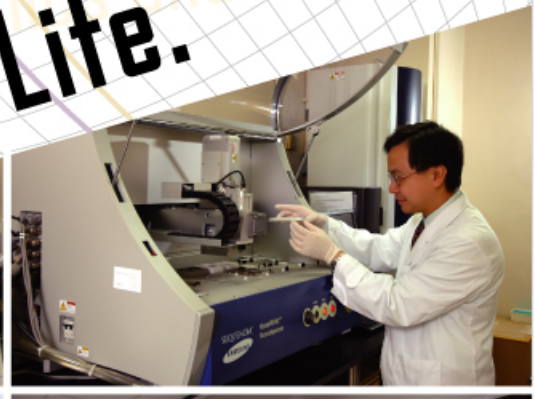
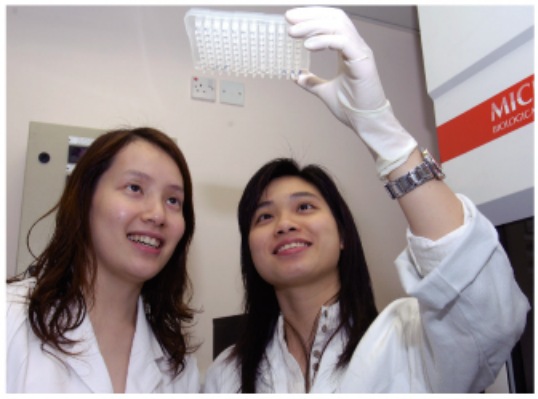
香港中文大學
THE CHINESE UNIVERSITY OF HONG KONG

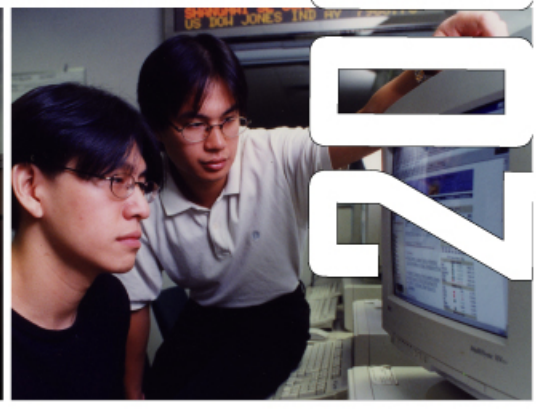
Biomedical Sciences
Information Sciences
Geoinformation and Earth Sciences
Economics and Finance

Innovation for Better Life.







2008

香港中文大學
THE CHINESE UNIVERSITY OF HONG KONG

Preface

The Chinese University of Hong Kong has advanced and excelled over the last four decades. As one of the leading comprehensive research universities in the region, the University engags in the exploration of new knowledge that is transferable to the community and contributes to the transformation of Hong Kong and the region to a knowledge-intensive and innovation-led society.

Technology Transfer: Centre for Innovation and Technology

The Centre for Innovation and Technology (CINTEC) in The Chinese University of Hong Kong is an unit that serves as a bridge between the University and the industry. CINTEC promotes communications, facilitates collaboration and fosters technology transfer to the society.

To facilitate communications, CINTEC regularly coordinates university participation in local and regional trade fairs. These participations serve as direct communication platforms between the society and our research teams. This year, CINTEC has extended the University's reach with worldwide research institutes and industries by participating in overseas technology fair, such as the "Research-to-Business 2008" in Italy.

香港中文大學在過去四十多年茁壯成長，今天已發展成為一所卓越的高等學府。作為領先區內的綜合研究型大學，中大積極探索有用於社會的新知識，致力推動香港以至區內邁向知識型，及以創新為主導的新社會形態。

創新科技中心促進科技轉移

香港中文大學創新科技中心是大學與業界溝通的橋樑，中心鼓勵雙方作多方面交流，並促成合作，使得大學研究成果用諸於社會。

為促進與業界的溝通，創新科技中心經常統籌大學各研究隊伍在本地以至區域性的科技展覽中參與展出，藉以提供社會與研究隊伍之間的直接溝通平台。今年，創新科技中心更把大學科研成果接觸面伸展至國際海外的展覽當中，如在義大利舉行的R2B 2008國際展覽會，就是一次與世界各地科研機構及業界接觸交流的好機會。

Prof. WONG Kam Fai
Director, Centre for Innovation and Technology
The Chinese University of Hong Kong
香港中文大學
創新科技中心主任
黃錦輝教授

序言

Researching in Future: Multidisciplinary Collaboration

Leading universities around the world are aware of the benefits of multidisciplinary collaboration among faculties, laboratories and research centres. The innovative research results produced often provide solutions to many of the society's most concerned problems.

CUHK encourages new research initiatives that bring together researchers across disciplines to combine their expertise to address major problems in the society. For example, a Joint Faculty Research Day was organized in June 2008 to promote and foster interdisciplinary research between Faculty of Engineering and Faculty of Science. CUHK also offers interdisciplinary programmes, e.g. MSc in Biomedical Engineering jointly organized by Faculty of Engineerings, Faculty of Medicine and Faculty of Science.

Connecting to China: State Key Laboratory

CUHK also contributes to the establishment of the regional innovative infrastructure and serves as a key player in the national research establishment. In April 2008, CUHK obtained approval of the Ministry of Science and Technology of China to set up the State Key Laboratory of Agrobiotechnology (CUHK), the second state key laboratory (SKL) at the University following the establishment of the State Key Laboratory in Oncology in South China (CUHK) in 2006. The laboratory aims to up-scale China's agricultural technology to the world frontier to increase agricultural productivity, safeguard food security in China and improve people's nutrition. Also in April, Ministry of Education (MOE) selected the MOE-Microsoft Key Laboratory of Human-Centric Computing and Interface Technologies (CUHK), established in May 2005, as one of the eight MOE Key Labs in China.

This brochure is complied by CINTEC to showcases the University's applied R&D results for promoting to the industry. The research projects are classified according to the five strategic research areas of the University: Chinese studies, Biomedical Sciences, Information Sciences, Economics and Finance, and Geoinformation and Earth Sciences, in which the University has attained landmark achievements.

If you are interested in any of the listed projects, or if there is any area you want to explore collaboration with our research teams, please feel free to contact us at CINTEC.

