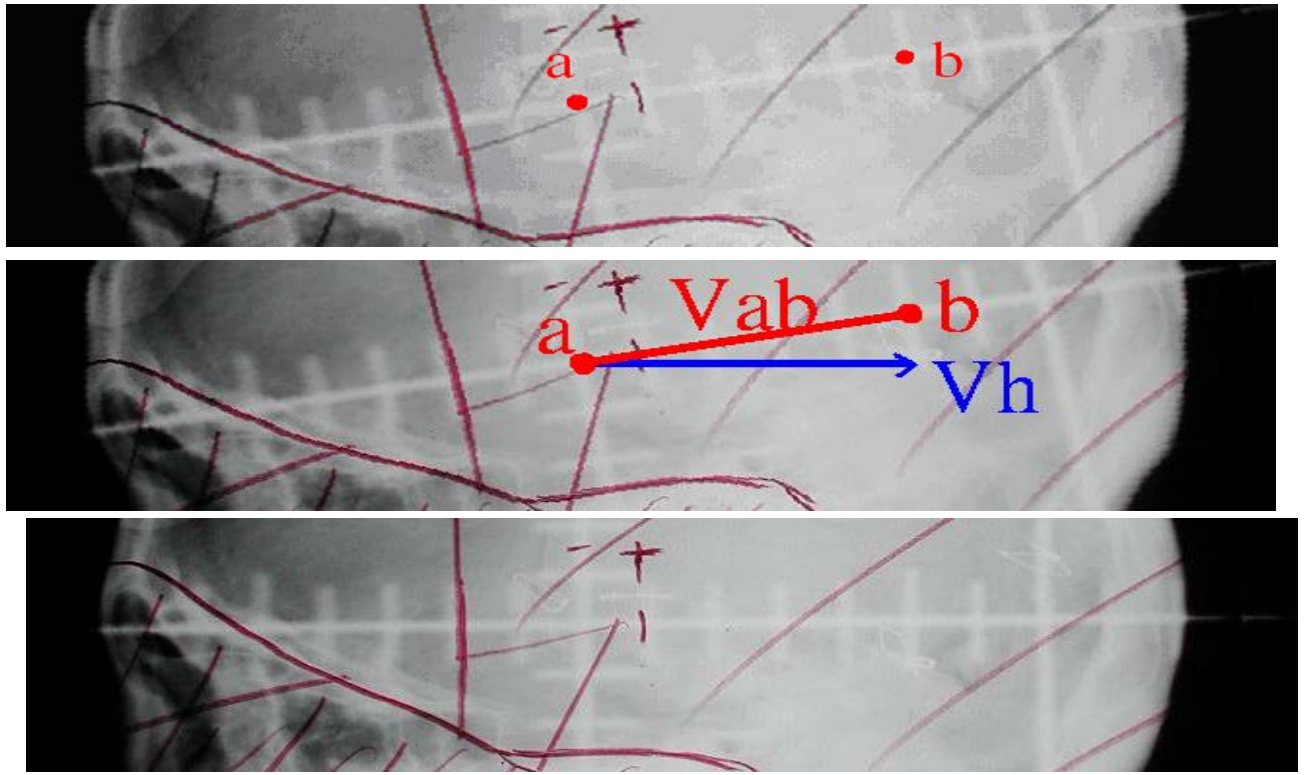


Simulation film

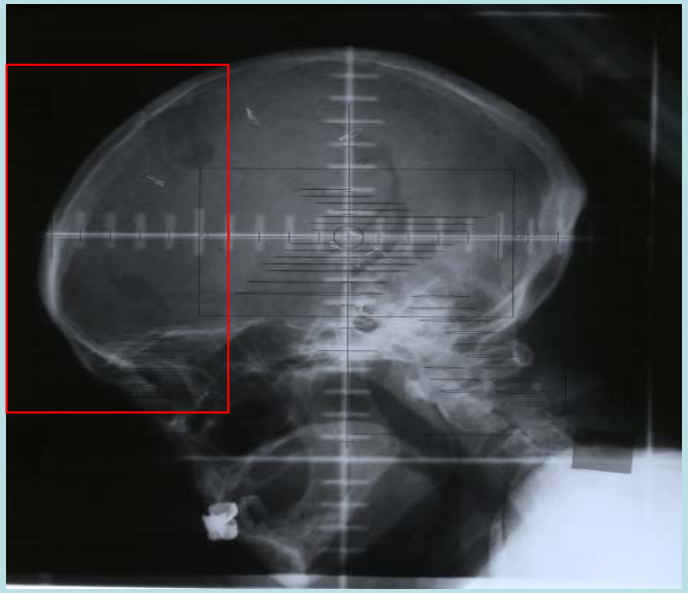
Stage I: Image Preprocessing

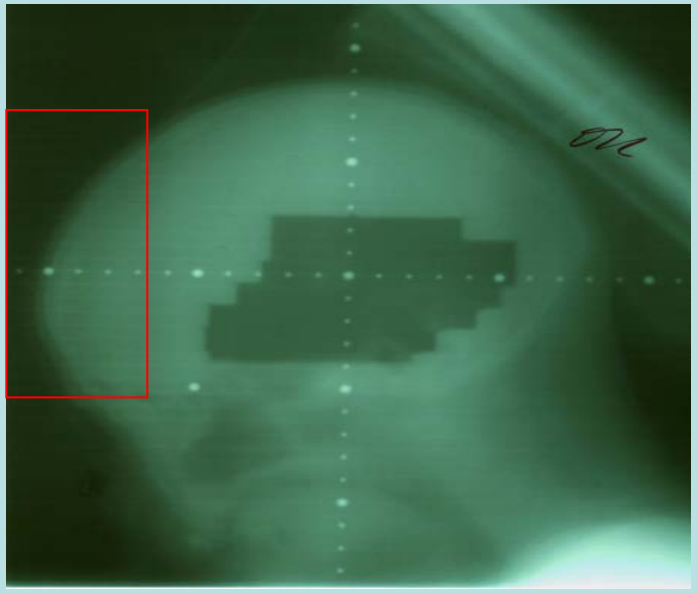
1. Image rotate and scale rectification

→manual-detect ------ control points



2. Select the region of interest to avoid the interference of the head frame



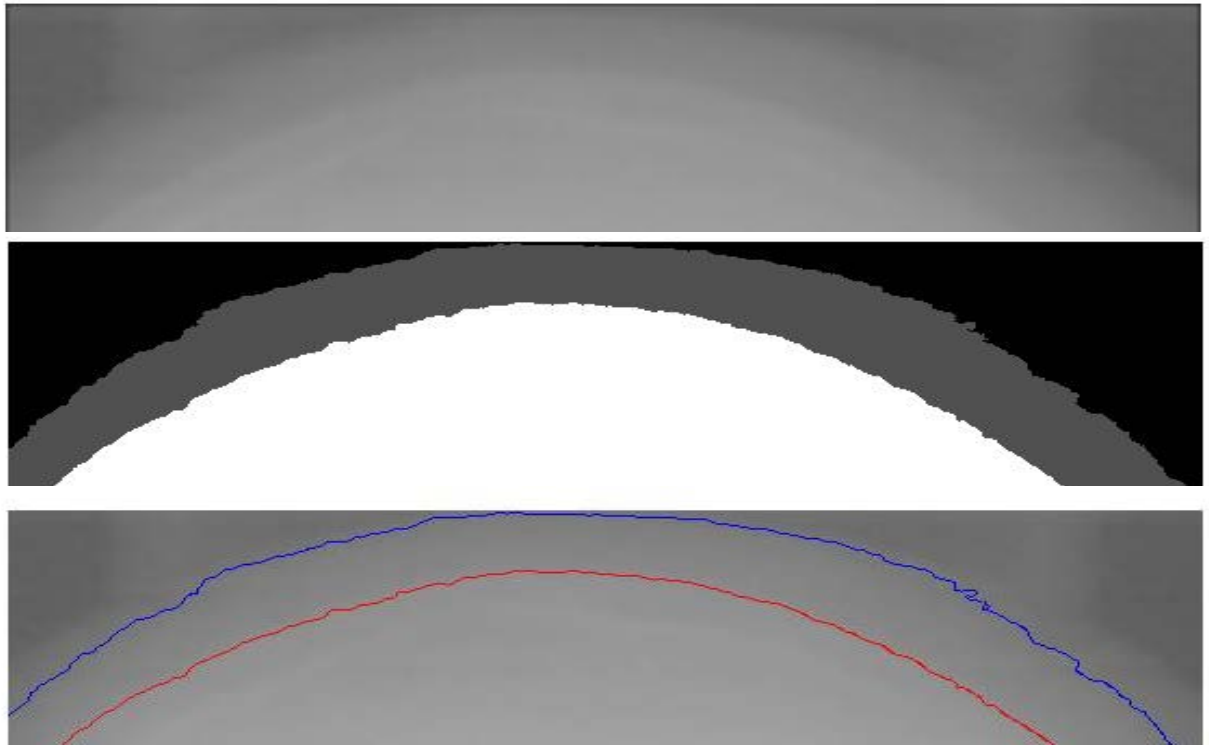


3. Apply the gamma transformation to enhance contrast

4. Eliminate noise and make region smoother by using average filter

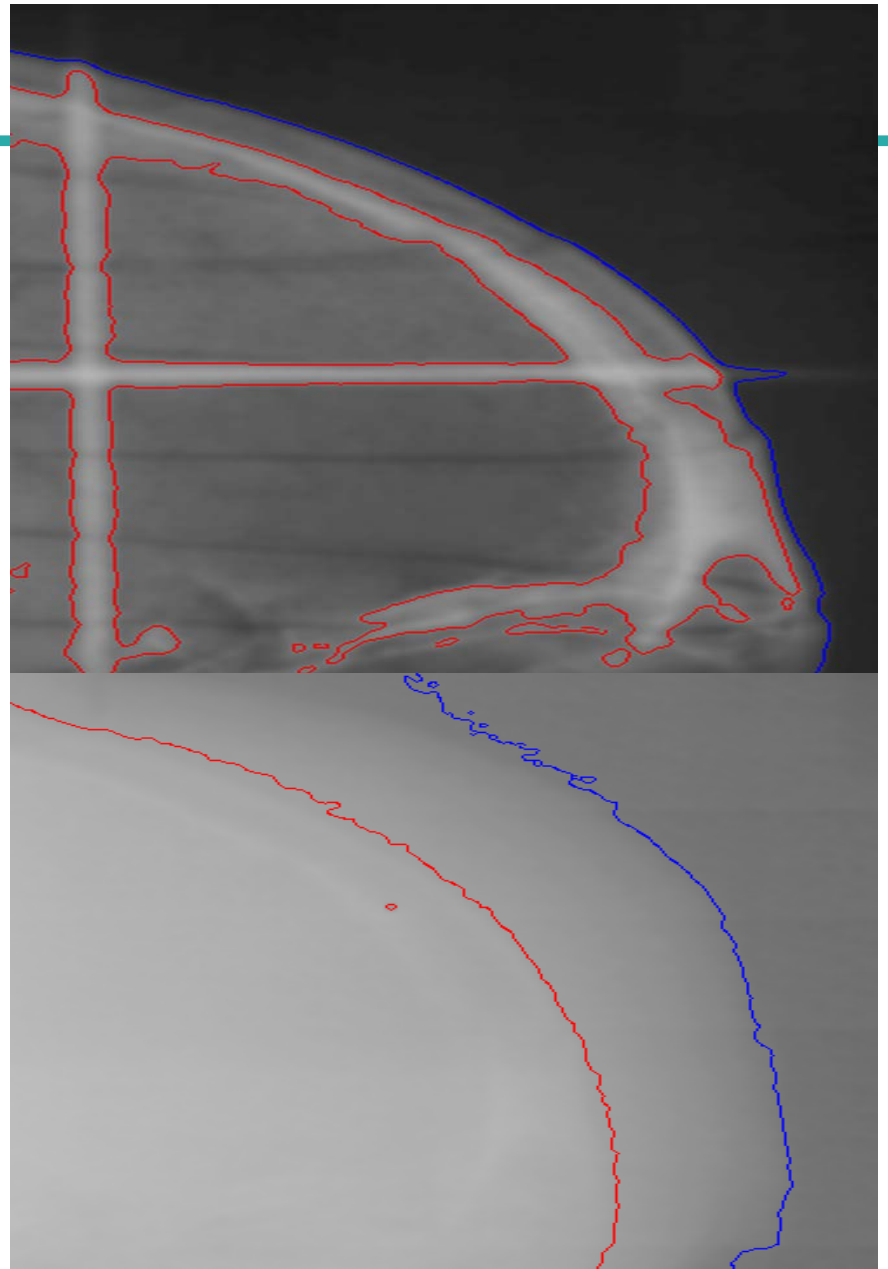
Stage 2: Segmentation

- Modify the Otsu's optimal threshold algorithm of one-threshold to multi-thresholds

