From Advanced Biomedical Imaging to Future Smart Healthcare

從先進的生物醫學成像看到未來的智能醫療

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Oct 2019
Imaging

- How many photos do you take per day?
- Snap shot, video or selfie
Face Recognition

1. **CAPTURING**
   Scanning existing images or using cameras

2. **EXTRACTING**
   Unique facial data is extracted from the image

3. **COMPARING**
   The data is compared with the database

4. **MATCHING**
   The software then decides whether the image matches any picture in the database or not
Applications

Face recognition
  - Access control
  - Payment
  - Security (e.g. airport, credit card – fraud detection)
  - Criminal identification
  - Surveillance
  - Marketing
  - Vending machine (UK)
  - Healthcare
PET, positron emission tomograph
LN-MRI, lymphotropic nanoparticle-enhanced MRI
MSCT, multislice CT

Biomedical Imaging
- fMRI
Region of the brain used in identifying faces

Experiments have shown that when people look at faces, areas in a region of the brain called the fusiform gyrus are activated. A new study by a Stanford neurologist investigated what happens when that section of the brain is overstimulated by an electrical charge.

Source: National Institutes of Health
Biomedical Imaging
Chest X-Ray: Lung Cancer

83 y/o F, aortic valve replacement

https://aimi.stanford.edu/medical-imagenet
Artificial Intelligence to improve imaging
- Deep Learning


https://aimi.stanford.edu/medical-imagenet
Provide ample and indepth information
MRI Human Brain

3D

Angiography

https://www.youtube.com/watch?v=aoBLGytBesg
Diffusion MRI

https://www.youtube.com/watch?v=Bjd8nPKKIU4
1. CAPTURING
Using medical imaging modalities

Biomedical imaging + Artificial Intelligence

2. EXTRACTING
Image features are extracted

3. COMPARING
The data is compared with the database

4. MATCHING
Similarities and differences can assist diagnosis
Healthcare applications

- Cloud healthcare

Healthcare applications - Robot

Capture human state and behavior

In-clinic and in-home servicing specific tasks

Snake-like robotic for endoscopic surgical procedures

Augment human mobility and capability

Human machine interaction

Learning and Adaptation

CityU
Focus areas at BME

Courses:
- Health Maintenance and Wellness Technology
- Biomedical Instrumentation
- Medical Imaging and Signal Processing
- Radiological Physics and Dosimetry
- Robotics and Machine Vision
- Biosafety and Security
- Tissue Engineering
- Biosensors and Biodevices
- Electrical and Electronic Principles
Learning Activities

- **Biomedical imaging lab class**
  - First MRI lab for undergraduates

**Preclinical MRI for Biomedical Imaging Laboratory**
（預臨床生物醫學磁共振成像實驗室）

**Bioluminescence Imaging**
Learning Activities

Robots

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Oversea Exchange/ Internship /Study Tour
Student Competitions / Awards

International Invention Innovation Competition in Canada (iCAN) 2018

HKEIA Innovation & Technology Project Competition 2016

Robocon 2016

Hong Kong Medical and Healthcare Device Industries Association (HKMHDIA) 2017

Cybathlon Championship for Athletes with Disabilities 2016

International Genetically Engineered Machine (iGEM) 2015
Career

- World Health Organization (WHO)

Imaging for medical purposes involves a team which includes the service of radiologists, radiographers (X-ray technologists), sonographers (ultrasound technologists), medical physicists, nurses, biomedical engineers, and other support staff working together to optimize the wellbeing of patients, one at a time. Appropriate use of medical imaging requires a multidisciplinary approach.

- Medical physicists
- BME departments at hospitals
- BESS (Biomedical Engineering Service Section) at Hospital Authority
- Biotechnology/Healthcare industry (e.g. Medical device)
Five technologies that will revolutionize healthcare by 2020

- Artificial Intelligence
  - machine or software with the ability to depict or mimic human brain functions
- 3D printing
  - tissue engineering
- Liquid Biopsy
  - cancer detection
- Immunotherapy
  - cancer therapy
- CRISPR
  - gene editing

Contact us

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