跨學科合作成科研新方向

世界各地著名大學都越來越重視不同學系、實驗室以至研究中心等跨學科合作研究，這些跨學科創新往往能為社會重要的問題帶來解決方案。

有見及此，香港中文大學鼓勵不同學科研究人員集合各自領域的專業見解，一同研究重大的社會問題，例如在2008年6月，工程學院與理學院合辦聯系研究日，目的為促進校內跨學科合作。此外，工程學院、醫學院和理學院更攜手合辦生物醫療工程碩士課程，實踐全方位跨學科研究活動。

連接祖國的國家重點實驗室

對於國家的科技研究建設及區內的創新環境，香港中文大學亦作出舉足輕重的貢獻。繼「華南腫瘤學國家重點實驗室」後，中大於2008年4月獲國家科學技術部批准成立「農業生物技術國家重點實驗室（香港中文大學）」，這是香港中文大學的第二個國家重點實驗室。該實驗室目標在於提升中國農業科技至世界頂峯，增加農業生產力、保障糧食安全、和改善人民從糧食攝取的營養。同年四月，國家教育部亦揀選了於2005年5月成立的「香港中文大學利群計算及界面科技教育部－微軟重點實驗室」作為教育部8間國家重點實驗室其中之一，成績令人鼓舞。

創新科技中心為向業界介紹大學的應用科研成果，特別编制這本小册子。研究項目根據大學五個重點策略範籌分類：即「中國研究」、「生物醫學科學」、「訊息科學」、「經濟與金融」及「地球信息與地球科學」。

如閣下對任何項目感到興趣，或有意與研究隊伍交流及了解某方面合作的可行性，歡迎隨時與我們聯絡。

Contact 聯絡方法

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Email 電郵 enquiry@cintec.cuhk.edu.hk

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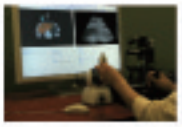



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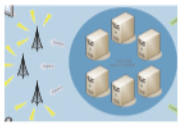

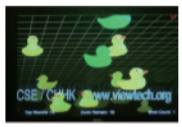



生物醫學科學
Biomedical Sciences

Virtual Human Visualization and Navigation
虛擬人體可視化與導航

Prof. HENG Pheng Ann
Department of Computer Science and Engineering
計算機科學與工程學系
王平安教授

Virtual medicine refers to the use of computer technologies in assisting the learning and training in medicine. One of the examples is virtual anatomy which can shorten the learning curve of understanding different human anatomical structure without the use of cadaver. The latest Chinese Visible Human (CVH) dataset is over 1 trillion bytes in data size; a virtual environment supporting highly precise visualization of such dataset is thus of great importance.

The limited texture memory on personal computer can only support visualization of relatively small datasets; such a limitation hinders a complete presentation of human anatomical details. The challenge of this project is to develop techniques for large-scale data visualization on the limited texture memory so that enormous data of human tissue structures can be interactively visualized with extra-fine fidelity.

虛擬醫學就是利用電腦技術來幫助醫學訓練與學習，例如虛擬解剖可以在沒有屍首的情況下縮短學習人體結構的時間。最新中國虛擬人的資料集容量已超過1萬億位元，要有效運用這龐大圖像資料庫，最重要當然要有一套高精確度的虛擬人體顯示平台。

目前電腦硬體的圖像紋理記憶容量有限，只能對較小資料庫進行視覺化處理，對於數據量龐大的人體組織結構，往往未能有效地顯示所有精密的細節。這個研究項目就是要解決圖像硬體引致的限制，實現大規模資料的視覺化，獲取大量的人體組織結構，清楚顯示其精密的結果。

Precise hand areolar connective tissue
精細手部空隙解剖

Highly precise subcutaneous capillary
高清晰皮下的毛細血管

Distinct anatomic structures
清晰解剖結構

We have deployed novel Graphics Processing Unit (GPU) accelerated visualization technique for high quality rendering. Our lossless texture compression technique has been optimized for GPU. Virtual navigation of human tissues (of 12G) can be interactively performed on a personal computer so that the details of human organ be clearly studied in real-time.

我們開發了一套基於個人電腦圖像卡的高質量描繪運算顯示加速技術，所用的圖像紋理無損壓縮法亦因應圖像硬體特別優化，即使處理一百二十億(12GB)的人體組織資料，也能以互動導航形式即時高清顯示人體器官組織的細節。

Funded by Innovation and Technology Commission and Vascular Intervention and Radiology Foundation
由創新科技署及透視微創治療基金資助

Prof. HENG Pheng Ann
Department of Computer Science and Engineering
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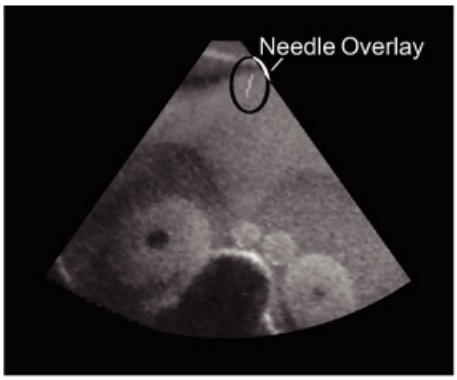
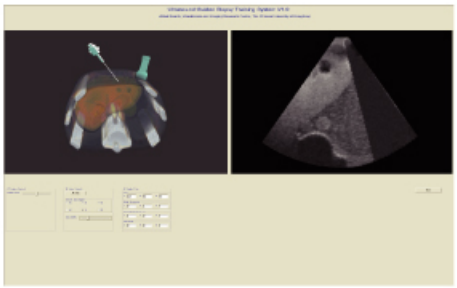
王平安教授

Ultrasound-guided Biopsy Simulation
超聲引導穿刺活體檢查訓練系統



Simulated needle insertion
針刺模擬



User interface
用戶介面

One of the most fundamental, but difficult, skills to acquire interventional radiology is ultrasound guided biopsy. Biopsy is the process of taking a sample of tissue from the body for analysis. The success of these procedures is dependant on the correct alignment of the biopsy needle with the scanning plane of the ultrasound probe; and with the target lesion.