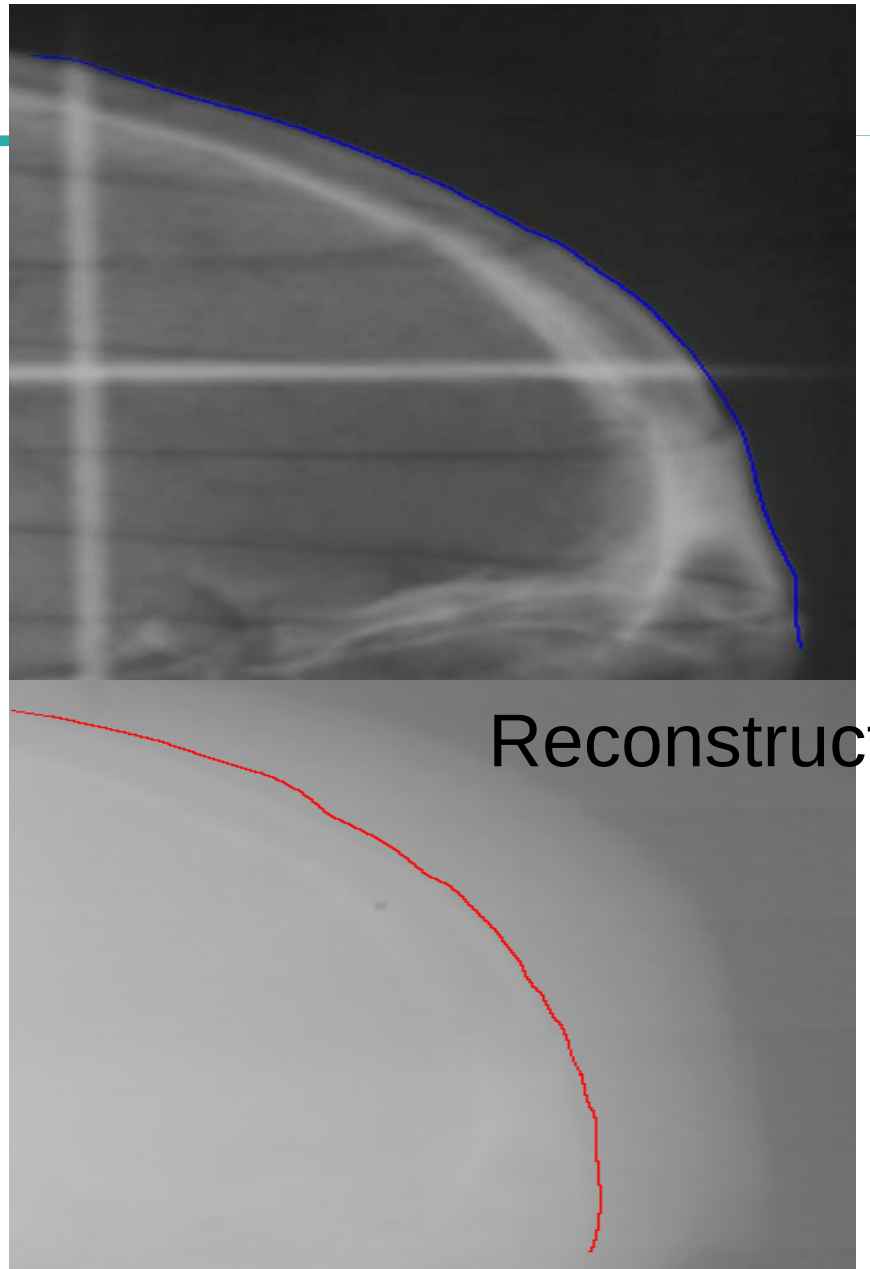


Contour Detection and Reconstruction

Original



Reconstructed



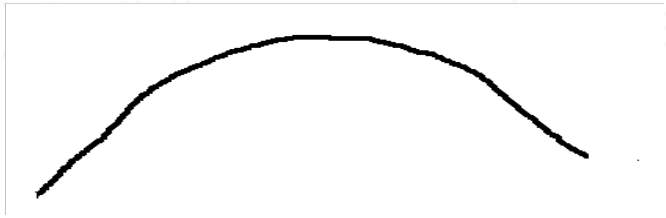
Stage 3: Image Registration

- Using Generalized Hough Transform (GHT) to register simulation and portal films
- The process includes two steps:

(1) Building the R-table

(2) [illegible] array

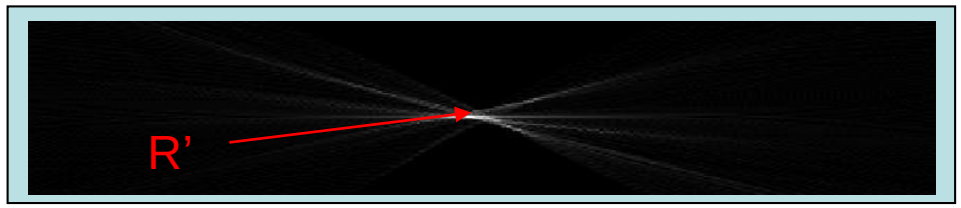
Simulation film



R-table

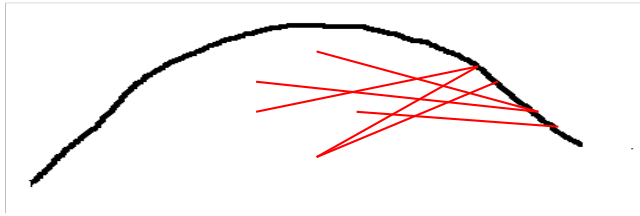
Table 1. R-table format

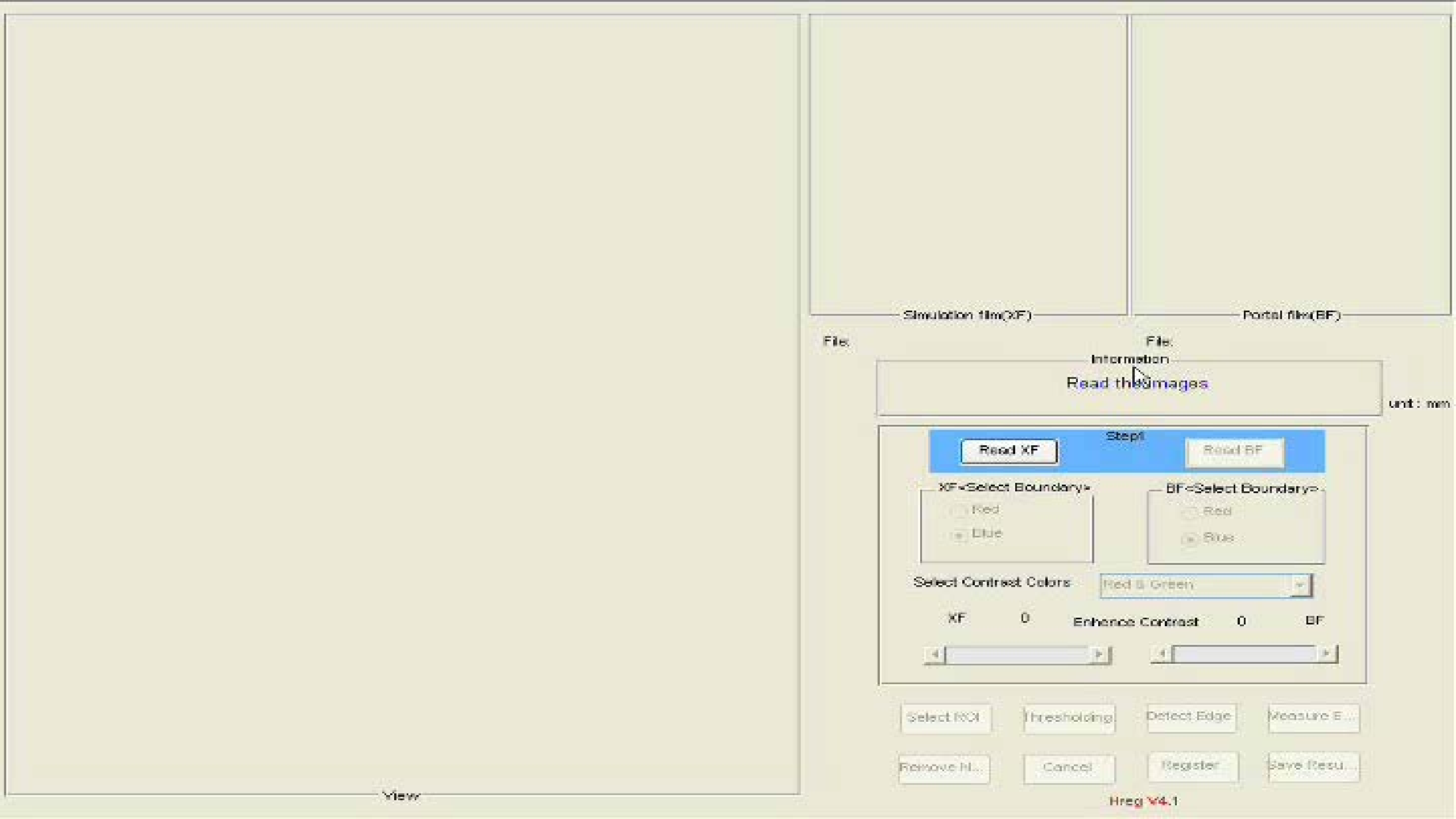
$\bar{a}_i$	Component vectors in x- and y- axis		$\|\bar{a}_i\|$
i=1	$\bar{x}_1$	$\bar{y}_1$	γ_1
i=2	$\bar{x}_2$	$\bar{y}_2$	γ_2
.	.	.	.
i=n	$\bar{x}_n$	$\bar{y}_n$	γ_n



accumulator array

Portal film




Simulation film(XF)
Portal film(BF)
File
File
Information
Read the images
unit : mm
Step1
Read XF
Read BF
XF<Select Boundary>
Red
Blue
BF<Select Boundary>
Red
Blue
Select Contrast Colors
Red & Green
XF
0
Enhance Contrast
0
BF
Select ROI
Thresholding
Detect Edge
Measure E...
Remove R...
Cancel
Register
Save Resu...
Hreg V4.1
View

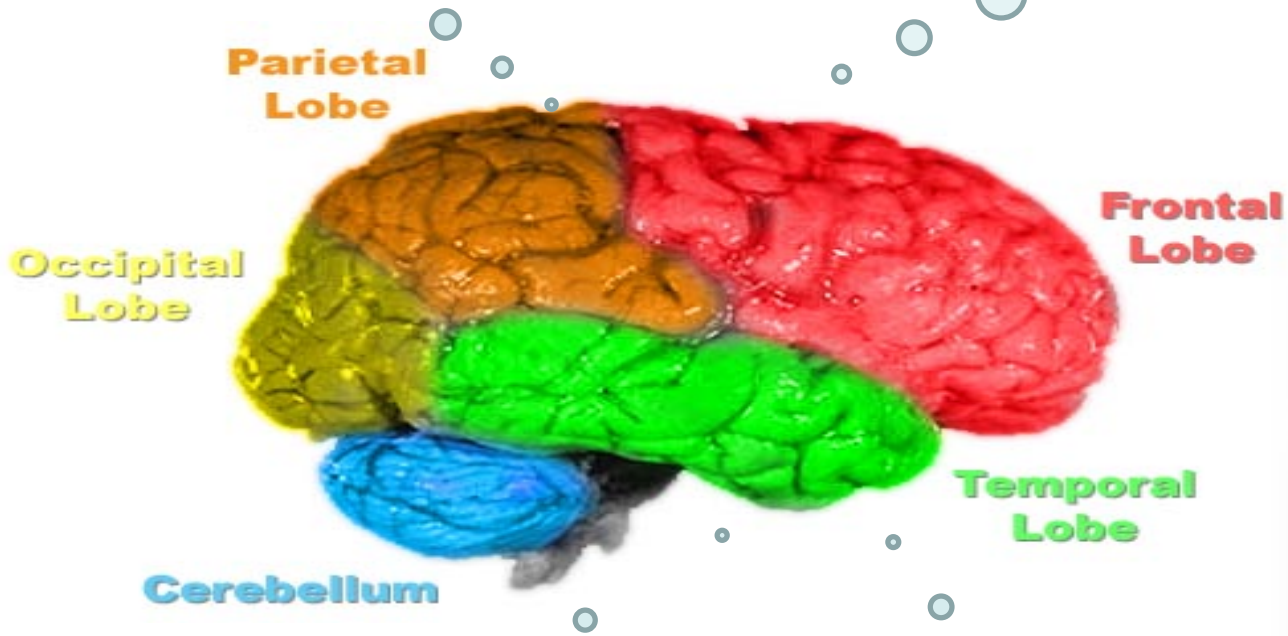
影響認知力的因素

- 影響因素
  - 年齡
  - 性別
  - 腦傷
  - 疾病　如注意力不足過動兒童(ADHD)、Alzheimer‘s Disease、精神病

腦與認知

方向感

推理力



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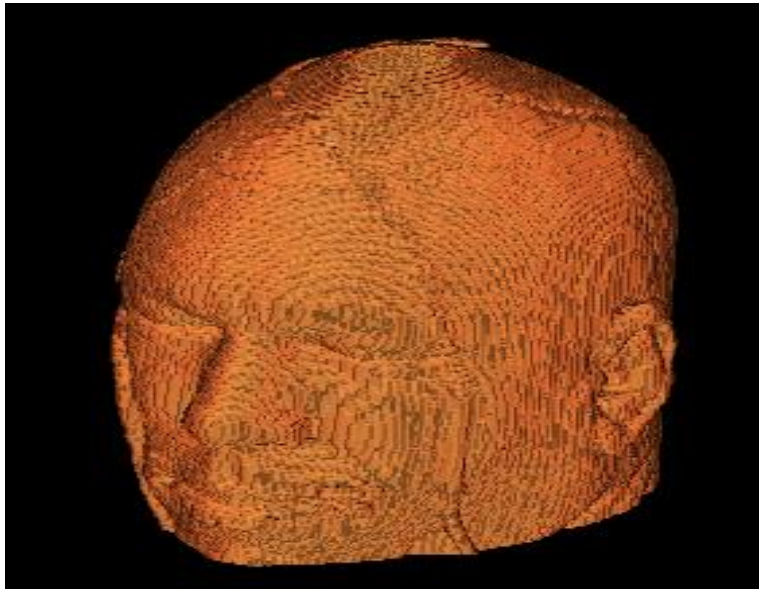
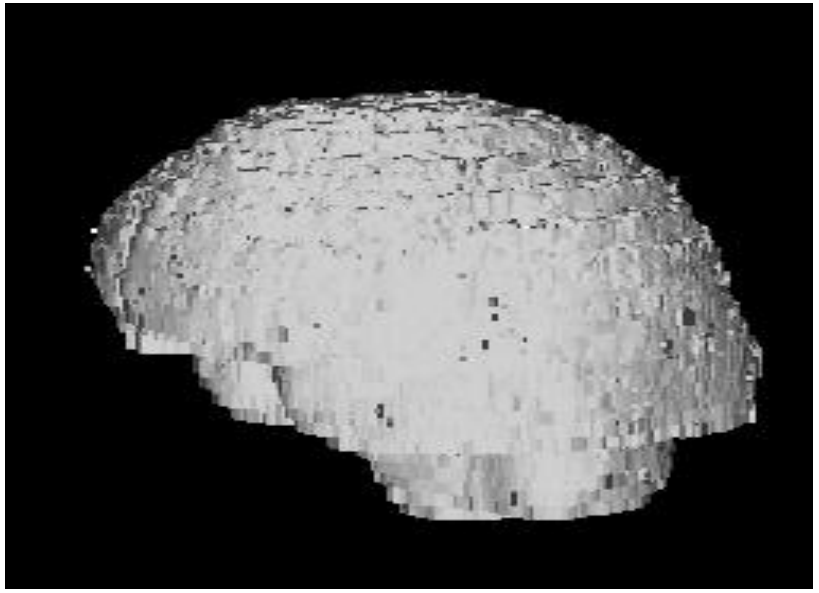
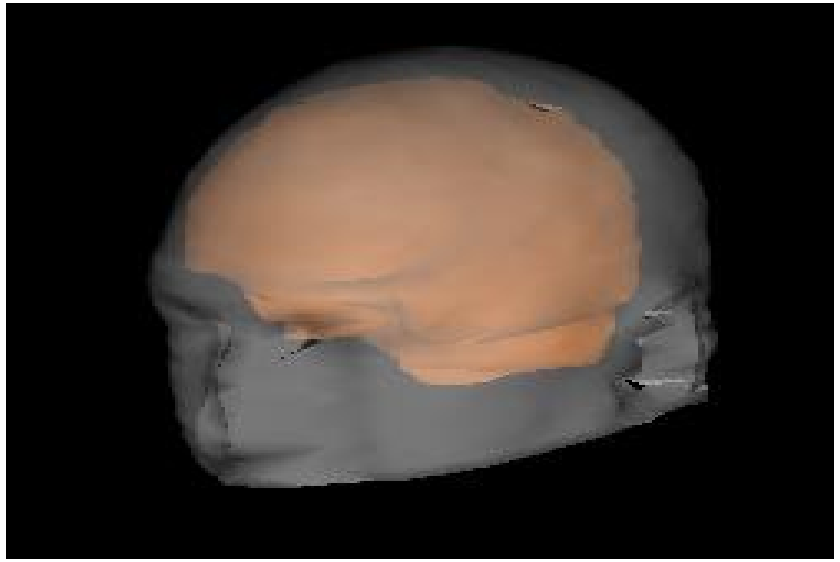
注意力