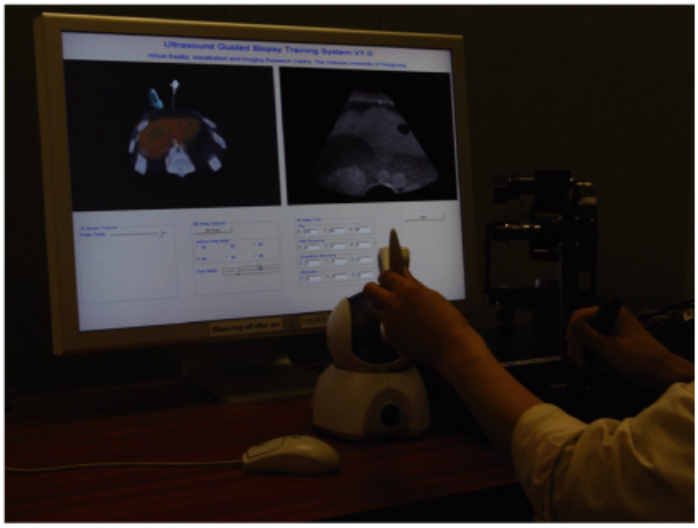
Biopsy procedure requires considerable hand eye co-ordination to perform and repeated practice to perfect. The ability to place a needle precisely into the target under ultrasound guidance is also the common first step in many complex interventional procedures. Currently the training in such procedures states that a significant proportion of the experience required by trainees can only be obtained in time spent practicing on live patients.

在介入放射學中，超聲引導穿刺活體檢查是一種最基本但難以掌握的技術。活體檢查是一個通過穿刺從病人體內提取組織樣本作病理分析的過程。該手術的成功取決於活檢針、超聲掃描圖像和目標病變組織的準確對位。

活體檢查手術需要很好的手眼協調能力，掌握該技術需要反復的練習。在超聲引導下將針頭精確地刺入目標組織也是很多複雜介入手術的第一個基本步驟。目前在該手術的訓練中，實習醫生的經驗很大程度上是從活體病人身上獲得的。

We have built a prototype virtual reality ultrasound guided organ biopsy system to facilitate the training of radiologists and physicians in ultrasound guided interventional procedures. The research issues addressed include a 3D anatomical model reconstruction, data fusion of multiple modalities data, realistic visualization and interactive navigation, and multi-sensory feedbacks. The proposed system can provide trainees with a structured learning experience, permitting practice with no danger to patients.

我們完成了一個初步的超聲引導組織穿刺虛擬現實系統來幫助放射學醫生在超聲引導介入手術方面的訓練。所研究的主要內容包括：三維組織模型的重建、多模態的資料融合、真實感的三維顯示和交互以及多種感覺的反饋。我們提出的訓練系統可以為實習醫生提供系統化的學習經驗，並且不會對病人產生任何危險。



Hardware interface
硬件介面

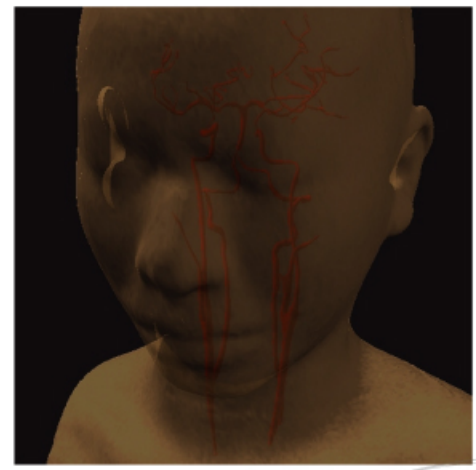
Funded by Reseach Grants Council
由研究資助局資助

Vascular Intervention and Radiology Simulation
透視微創模擬系統

Prof. HENG Pheng Ann
Department of Computer Science and Engineering
計算機科學與工程學系
王平安教授

Vascular Interventional Radiology (VIR), an indispensable standard component of modern medicine, of which the demand increases rapidly over the past decade. We aim to develop an interactive visualization system of 3D physiological anatomy and vascular network and to develop a multi-sensory virtual reality based simulator for education, training, and evaluation of medical personnel in percutaneous and transcatheter VIR procedures.

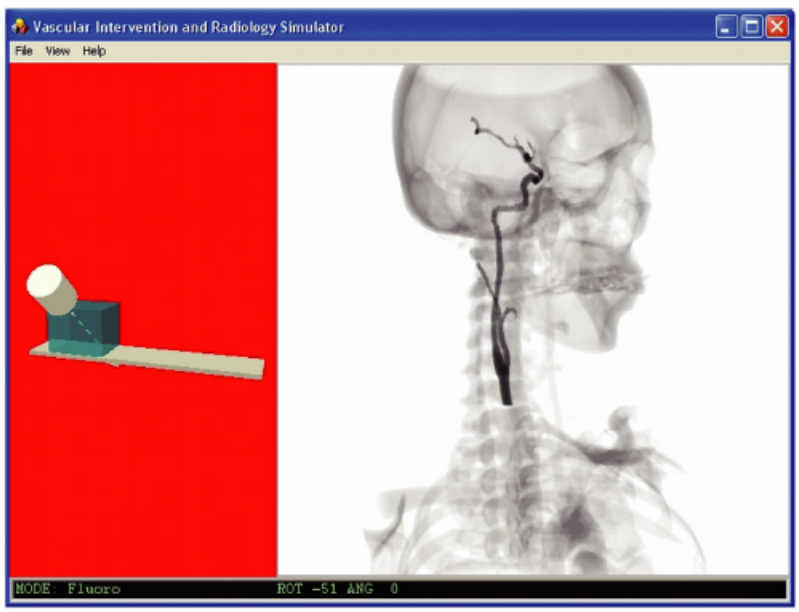
The research and development challenges include 3D anatomic model reconstruction of organs and vascular network from CVH data, interactive navigation and visualization, physiological simulation (likes respiration and blood flow) and realistic simulation of percutaneous and transcatheter procedures with multi-sensory feedbacks. This training system will provide simulated ultrasound-guided percutaneous needle insertion and virtual fluoroscopy for transcatheter procedures in real time.



Anatomical navigation
解剖導航

透視微創治療已成為現代醫學不可缺少的一項常規技術，近年來需求量迅速增大。我們的目標是開發一套融合三維血管網等生理解剖的互動式可視化系統與多重感覺虛擬現實模擬系統，用於透視微創治療的教育、訓練及操作評估。

此項目研究困難在於：利用中國可視人數據重建得到血管網等不同組織的三維解剖模型、互動式導航及可視化、生理功能模擬（如呼吸和血流等）與多重感覺的力反饋仿真模擬，並提供超聲波引導針刺模擬與實時虛擬透視檢查。



User interface
用戶介面

Our system is a cost-effective approach to provide standardized clinical education, training and accelerated learning for various percutaneous interventions on the treatment of tumors and blood vessel diseases etc. The proposed system will benefit trainees with articulated learning experiences allowing practice with no harm to patients.

此系統為腫瘤及血管疾病等透視微創治療的教育和訓練提供一套成本效益較高的方法。受訓者可在完全不傷害病人下進行系統化的學習和訓練。

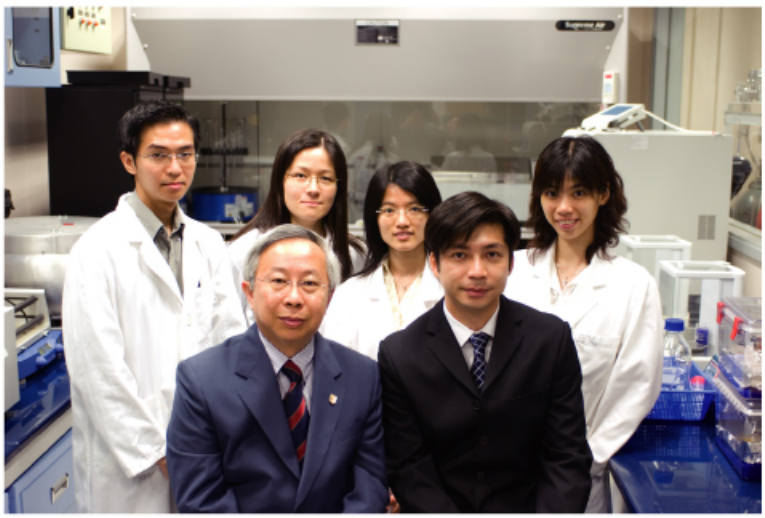
Funded by Innovation and Technology Commission and Vascular Intervention and Radiology Foundation
由創新科技署及透視微創治療基金資助

Prof. KWAN Hoi Shan
Food Research Centre
食品研究中心
關海山教授

Food Composition Database

Owing to the increasing public awareness of the nutritional value of food consumed and produced in Hong Kong, nutrition label becomes an important tool for consumers to choose their food. Food and Drugs (Composition and Labelling) (Amendment: Requirements for Nutrition Labelling and Nutrition Claim) Regulation 2008 (Amendment Regulation) was enacted by the Legislative Council on 28 May 2008 and will come into effect on 1 July 2010. Apart from those exempted products, it is mandatory for all prepackaged foods to carry nutrition labels, which must list information on energy plus 7 core nutrients. Moreover, nutrition labels must list the amounts of nutrients related to claims. There will be a two-year grace period for the local food industry to prepare.

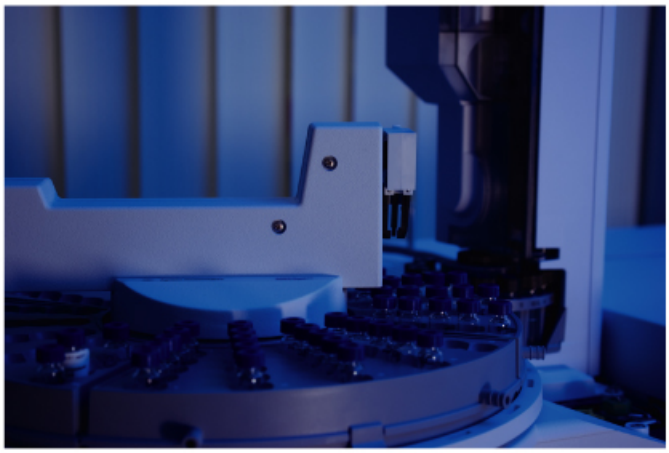
In order to comply with the Amendment Regulation, local food trade will need to create suitable nutrition labels for their individual products, while the extra costs involved (such as food composition analysis, printing nutrition labels and re-packaging etc.) would undoubtedly be a great burden to the local food trade especially the small and medium enterprises (SMEs). The most direct method for the trade to create their nutrition labels is based on the nutrition information obtained from laboratories' analytical results, however, these analysis are not only expensive (HK$ 4,000-8,000 per sample), but the results are also product-specific. Another practical and relatively economical means is indirectly calculated the products' nutrient contents with reference to the data of those internationally recognized food composition tables. Nevertheless, there is a lack of nutrition data on many local food ingredients in the food composition tables throughout the world at present. Besides, there is also no technical support for the trade to comply with the upcoming Amendment Regulation offered by any local organizations.



隨着消費者愈來愈關注食物的營養價值，食品包裝上的營養標籤已成為他們選擇食物的重要工具。《2008年食物及藥物(成分組合及標籤)(修訂：關於營養標籤及營養聲稱的規定)規例》(《修訂規例》)已於2008年5月28日獲立法會通過，並將於2010年7月1日起實施。屆時所有預先包裝食物（獲豁免的產品除外）必須附有營養標籤，並載列熱量加7種核心營養素資料。此外，凡涉及聲稱的其他營養素亦必須於營養標籤中標明含量。本地食品業將有兩年寬限期作準備。

為符合有關制度要求，香港食品業將須為個別產品製作合適的營養標籤，而當中涉及的額外成本 （營養成分分析、印製營養標籤及重新包裝等），必將為本地食品業（尤其中小企業）帶來沉重的負擔。雖然業界為產品製作營養標籤的最直接方法為營養資料取自化驗室的檢測結果，但此方法不但費用高昂(每個樣本約為港幣4,000-8,000元)，而且只針對單一產品；另一可行及較經濟的做法則為參考國際認可的食物成分表上的資料，間接計算產品的營養素含量。然而，目前世界各國的食物成分表缺乏本地常用食品原料之營養資料，而本地亦未有任何機構就即將推行的制度為業界提供技術支援。

食品成分資料庫



Funded by The Hong Kong Jockey Club Charities Trust and supported by Centre for Food Safety, Food and Environmental Hygiene Department, Food Research Centre of The Chinese University of Hong Kong initiated to set up the first Food Composition Database in Hong Kong which has been commenced to operate since July 2007. Apart from analyzing over 1,000 food ingredients and products commonly used in the local territory in 2 years, the Database will provide detailed food composition reference data and technical support for the local food industry (especially the SMEs) via its website with an aim to assist the industry to comply with the upcoming Amendment Regulation. Besides, in addition to disseminating the latest progress of the Amendment Regulation, the Database will regularly promote the concept of nutrition label and balanced diet to the local food industry and the public via various channels such as website, poster, brochure, workshops and forums.