記憶力

3. 腦影像(3D)對位系統

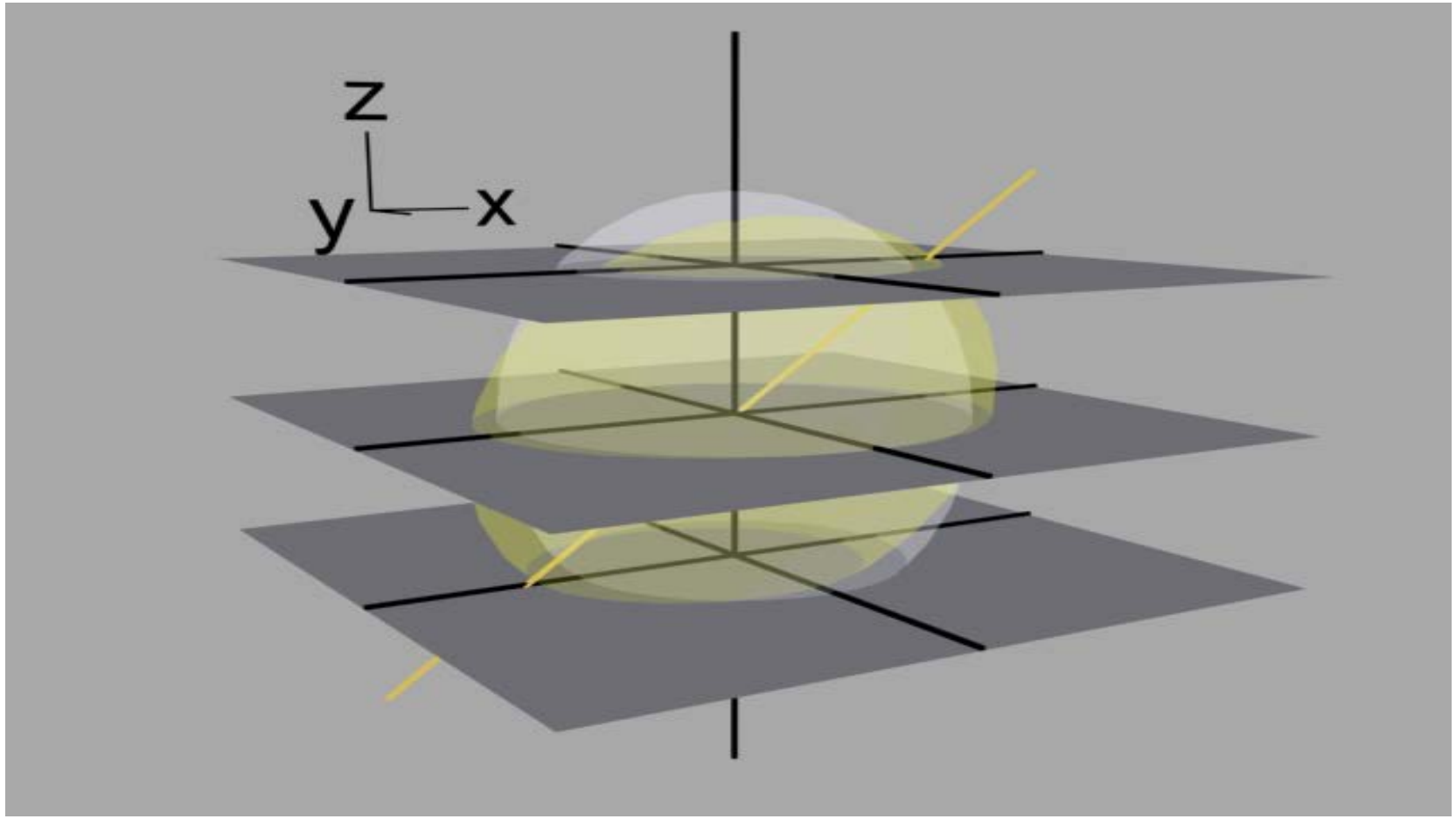




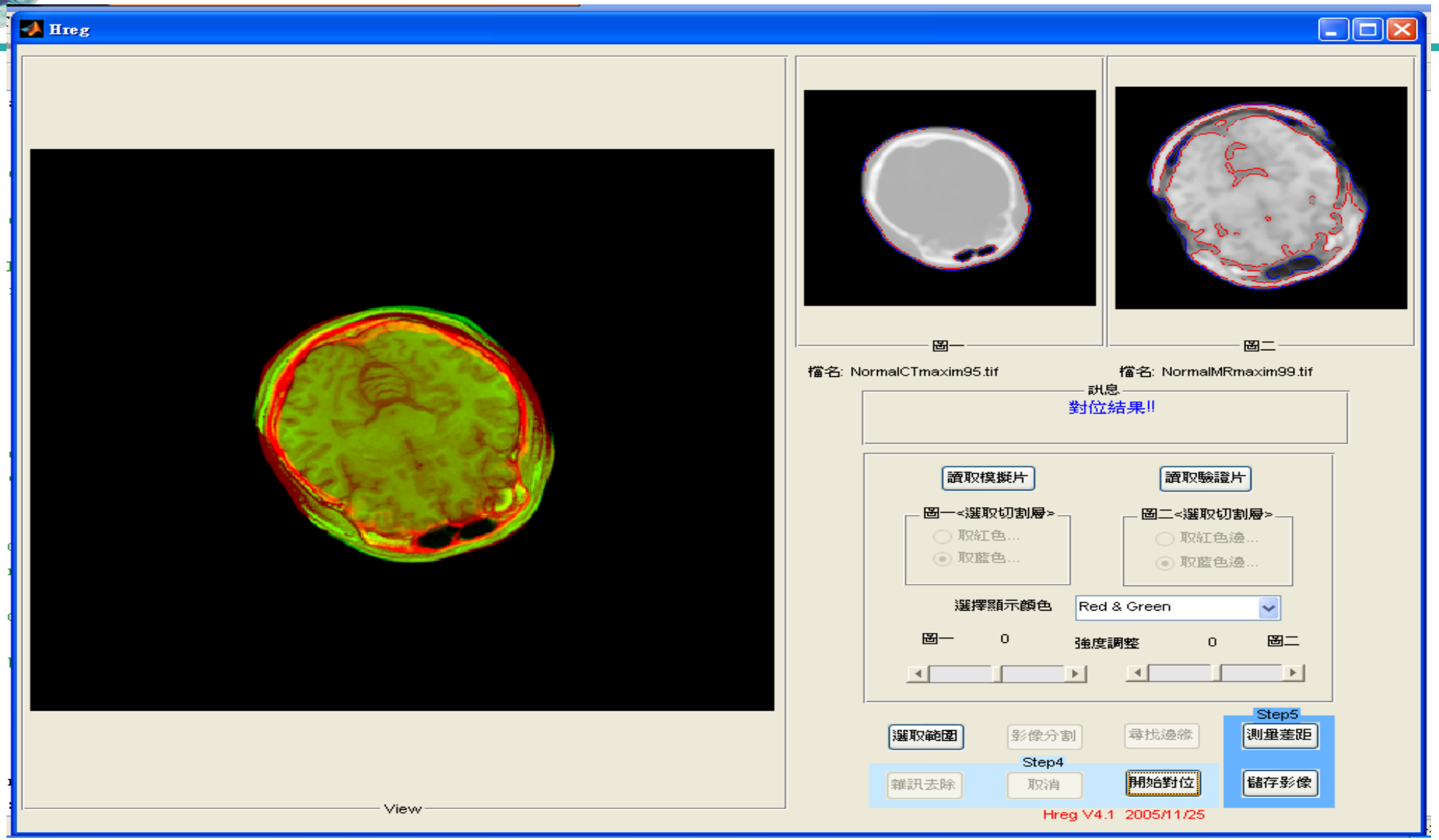


Problems in 3D Registration

- Different orientation of Principal Axes

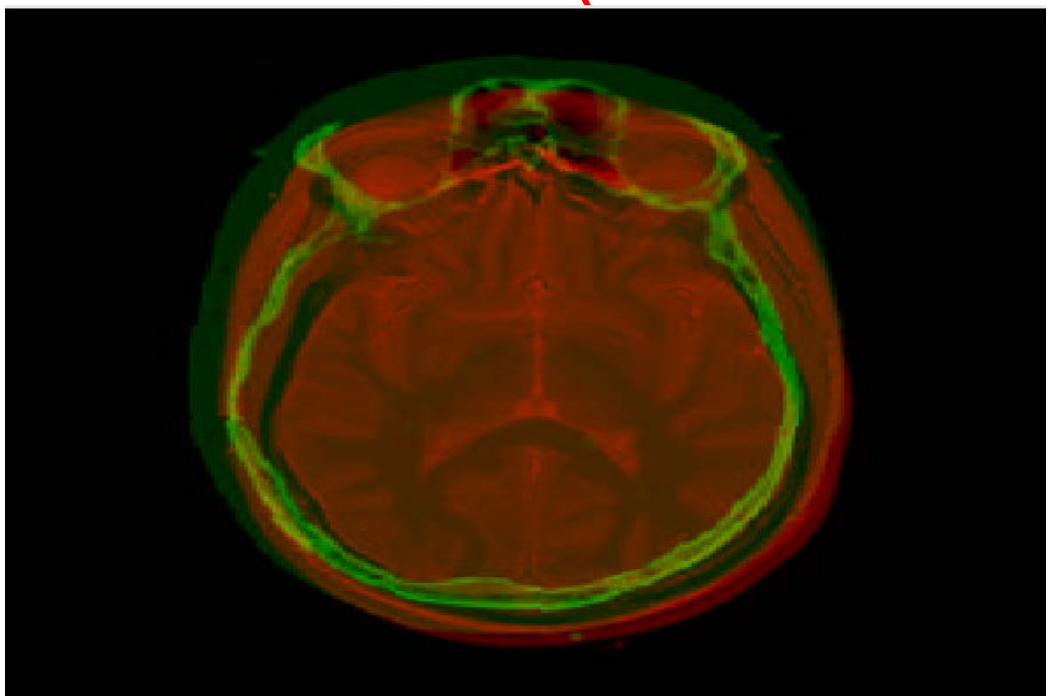


以最大切面做XY切面校正

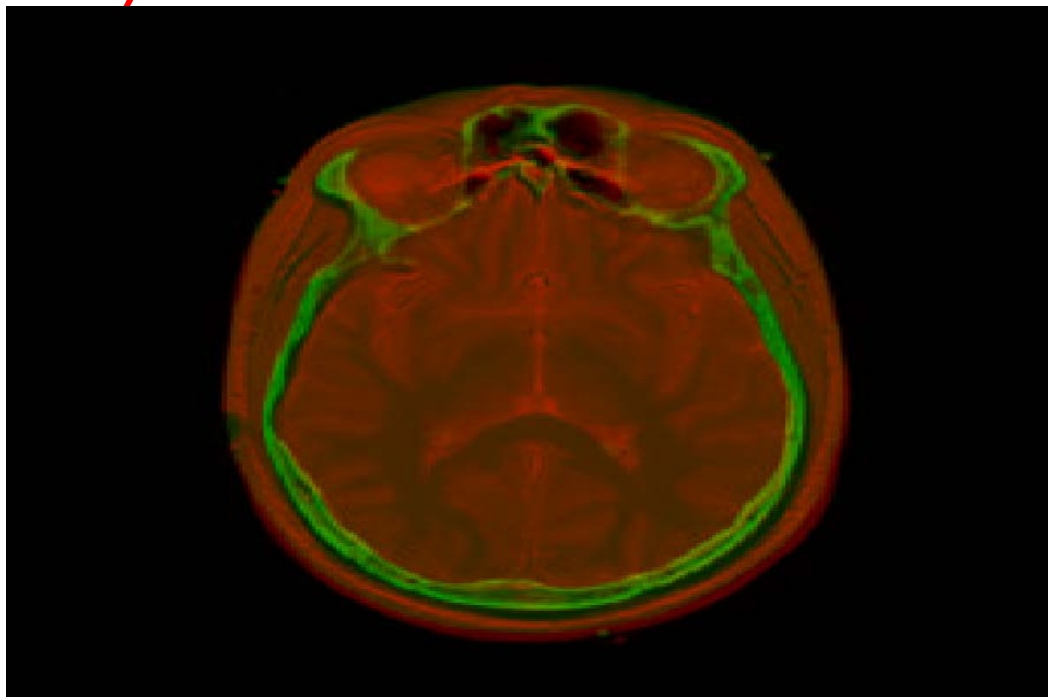


PAR + Hough Transform

2D Maximum area (Case I : MR + CT)



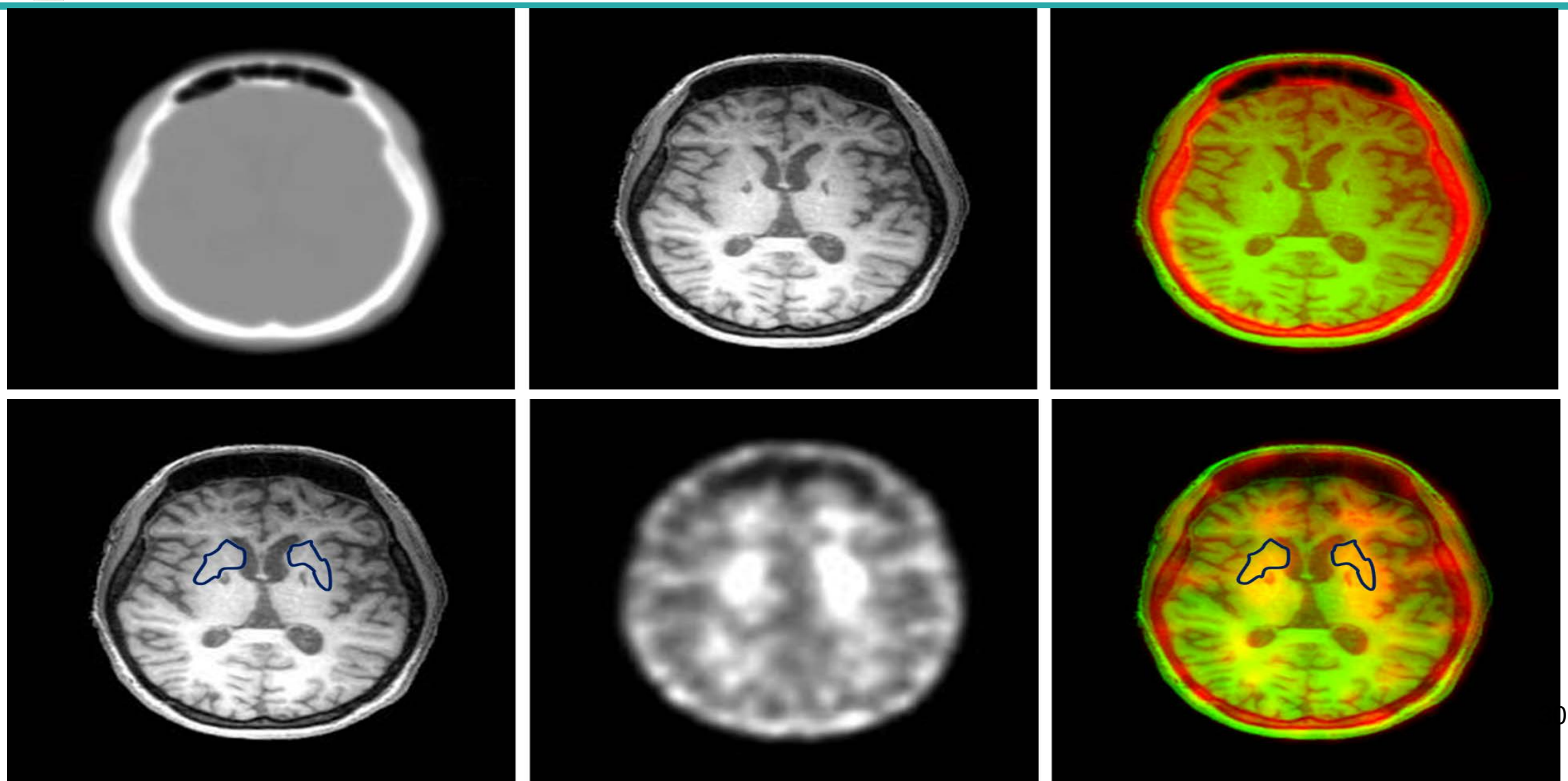
PAR Method

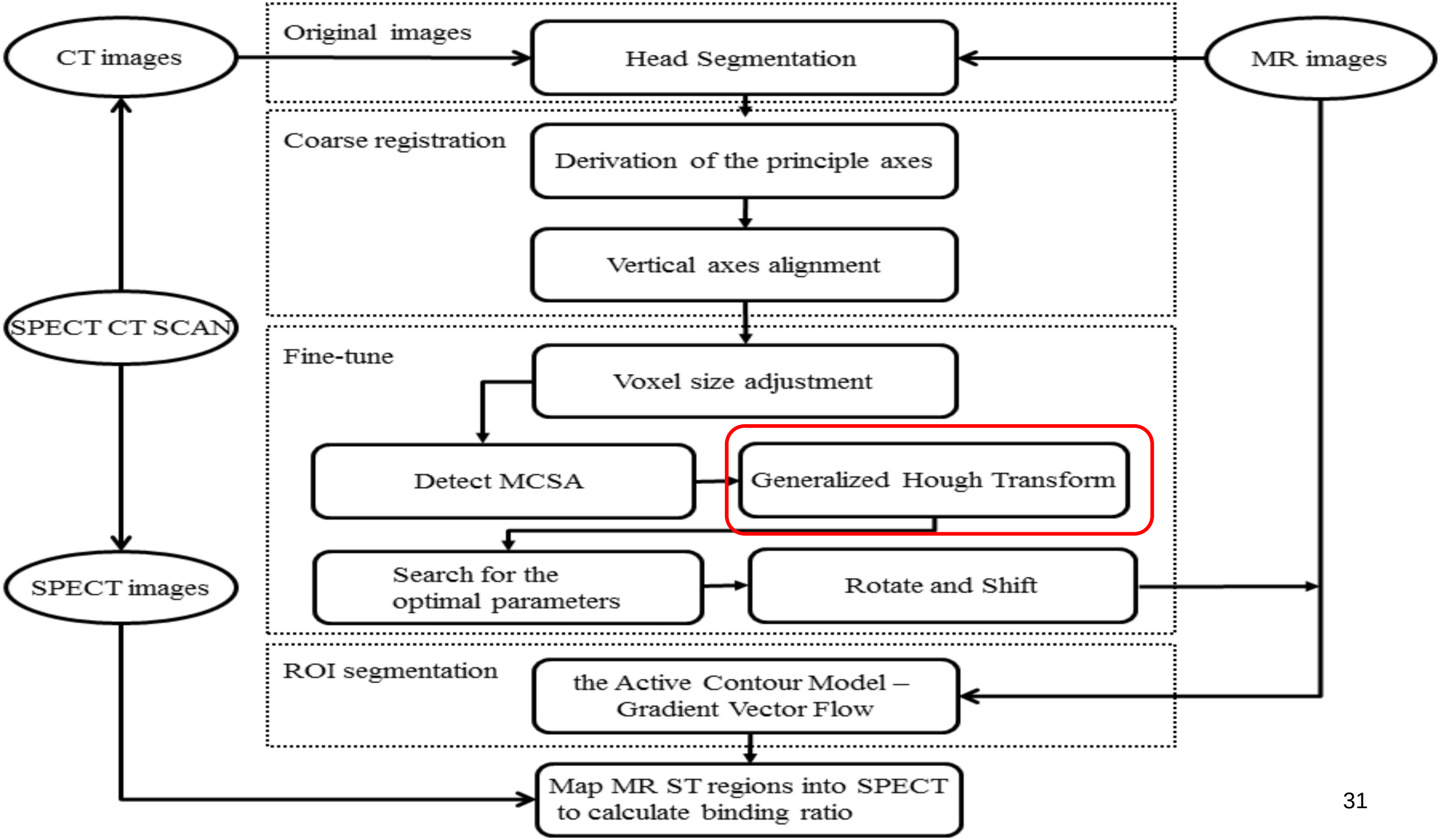


Hybrid Method

Ching-Fen Jiang*, Chih-Hua Huang, Shih-Ting Yang, "Using Maximal Cross-Section *Detection* for the Registration of 3D Image Data of the Head," *Journal of Medical and Biological Engineering*, vol. 31, no. 3, pp. 217-226, 2011.06 (**SCI, EI**).

Application 1 -
Quantification of 99mTc-TRODAT -1



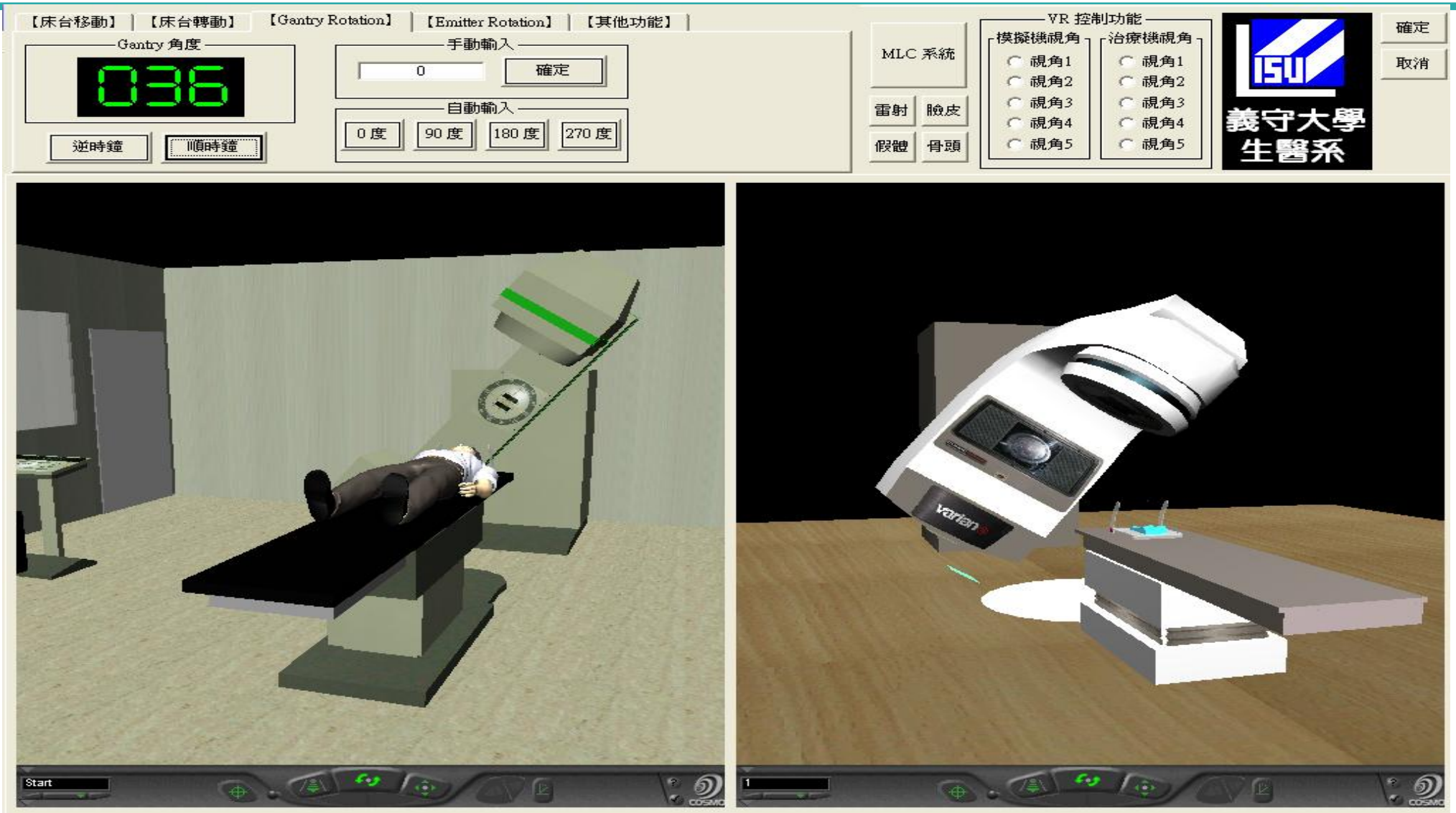

CT images
Original images
Head Segmentation
MR images
Coarse registration
Derivation of the principle axes
Vertical axes alignment
SPECT CT SCAN
Fine-tune
Voxel size adjustment
Detect MCSA
Generalized Hough Transform
Search for the optimal parameters
Rotate and Shift
SPECT images
ROI segmentation
the Active Contour Model – Gradient Vector Flow
Map MR ST regions into SPECT to calculate binding ratio

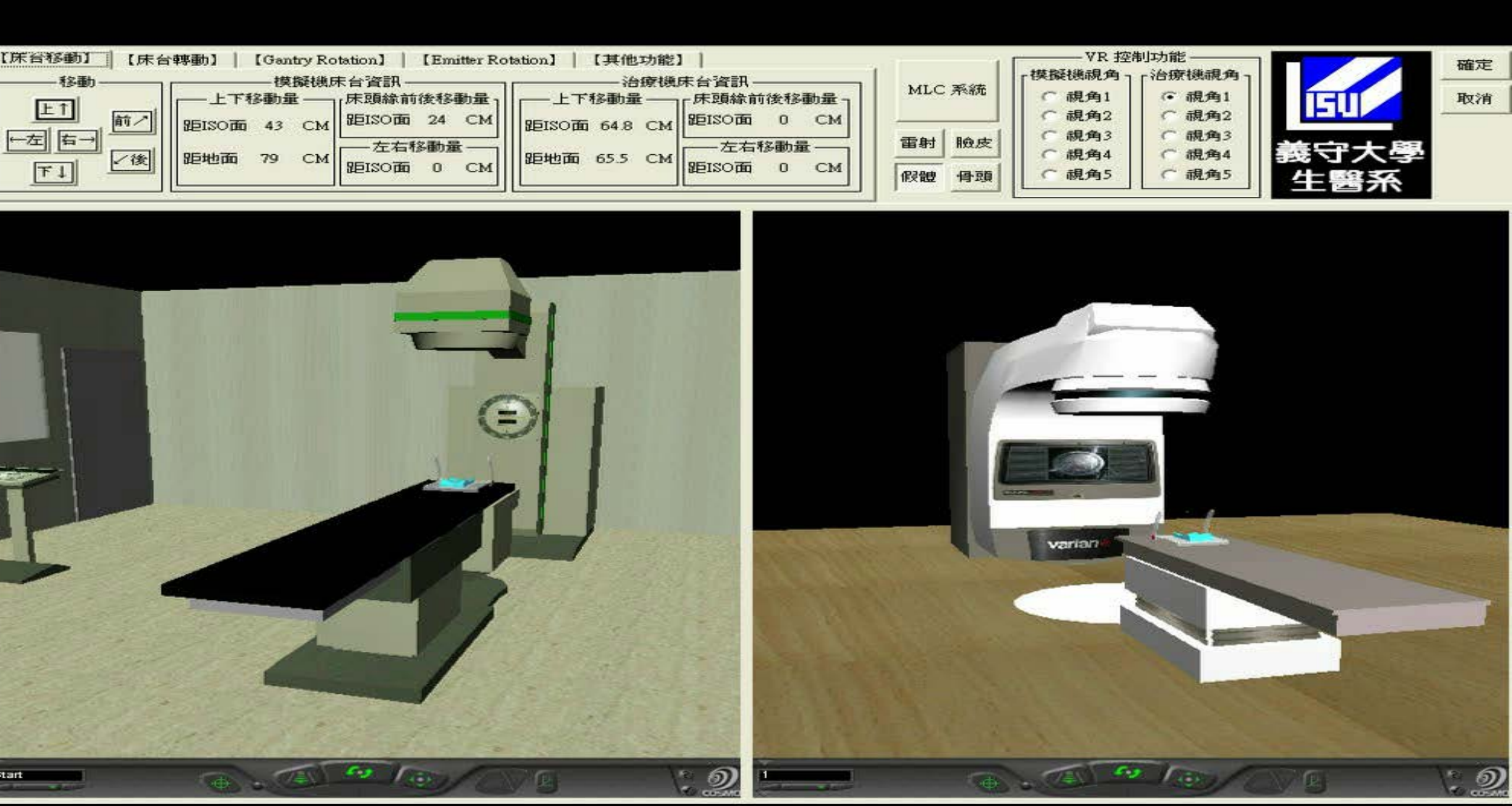
1. Ching-Fen Jiang*, Chiung-Chih Chang, Shu-Hua Huang, “Regions of Interest extraction from SPECT Images for Neural Degeneration Assessment Using Multimodality Image Fusion,“ *Multidimensional Systems and Signal Processing*, vol. 23, pp. 437-449, 2012.07 (SCI, EI)