For details, please visit:
http://foodcompdb.fns.cuhk.edu.hk/

香港中文大學食品研究中心有幸獲得香港賽馬會慈善信託基金捐助以及食物環境衞生署食物安全中心全力支持，創立全港首個食品成分資料庫。資料庫已於2007年7月正式運作，將於兩年內為本地千多種具代表性的常用食品原料及產品進行營養成分分析，並透過資料庫的網站向本地食品業（尤其中小企業）提供實用的食品成分參考資料及技術支援，以協助業界配合快將推行的修訂規例。此外，資料庫亦會定期透過網站、宣傳海報、小冊子等渠道，向業界及公眾提供有關修訂規例的最新資訊，以及推廣營養標籤和均衡飲食的概念。

有關詳情請瀏覽食品成分資料庫網站：
http://foodcompdb.fns.cuhk.edu.hk/

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Core Facilities Serving Biomedical Sciences -Rapid Full Genome Sequencing

生物醫學重點設施 – 快速基因組測序

Prof. Kwan Hoi Shan
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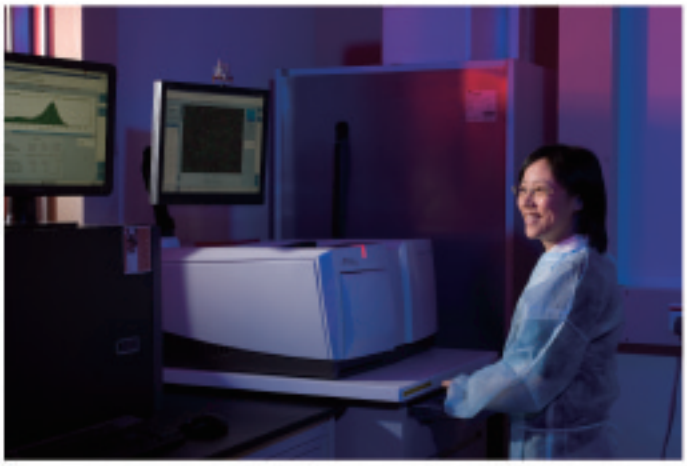

The DNA sequence of an individual not only determines one's physical appearance, but also unveils useful information such as susceptibility to diseases and undesirable drug induced responses. The sequence information may provide clues to the prevention, diagnosis and treatment of diseases like cancer, diabetes and many genetic diseases. Foodborne infection caused by bacterial pathogens is a common and important public health issue. Determining the genome sequence of these pathogens may expedite the identification of pathogen and may provide a better understanding of pathogenesis.

Conventional DNA sequencing is a costly, laborious and use of DNA sequencing technologies and to foster innovative applications, CUHK scientists have acquired the latest sequencing equipment, which allows the generation of genome sequence information 100 times faster than conventional DNA sequencing systems. This latest sequencing equipment offers sequence data of much higher throughput with a drastic cost reduction by 90%.

脫氧核糖核酸序列不僅決定個人的外觀，而且還決定個人對疾病的易感性及藥物誘導的不良反應。脫氧核糖核酸序列也可以提供一些資料來預防、診斷和治療致命性疾病，如癌症、糖尿病和遺傳病。細菌所造成的食源性感染是常見及重要的公共衛生問題。確定細菌的基因序列，更可加快病原鑑定，並了解其發病機制。

傳統脫氧核糖核酸測序不僅費用高昂，而且費時費力。為使脫氧核糖核酸序列技術被廣泛應用，香港中文大學科學家們利用最新測序設備及優化實驗過程，令基因測序過程比傳統方法快100倍，而且成本更可減少達90% 。

This fast, high-throughput and accurate sequencing system will open up new application in DNA sequencing, including personalized medicine and diagnosis, oncology research, understanding third world diseases, and providing fast responses to bioterrorism. The high-throughput system also unveils the genome sequence of microbes such as food pathogens rapidly with a very reasonable cost. The microbe genome databases will shorten the time to identify pathogen and assist the investigation of pathogenesis.

快速準確的序列分析系統為生物信息學開闢新的一頁，包括個性化醫學診斷、腫瘤及世界第三疾病研究，並防止生物恐怖主義。快速序列分析更能顯示微生物的基因組序列，以合理成本識別受污染食品中的微生物。微生物基因組數據庫更能縮短檢測時間，找出病原，並協助調查污染源頭。

Steering Committee for Biomedical Sciences,
Chinese University of Hong Kong
香港中文大生物醫學科學督導委員會

Chinese Medicine Research and Further Development
中醫中藥研究與發展

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梁秉中教授

In 2001, the project "Chinese Medicine Research and Further Development", led by the Institute of Chinese Medicine of CUHK, was selected as an "Area of Excellence" by the University Grants Committee (UGC) and was awarded HK$25 million for research and development. This is a 5-year project targeting at areas where western medicine has no optimal solution, including viral infection, chronic disorder, degenerative disease, allergy and preventive therapy.
In 2007, the UGC has awarded a sustained funding for 3 years to the project for further development. Two priority projects on "diabetic foot ulcer" and "cardiovascular tonic" are to be further studied.
Researches on Chinese medicine as the alternative remedies complementary to conventional modern medicine have drawn increasing attention. Reports on anecdotal observations or pure laboratory-based studies on Chinese medicines are numerous. has attempted to integrate the laboratory and clinical investigation of Chinese medicine. Example on objective evaluation of the therapeutical application of Chinese medicine remains lacking. To develop the Chinese medicine which is complex in nature into a modern science and art of healing, and to bring Chinese medicine into the international market, a comprehensive efficacy driven approach aiming at safety, quality control and objective proof of efficacy is necessary.