2. **Ching-Fen Jiang***, Chiung-Chih Chang, Shu-Hua Huang, Chia-Hsiang Wu, "Segmentation of the Striatum from MR Brain Images to Calculate the 99mTc-TRODAT-1 Binding Ratio in SPECT Images", *Computational and Mathematical Methods in Medicine*, vol. 2013, no. http://dx.doi.org/10, 2013.06 (**SCI**)

4. VR 與醫學影像的結合

放射治療模擬系統

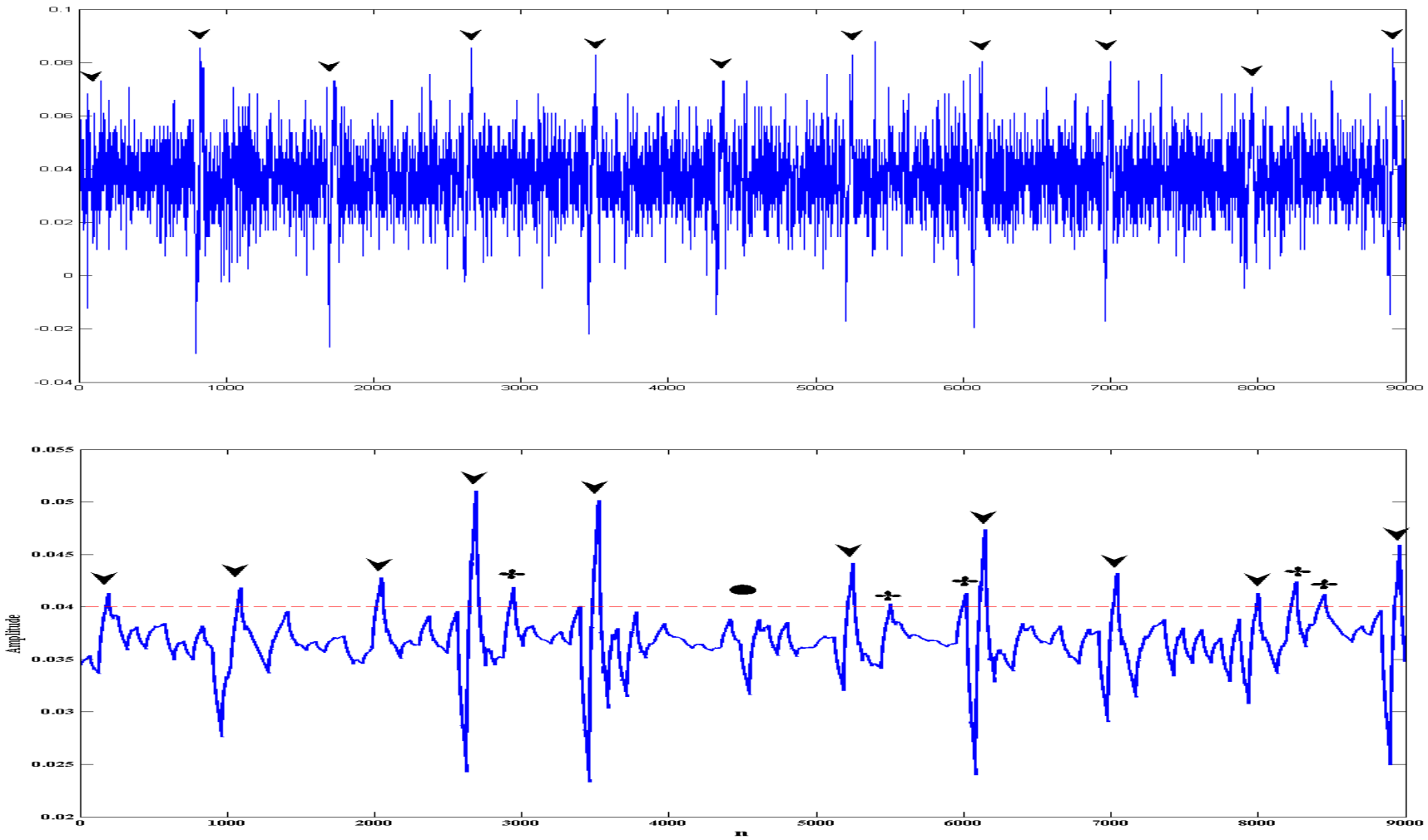



【床台移動】
【床台轉動】
【Gantry Rotation】
【Emitter Rotation】
【其他功能】
移動
上↑
←左
右→
下↓
前↗
↙後
模擬機床台資訊
上下移動量
距ISO面 43 CM
距地面 79 CM
床頭線前後移動量
距ISO面 24 CM
左右移動量
距ISO面 0 CM
治療機床台資訊
上下移動量
距ISO面 64.8 CM
距地面 65.5 CM
床頭線前後移動量
距ISO面 0 CM
左右移動量
距ISO面 0 CM
MLC 系統
雷射
臉皮
假體
骨頭
VR 控制功能
模擬機視角
視角1
視角2
視角3
視角4
視角5
治療機視角
視角1
視角2
視角3
視角4
視角5
義守大學
生醫系
確定
取消
varian

5. Electromyography

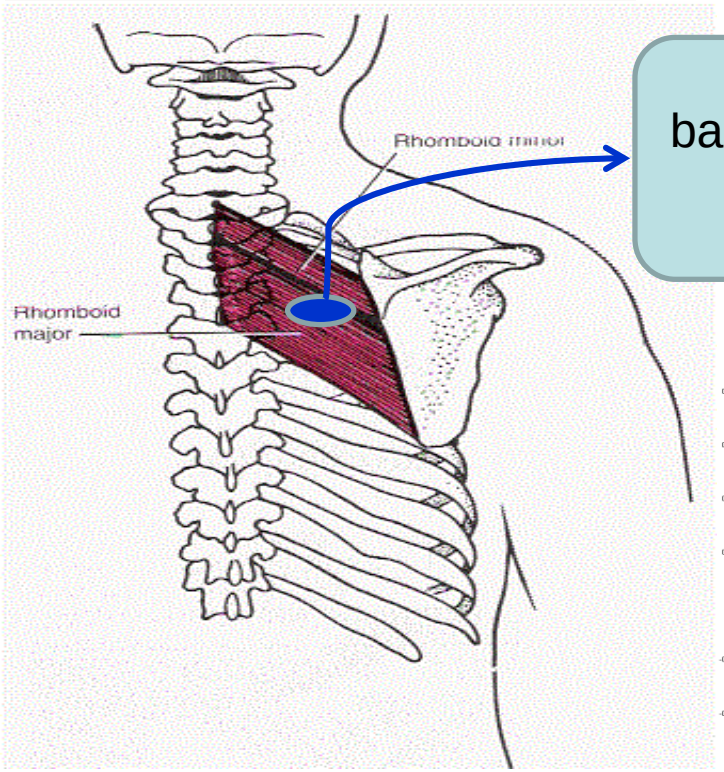
Myofascial Pain

動作電位的偵測

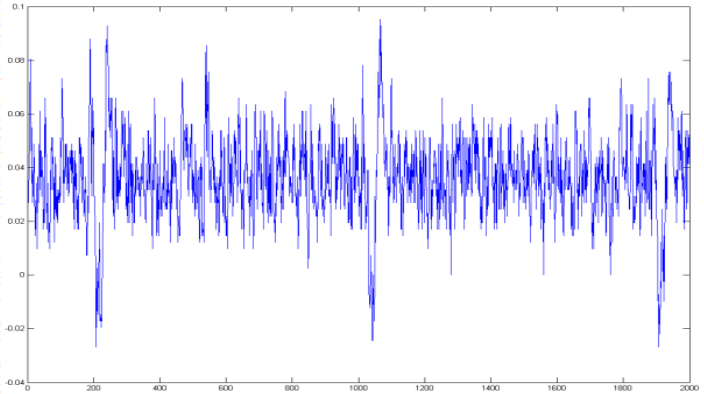

0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
0.055
0.05
0.045
0.04
0.035
0.03
0.025
0.02
Amplitude
n

Method (3/5)

Signal Processing and Modeling

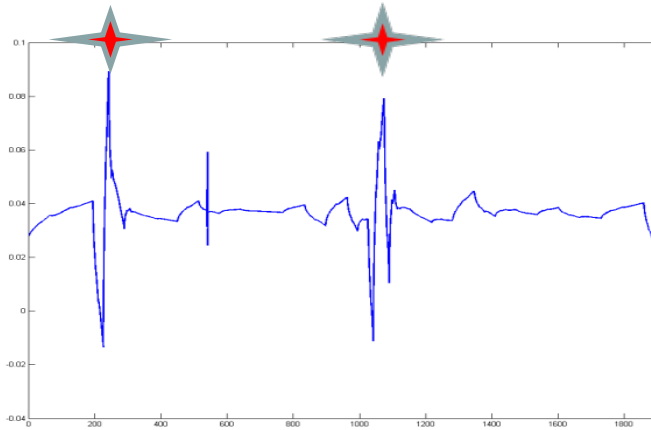


x 3800
band-pass (20–3,000 Hz)
fs= 5000 Hz



Wavelet denosing

Spike Detection



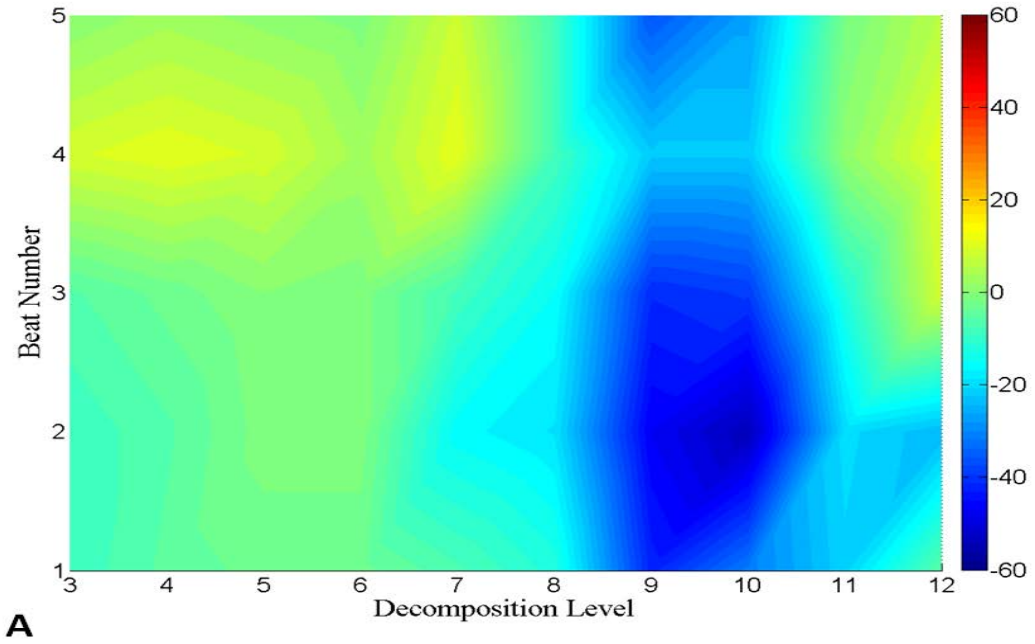
Multi-scale Modeling

1. C.F. Jiang, et al., IJEE, *IJEE*, (2008)
2. C.F. Jiang, et al., *IEEE Trans Neural Syst Rehabil* Eng, (2013)

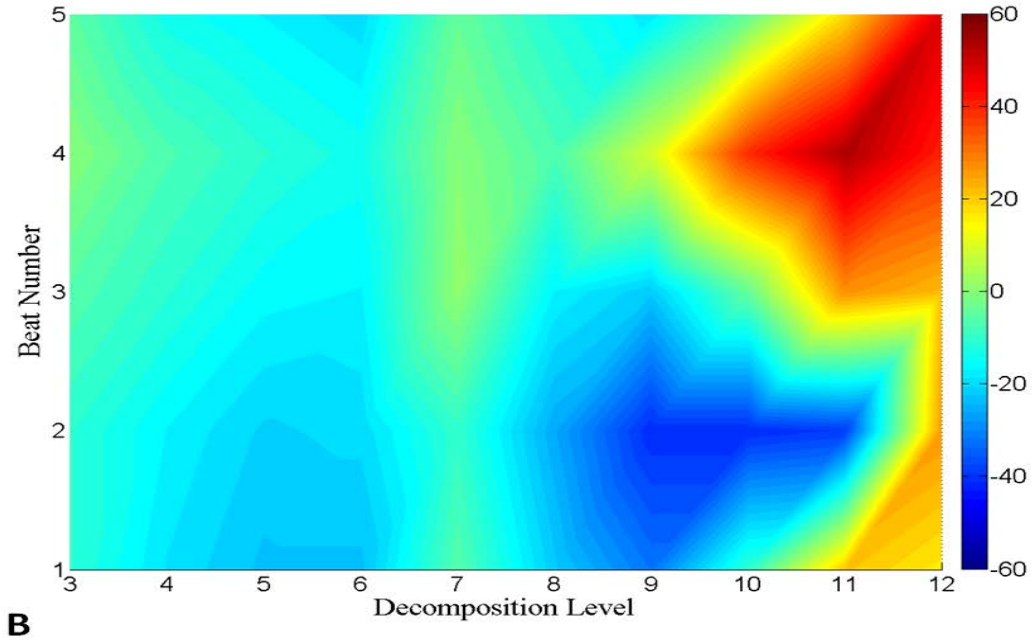
肌筋膜炎的偵測

Multi-**S**cale **W**avelet **E**nergy **V**ariation graph (MSWEV graph)