由香港中文大學中醫中藥研究所統籌的「中醫中藥研究與發展」項目於二零零一年榮獲大學教育資助委員會甄選為「卓越學科領域」，並獲撥款二千五百萬元作為研究及發展。這項五年項目主要針對傳統西方醫學仍未有解決良方之範疇，包括“病毒感染”，“失調”，“衰退性疾病”，“敏感”及“治未病”。
隨後於二零零七年，項目再次獲得大學教育資助委員會三年撥款，用作持續發展兩項主要項目，包括“糖尿足潰爛”及“心血管保健”之研究。
從中醫藥中尋找可互補西方醫學未有完善解決方案的有關研究漸受關注。相關研究發表的文章亦為數不少，內容多以有趣的觀察或基礎實驗室研究結果為主，但未見有綜合實驗室研究及臨床探究相關的中醫藥報導，以至缺乏客觀評估中醫藥療效研究的參考例子。要將成份複雜的中醫藥發展成一門現代的科學及能切實應用於治療，並帶進國際的市場，必需採用一個綜合以療效主導的研究方向，當中以安全應用、品質控制及客觀療效確據為基礎。

A unique three-prong efficacy-driven approach is adopted for the research on Chinese medicine as the alternative adjuvant remedies to difficult areas in clinical practice. The unique approach emphasizes on the objective clinical proof of efficacy, while in parallel, understanding the mechanisms of action, quality control and safe applications. A vast inter-institutional collaboration is thus established with the participation of clinicians, biologists, biochemists, pharmacologists, pharmacists and chemists. The project features the integration of laboratory investigation and evidence-based clinical trial leading to a remarkable example of an objective evaluation of the therapeutical application of the Chinese medicine.

整個研究項目採納了一個獨特的三向療效主導的研究路向，希望在西方醫學未能完全解決的難題上可找到能互補的中醫藥。該獨特的研究路向注重客觀的臨床療效實証，同時亦以深入了解中藥方劑的活性機理、品質控制及安全應用為研究基礎。因此，參與研究的專家包括臨床醫生、生物學家、生物化學家、藥理學家、藥劑學家及化學家，組成了一個跨院校的龐大合作網路。整個研究體現實驗室研究及實証為據的臨床研究的相融合，為客觀研究中醫藥的療效樹立了一個重要的例子。

Funded by University Grants Committee
– Areas of Excellence Scheme
Collaboration with HKUST, PolyU, CityU
由大學資助委員會卓越學科領域資助
合作夥伴為香港科技大學、香港理工大學及香港城市大學

Scientifically Validated Chinese Medicine for Cardiovascular Disorder
科學驗證心血管疾病中藥成效

Prof. LIN Ge
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林革教授

Rhizoma Chuanxiong

Chinese herbal medicine has a history of thousands years and has proven to provide effective cure and minimal side effects. Rhizoma Chuanxiong is an effective herb clinically used for the protection and treatment of cardiovascular disorders. It has been widely used in Chinese communities for treatment of

- Angina pectoris
- Ischemic stroke
- Thrombosis
- Migraine, or
- Pain induced by blood stagnation syndrome"

However, scientific evidence for validating its therapeutic value and clear knowledge of chemical and pharmacological bases are not completely developed.

川芎

中藥已有上萬年歷史，並已證實能以最小副作用治療各種疾病。川芎是一種臨床上用於保護及治療心血管疾病的中藥。它已被廣泛用於華人社區，以治療

- 心絞痛
- 缺血性中風
- 血栓塞
- 偏頭痛，或
- 用於“活血化淤”

然而，現今中藥缺乏科學證據證實其治療價值、化學成分及藥理活性。

A novel integrated production process has been developed at CUHK with which a Chuanxiong-based drug was developed. For effective quality control and consistent therapeutic value, a proprietary processes have been developed. It covers:

- Source of Herb: Good agricultural practices and plant authentication by DNA analysis
- Crude Extraction: Process for supercritical fluid extraction from herb
- Absorbable Active Ingredients: Oral absorbable ingredients are identified with their appropriate proportions for optimal synergistic effects

Features of potential Chuanxiong-based product developed by CUHK:

- Sublingual fast delivery
- Strong anti-thrombotic action plus moderate vasodilatation and anti-platelet aggregation
- No gastric side effects
- No significant bleeding effects
- No interactions with aspirin or warfarin

香港中文大學開發一種嶄新綜合中藥生產過程，其中以川芎為主要成分的中藥，更成為研究目標。為有效地控制質量，研究包括：

- 藥草來源：耕種規範及植物DNA驗證分析
- 提煉：超臨界提取技術
- 可吸收的活性成分：特定口服比例，具協同效應

中文大學研發川芎產品的特點：

- 舌下含化快速傳達
- 具抗血栓形成，溫和血管舒張及抗血小板凝聚作用
- 無灼胃副作用
- 不與阿司匹林或華法林互相作用
- 無內出血副作用

Funded by Innovation and Technology Commission
由創新科技署資助

A Bio-activity Guided in Vitro Pharmacokinetic Method for Quality Control
以生物活性為指導的體外藥代動力學方法在中藥產品品質控制中的應用--單味中藥材及中藥複方製劑的實例

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School of Pharmacy
藥劑學院
周煜森教授
左中教授

Lack of good quality control (QC) of Traditional Chinese Medicine (TCM) products is a concern. Without good QC, the efficacy and safety of TCM products are difficult to establish and worldwide acceptance of TCM is unlikely. The purpose of this project is to demonstrate an improved QC method of TCM product by using a bioactivity guided pharmacokinetic method (BAPK): utilizing Si-Wu-Tang as an example.

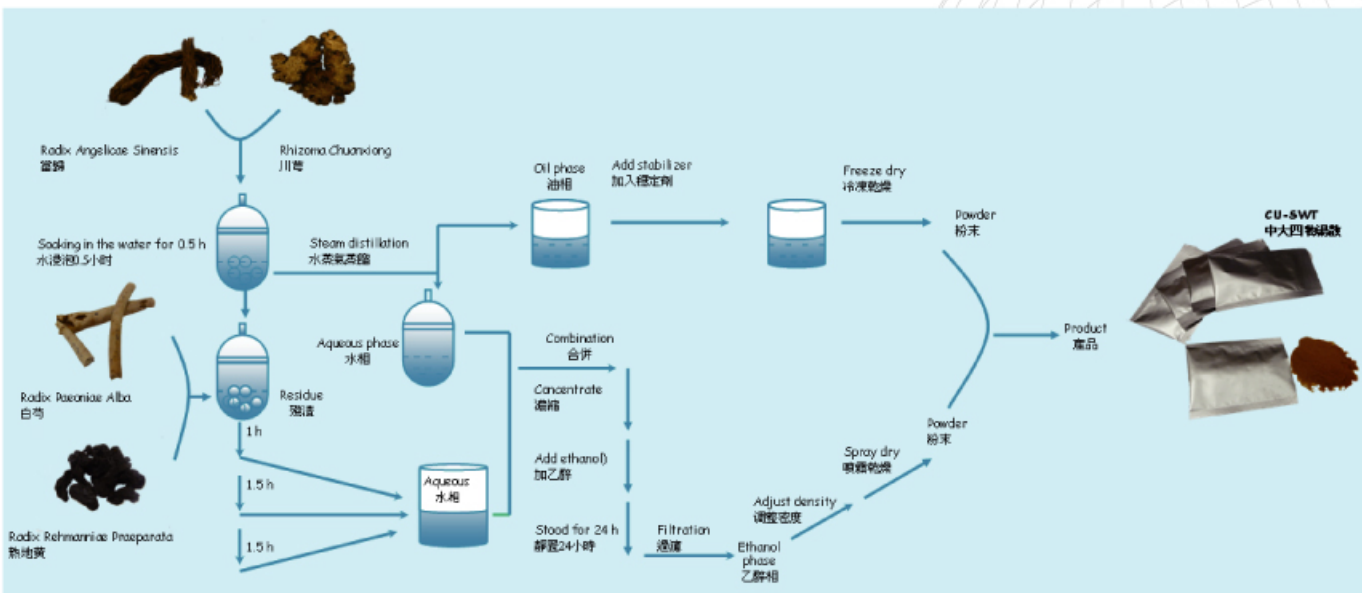
The BAPK method aims to provide a more relevant approach for QC. The existing method of QC for TCM involves stability test using any designated marker(s); such markers are usually chosen arbitrarily with no relevance to the product activity and could be quite meaningless.

The BAPK method combines identification of bioactive component(s) of a given TCM product and rapidly determines their absorption potential by using a rapid in vitro approach. The applicability of this new BAPK method has been demonstrated to Si-Wu-Tang (SWT) products. The BAPK method is able to distinguish different SWT products and one specially manufactured. SWT product is found to meet the specification recommended in the Chinese Pharmacopoeia much better than other products sold in the market.

目前傳統中藥產品缺少一個完善的品質控制方法。沒有品質控制的中藥產品，其功效和安全性很難保證，從而很難被廣泛接受。本項目旨在用生物活性指導的藥代動力學方法（BAPK法）來改進現有中藥產品 （四物湯爲例）的品質控制方法。

BAPK法旨在提高質量控制方法的相關性。目前中藥品質控制是檢測產品中標記化合物的含量。因爲這些標記化合物可能與產品的活性完全無關，所以此種質控可能完全沒有意義。

BAPK法結合了對產品中活性化合物以及可吸收成分的肯定。該方法被應用於檢測四種市售及本項目專門生產的四物湯產品。本專案產品不僅能達到要中國藥典的要求，而且比市售的同類產品包含更多的活性成分。



Funded by Innovation and Technology Commission
Collaboration with
Zigen Pharmaceutical Limited
由創新科技署資助
合作夥伴為時珍科技藥業有限公司

Chinese Medicine for Treatment of Terminal Liver Cancer
治療晚期肝癌中藥

Prof. Ho Wing Shing John
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何永成教授

Liver Cancer is the fifth most common cancer with high lethal rate worldwide. There are 10 to 20 cases per 100,000 reported in Asian population. It is the second leading cause of cancer death and there are 1500 new cases found every year in Hong Kong. The treatment of the liver cancer has been very difficult.

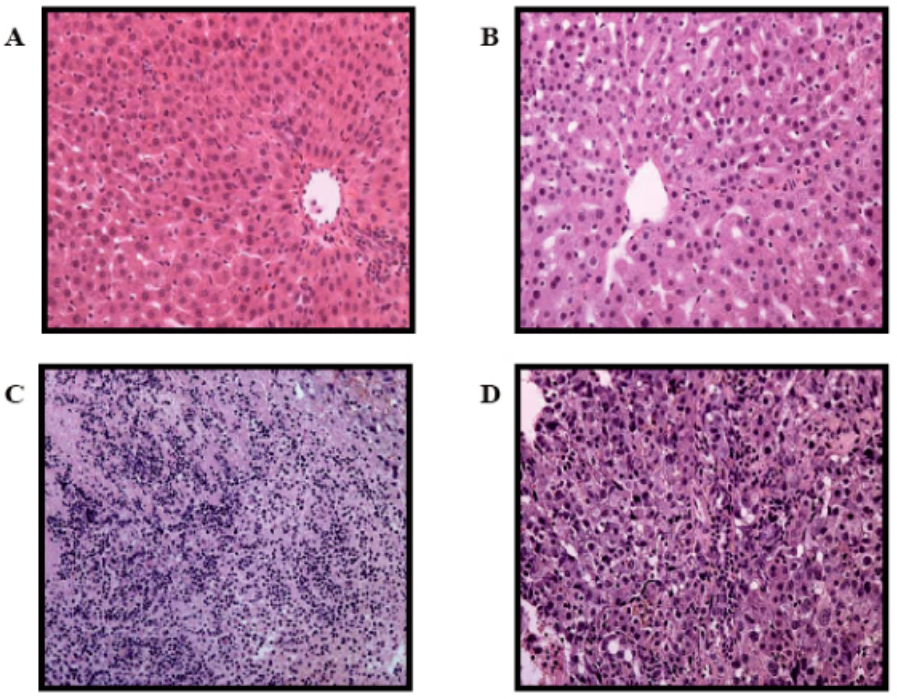
Through continuous research in isolation, purification and identification of active components from traditional Chinese medicine, CUHK has developed different nano-molecules that have excellent potential for effective treatment of liver cancer including the terminal stage cancer.