正常人

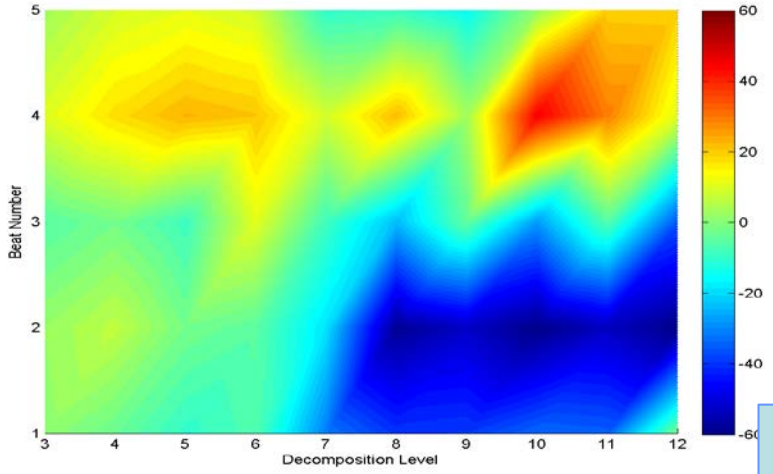


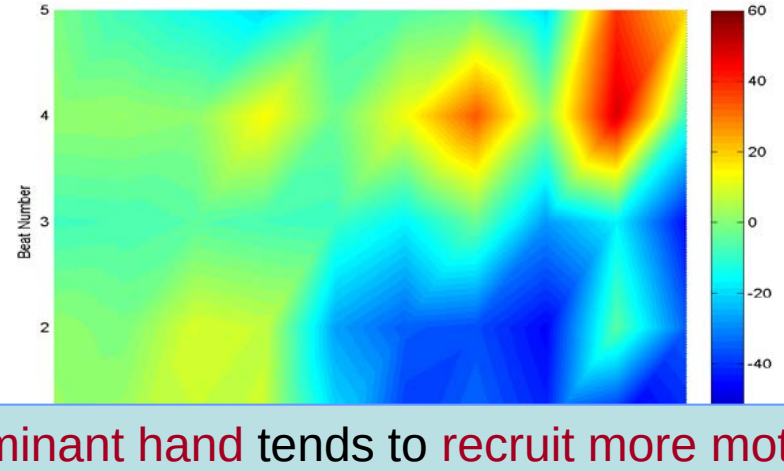
患者



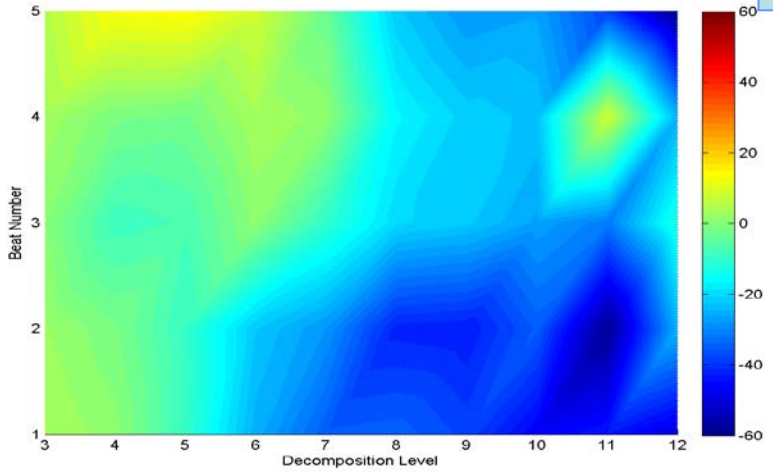
慣用手分析

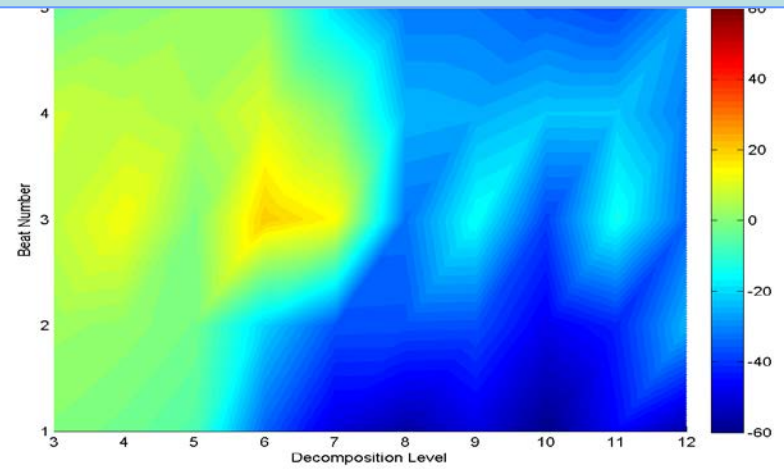
- the *Right-handed* group





- the *Left-handed* group





- the dominant hand tends to recruit more motor units to accomplish the backward shoulder extension

1. Yu-Ching Lin, Nan-Ying Yu, Ching-Fen Jiang, Shao-Hsia Chang, “ Characterizing the SEMG Patterns with Myofascial Pain Using a Multi-Scale Wavelet Model through Machine Learning Approaches”, *Journal of Electromyography and Kinesiology*, vol. 2018, no. 41, pp. 147-153, 2018.08 **(SCI)**

2. Ching-Fen Jiang*, Yu-Ching Lin, Nan-Ying Yu, "Multi-Scale Surface Electromyography Modeling to Identify Changes in Neuromuscular Activation with Myofascial Pain," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 20, issue 6, pp. 88-94, 2013.01 **(SCI, EI)**

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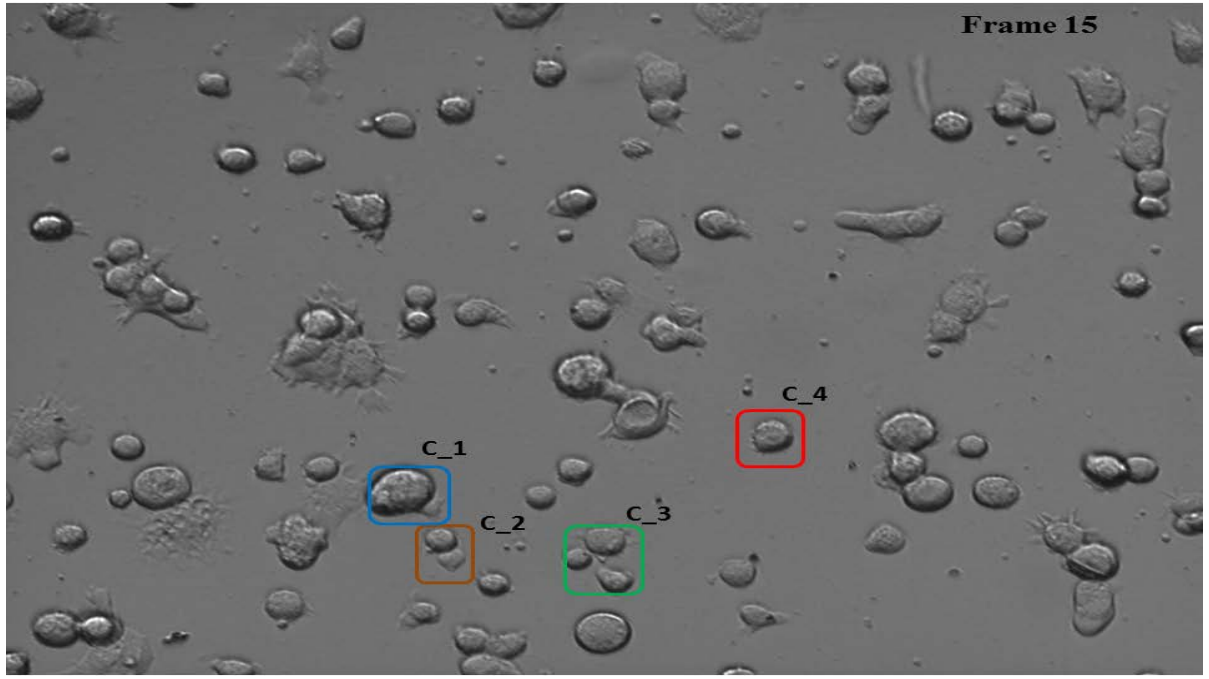
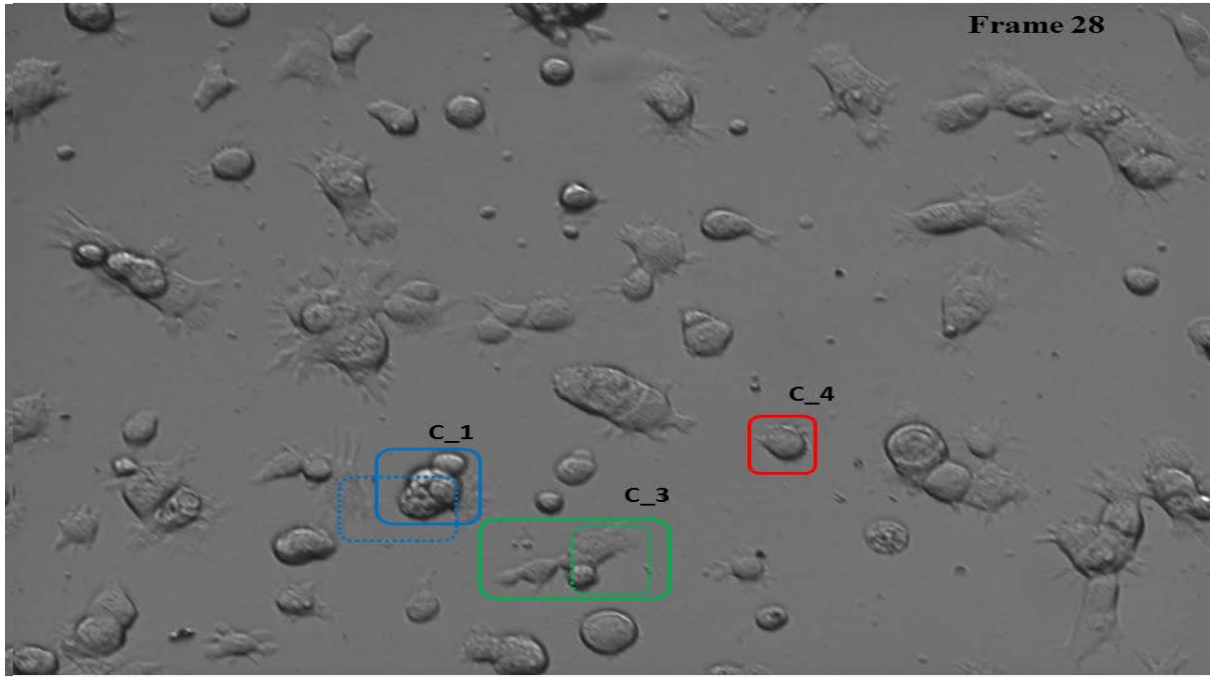
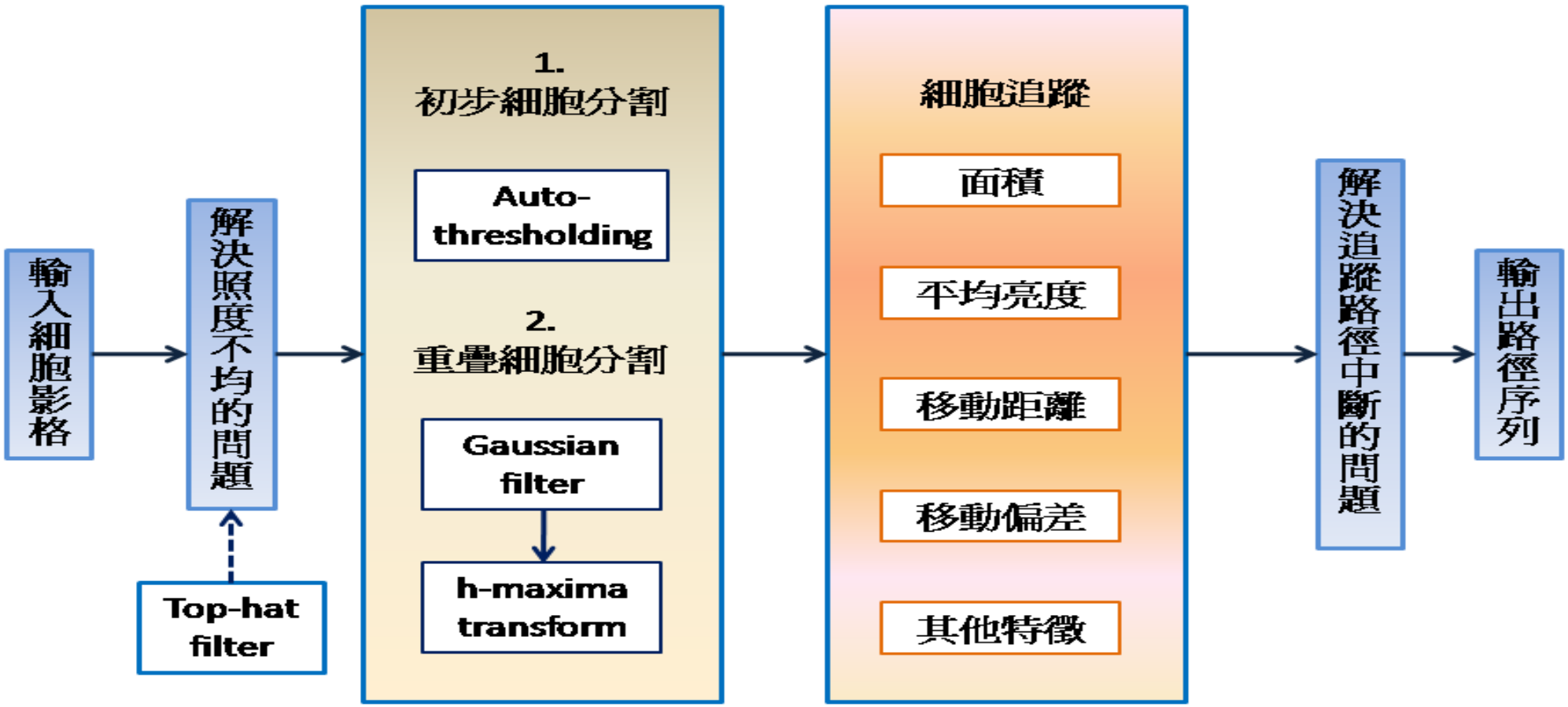
6. Stem Cell Tracking

- Why stem cells
- Why needs cell dynamics analysis

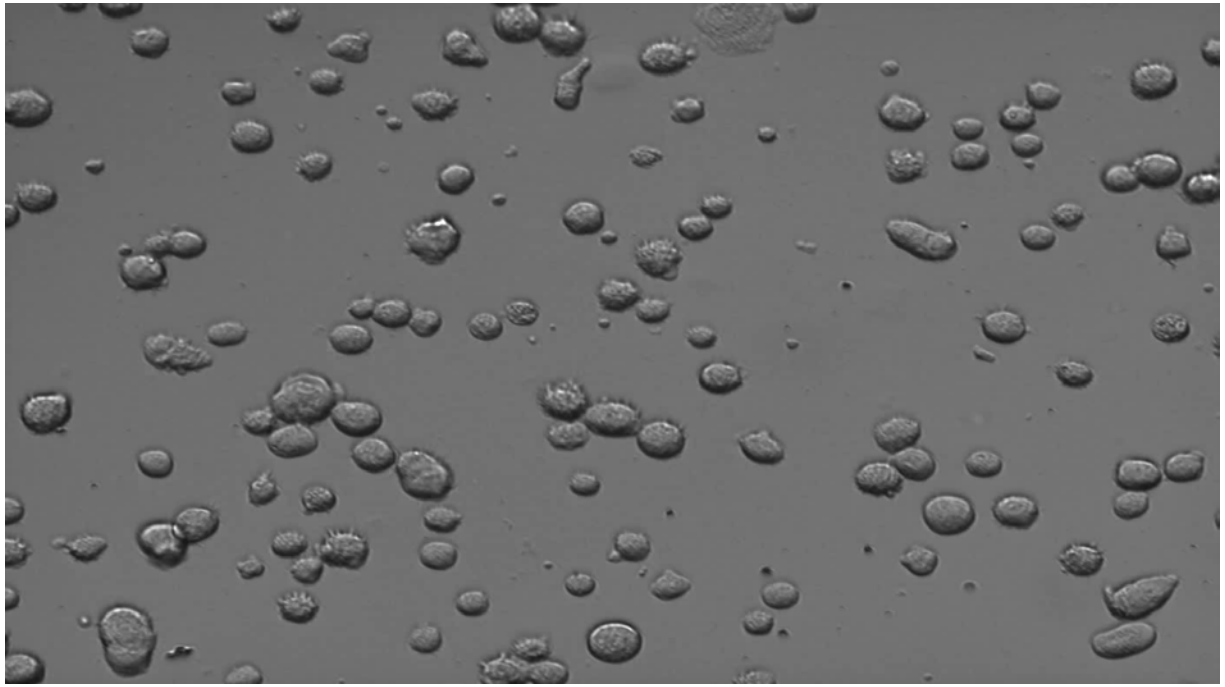


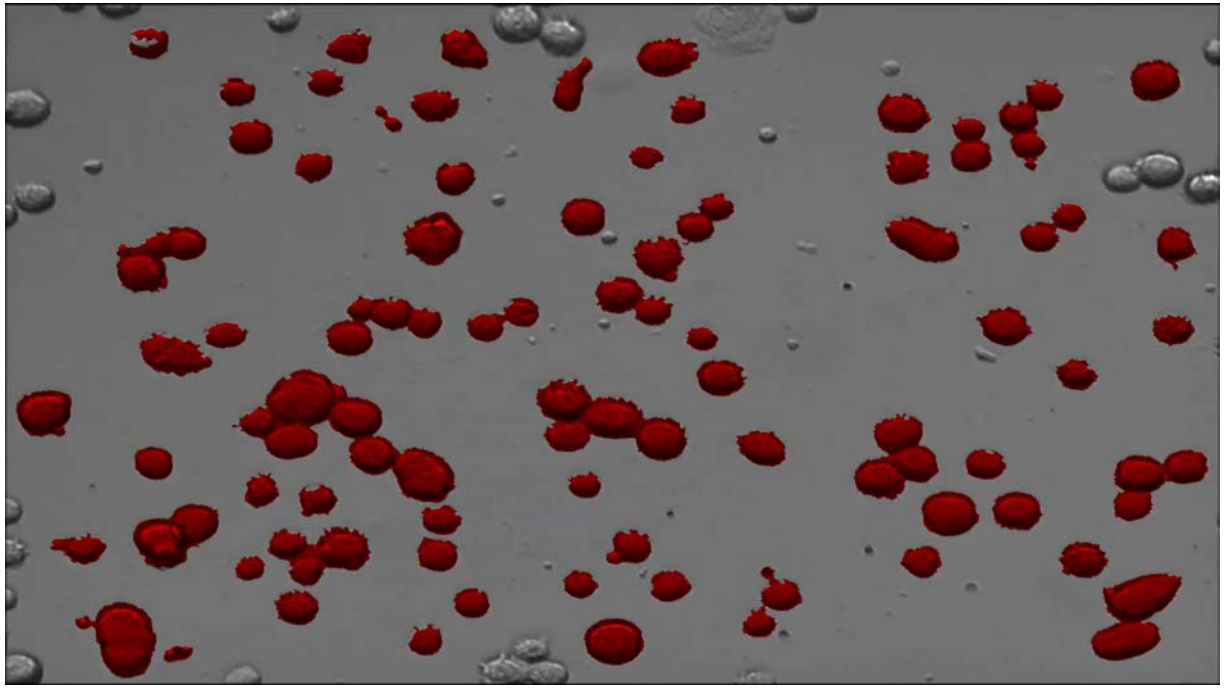


Tracking methods



Tracking Results





1. Ching-Fen Jiang, Shan-hui Hsu, Yu-Man Sun, Ming-Hong Tsai, “Quantitative Bioimage Analysis of Passaging Effect on the Migratory Behavior of Human Mesenchymal Stem Cells during Spheroid Formation”, *Cytometry Part A*, vol. 97, no. 4, pp. 394-406, 2020.04 (feature of the issue)

2. Ching-Fen Jiang*, Shan-hui Hsu, Ka-Pei Tsai, Ming-Hong Tsai, "Segmentation and Tracking of Stem Cells in Time Lapse Microscopy to Quantify Dynamic Behavioral Changes during Spheroid Formation", *Cytometry Part A*, vol. 87A, no. 6, pp. 491-502, 2015.06 **(SCI).**

顯微影像檢測系統及方法

用以檢測蛋白特徵物之顯微影像檢測系統以及顯微影像檢測方法

專利發明人：江青芬、蔡明宏

中華民國(I595372)、美國(US10274711B2)

中華民國專利證書

發明第 I595372 號

發明名稱：用以檢測蛋白特徵物之顯微影像檢測系統以及顯微影像檢測方法

專利權人：義守大學

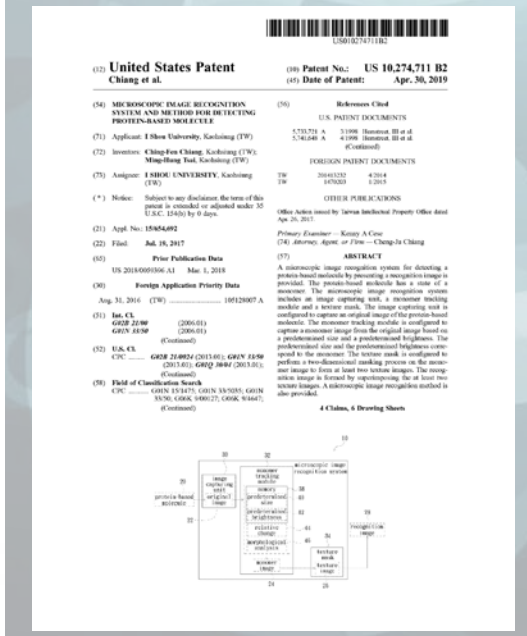
發明人：江青芬、蔡明宏

專利權期間：自2017年8月11日至2036年8月30日止

上開發明業經專利權人依專利法之規定取得專利權

經濟部智慧財產局 局長 洪淑敏

中華民國 106 年 8 月 11 日



(12) United States Patent
Chiang et al.

(10) Patent No.: US 10,274,711 B2
(45) Date of Patent: Apr. 30, 2019

(54) MICROSCOPIC IMAGE RECOGNITION SYSTEM AND METHOD FOR DETECTING PROTEIN-BASED MOLECULE

(71) Applicant: I Shou University, Kaohsiung (TW)

(72) Inventors: Ching-Fen Chiang, Kaohsiung (TW); Ming-Hung Tsai, Kaohsiung (TW)

(73) Assignee: I SHOU UNIVERSITY, Kaohsiung (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 15/654,692

(22) Filed: Jul. 19, 2017

(65) Prior Publication Data

US 2018/0059306 A1 Mar. 1, 2018

(30) Foreign Application Priority Data

Aug. 31, 2016 (TW) ..... 105126007 A

(51) Int. Cl.
G02B 21/00 (2006.01)
G01N 33/50 (2006.01)
(Continued)

(52) U.S. Cl.
CPC G02B 21/0024 (2013.01); G01N 33/50 (2013.01); G02Q 30/01 (2013.01);
(Continued)

(58) Field of Classification Search
CPC G01N 15/1475; G01N 33/5035; G01N 33/50; G06K 9/00127; G06K 9/4647;
(Continued)

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(Continued)

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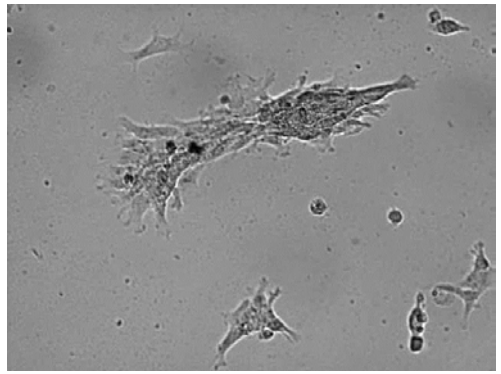
Office Action issued by Taiwan Intellectual Property Office dated Apr. 20, 2017.

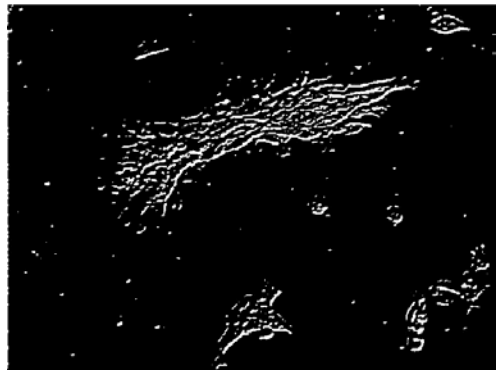
Primary Examiner — Kenny A Cese
(74) Attorney, Agent, or Firm — Ching-Ju Chiang

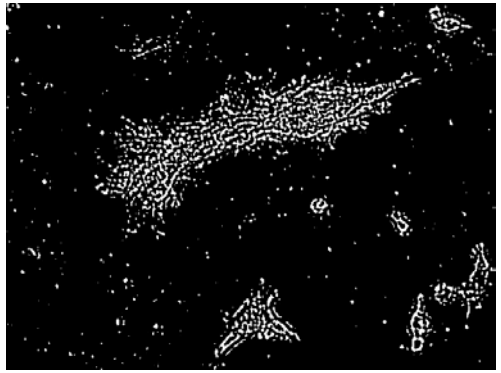
(57) ABSTRACT

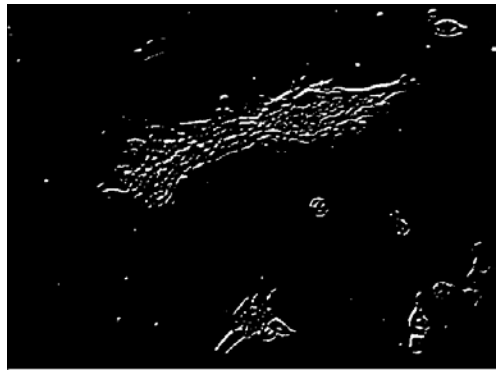
A microscopic image recognition system for detecting a protein-based molecule by presenting a recognition image is provided. The protein-based molecule has a state of a monomer. The microscopic image recognition system includes an image capturing unit, a monomer tracking module and a texture mask. The image capturing unit is configured to capture an original image of the protein-based molecule. The monomer tracking module is configured to capture a monomer image from the original image based on a predetermined size and a predetermined brightness. The predetermined size and the predetermined brightness correspond to the monomer. The texture mask is configured to perform a two-dimensional masking process on the monomer image to form at least two texture images. The recognition image is formed by superimposing the at least two texture images. A microscopic image recognition method is also provided.

4 Claims, 6 Drawing Sheets

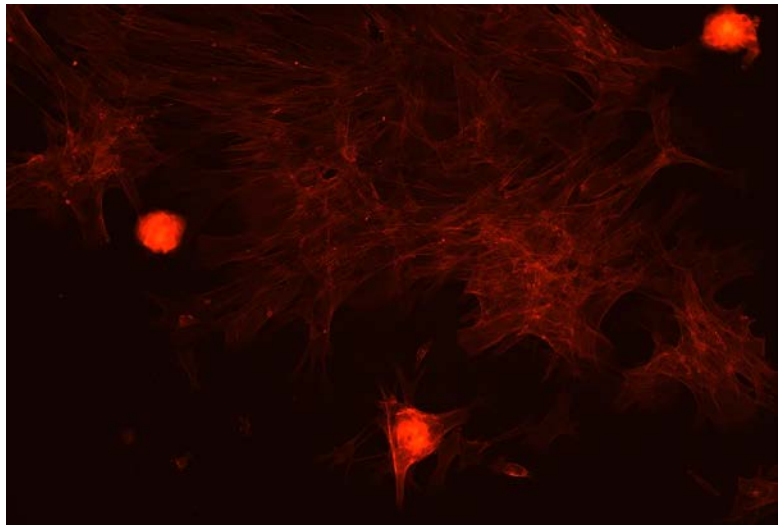


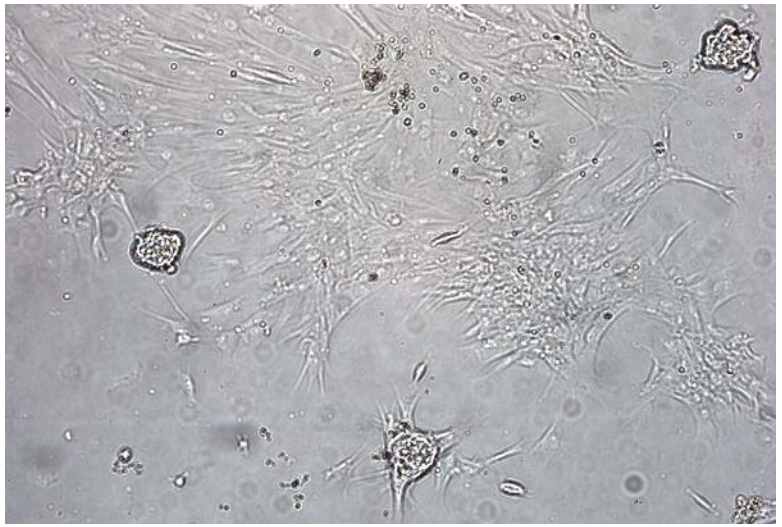


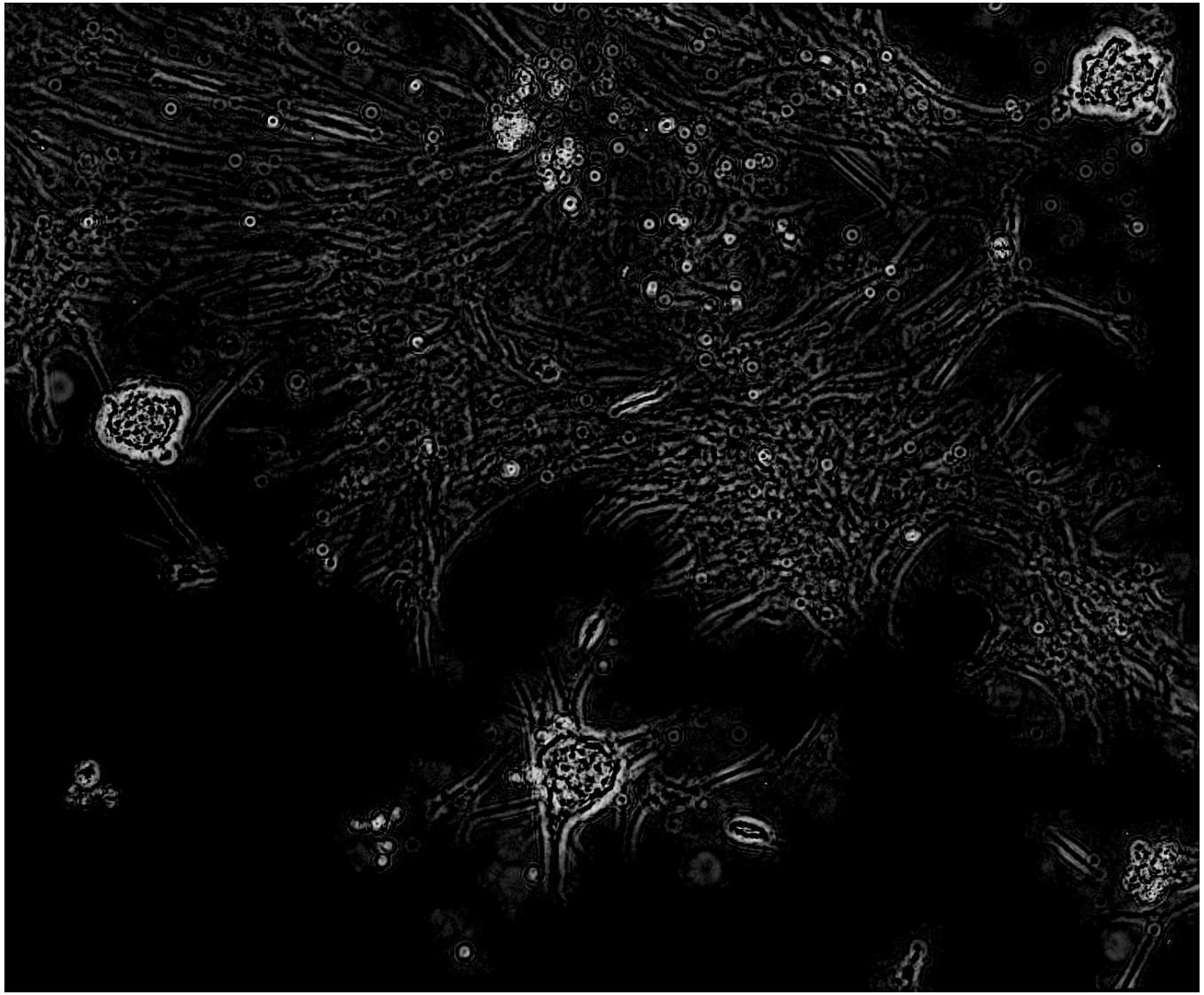


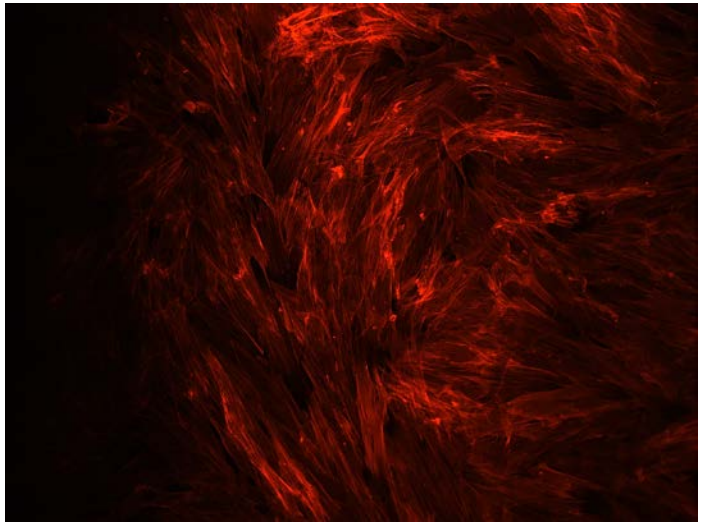


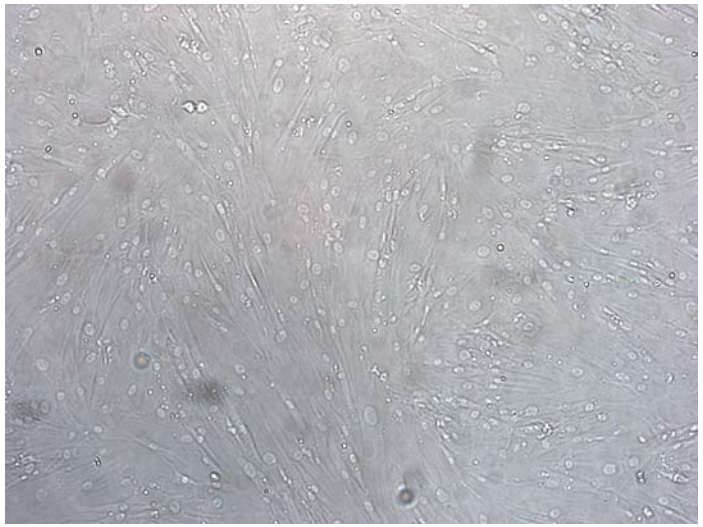
細胞蛋白纖維
紋理&
背景紋理移除

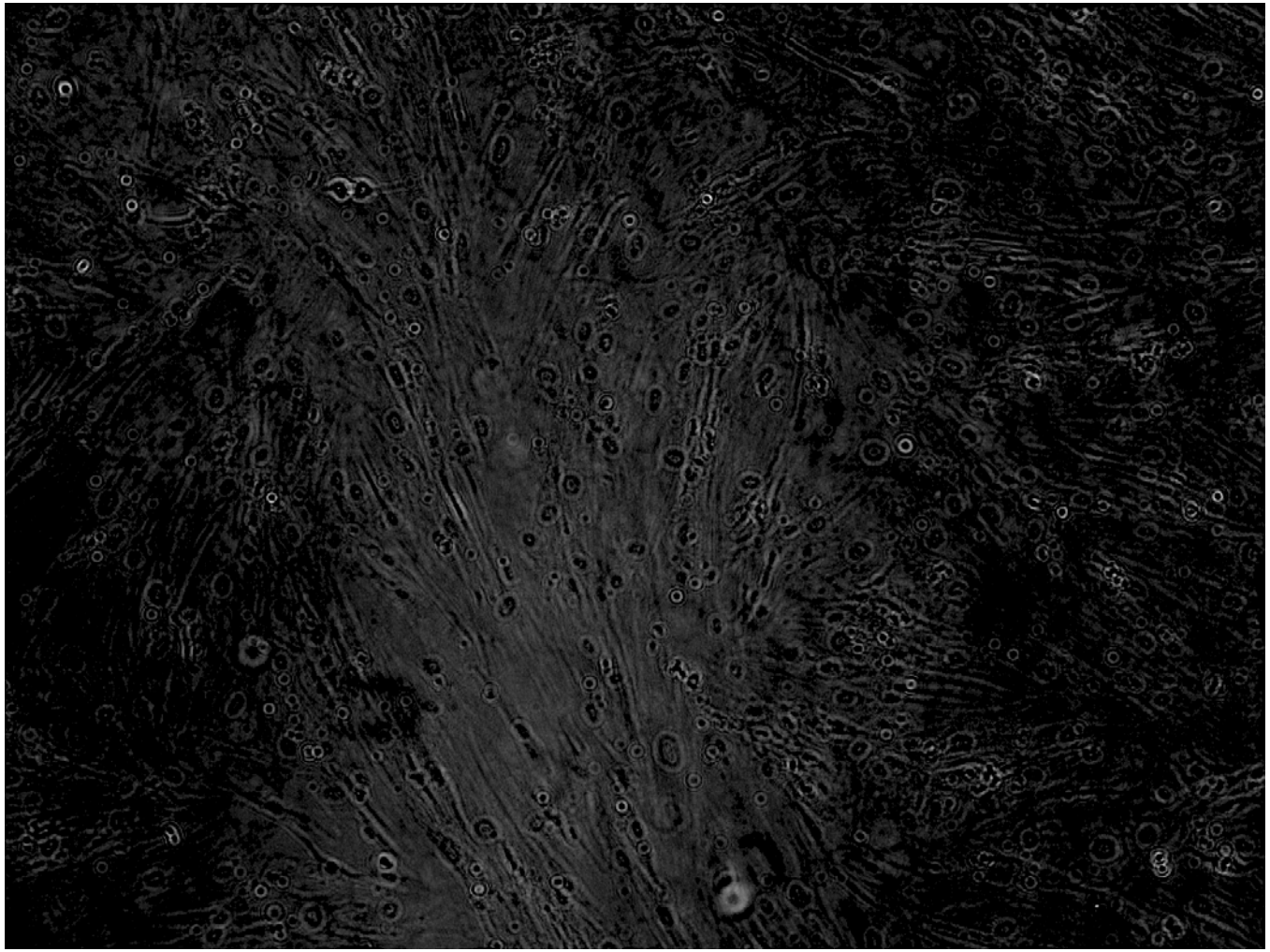




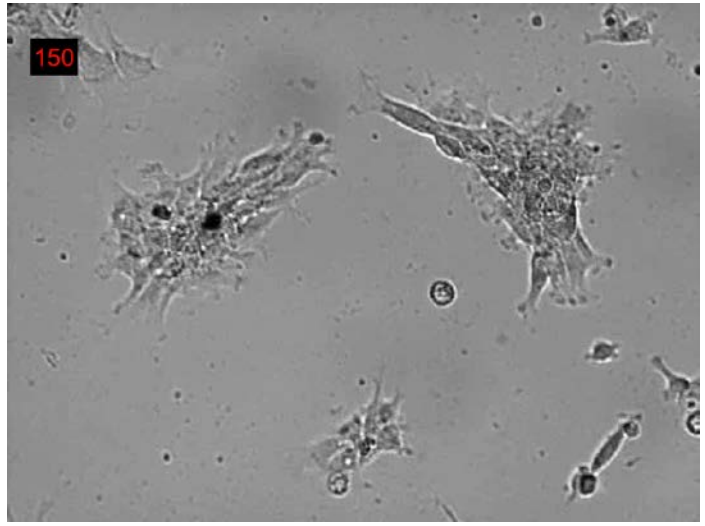




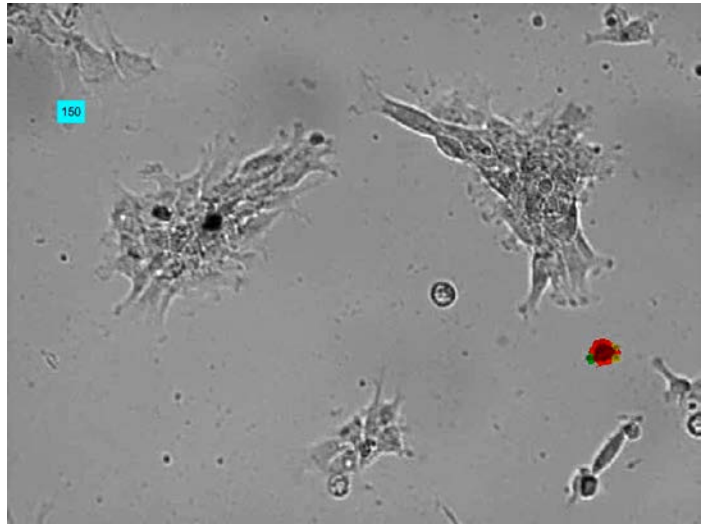




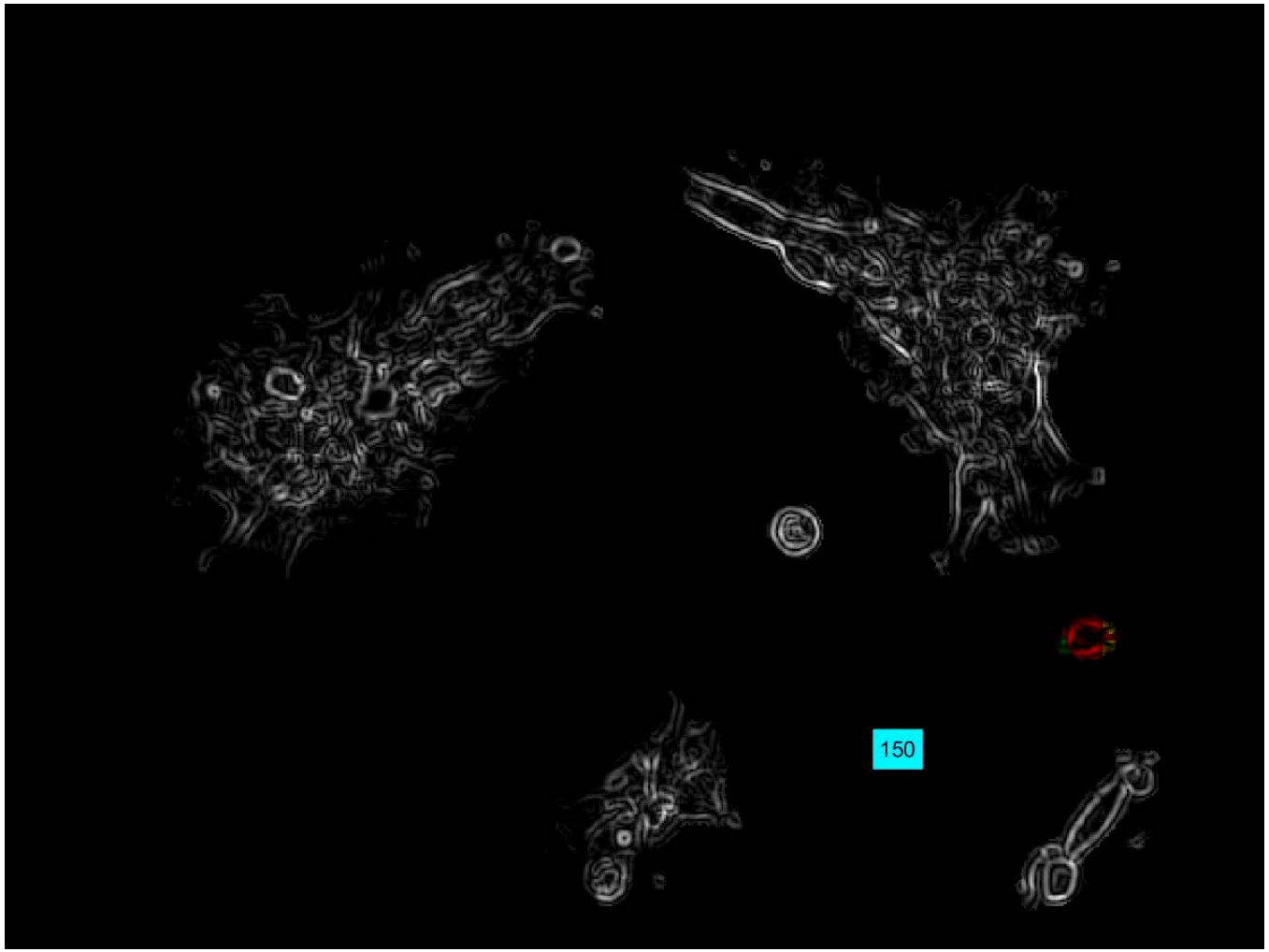
原始影像



單一細胞追蹤



對該特定細胞紋理分析



Trust me,

You can make it!