肝癌乃五大常見癌症之一。每十萬亞洲人口中，便有 10-20 個病例。肝癌已成為第二號殺手，香港每年大約有1500宗新症，治療晚期肝癌更是非常困難。

通過不斷研究，香港中文大學從傳統中藥中分離、純化和鑑定活性成分，從而研發出一種具治療晚期肝癌功效的化合物。

These compounds have been tested one at a time in rats with liver cancer for more than a year. It demonstrated excellent results in vitro and in vivo tests, such as enzyme assays, histological analysis, cDNA micro-array, urinary nucleosides contents, etc. 100% of the rats responded to the treatment with the compound. No side effect was found after more than a year of continuous study in the rats. The results suggest an excellent chance of success for cancer therapy in humans.

該化合物已在老鼠身上測試超過1年，如酵素活性實驗、組織分析、核酸晶片及尿中核苷等等體外及體內測試均証明效果顯著。測試中所有實驗鼠皆對化合物治療作出反應，在一年以上的持續研究中，並無發現副作用，証明該化合物對治療人類肝癌應有很大潛力。



Hematoxylin & Eosin (H&E) staining of rat livers in the progression stage of hepatocarcinogenesis

A) The liver section of a negative control rat (20X)

B) The liver section of a rat treated with an anti-cancer agent (20X)

C) Positive control sections [without treatment] with no distinct cytoplasm (10X)

D) Hepatocytes were arranged randomly in the liver section in the positive control (20X).

經蘇木紫-伊紅染色的老鼠肝臟癌病變細胞

A) 陰性對照老鼠肝臟切片(20倍)

B) 防癌劑處理後老鼠肝臟切片(20倍)

C) 陽性對照切片[並無任何治療]細胞質無明顯的分別(20倍)

D) 陽性對照肝臟切片中隨機抽取的肝細胞(20倍)

Genetic Technology to Enhance Tolerance of Crops against Salinity and Drought
提高農作物對鹽度和乾旱耐受性的基因技術

Prof. LAM Hon Ming
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The recent fall in crop yield has caused a sharp increase in the price of rice. This results in increasing pressure to the life of people worldwide, particularly to the less-developed countries. This reminds us the continuous need to improve the yield of crops to ensure sufficient supply of food to mankind.

Irrigation to plants is largely affected by weather and geographic environment. Salinity and drought cause damage to plant cells, resulting in retarded growth and consequently reduction in crop yield. When the tolerance of plants against salinity and drought is improved, the corresponding agricultural yield can be increased.

近期農作物產量降低造成米價大幅上漲，對世界各地人民生活構成重大壓力，特別在發展中國家，情況更加嚴重。因此，我們必需不斷改善農作物的產量，以確保糧食供應充足。

灌溉主要受天氣及地理環境等天然因素影響。乾旱和鹽度嚴重損害植物細胞，導致農作物生長遲緩，影響收成。提高植物對鹽度和乾旱的耐受性，有助增加農業產量。

CUHK research team has developed a novel technology that introduces novel salinity and drought genes from soybean to improve tolerance in other crops such as rice. Significant improvement of salinity and drought tolerance was observed. The technology has good potential for improving agricultural yields.

香港中文大學研究小組開發一種新技術，利用由大豆中獲得的嶄新耐鹽旱基因，來提高如水稻等其他農作物的耐受性。結果表明耐鹽旱的能力有顯著提高，有關技術對增加農業產量有良好的潛力。

Achievements
Second Class Beijing Technological Advancement Award
Second Class Zhejiang Province Science and Technology Award

成就
北京科技進步獎二等獎
浙江省科學技術獎二等獎

Funded by University Grants Committee - Area of Excellence Scheme
Collaboration with Institute of Crop Sciences, The Chinese Academy of Agricultural Sciences.
由大學教資會卓越學科領域資助
合作夥伴為中國農業科學院農作物科學研究所

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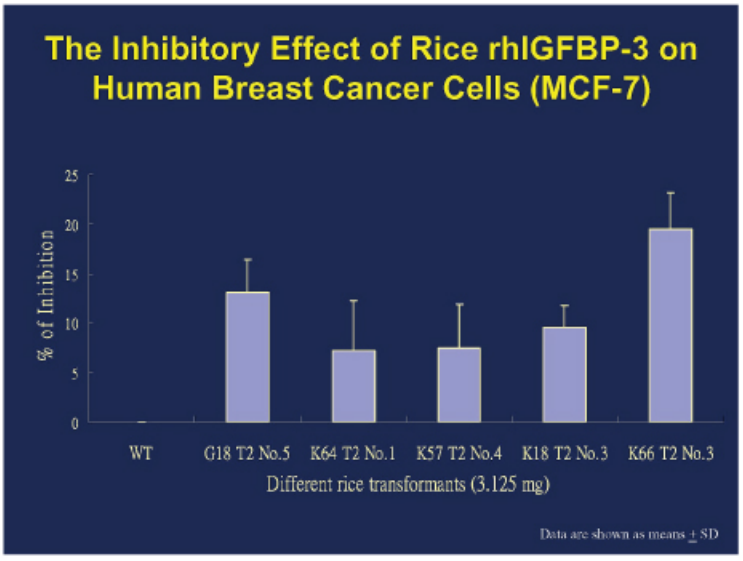
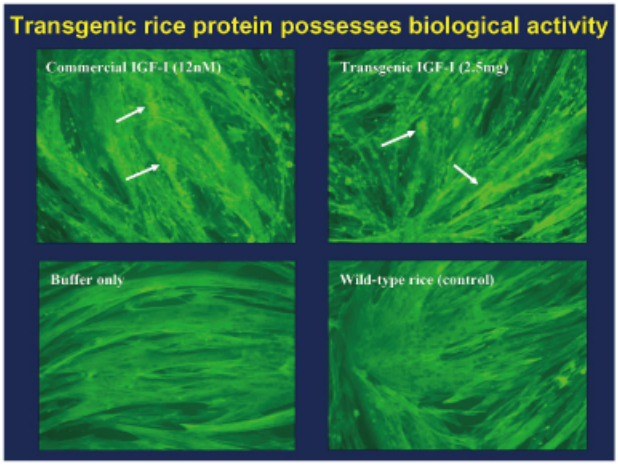
Transgenic Rice Proteins for Treatment of Diabetes, Obesity and Cancer
轉基因水稻蛋白治療糖尿病、肥胖及癌症

rhIGF-1 and rhIGFBP3 complex has been approved by FDA treatment of Growth Hormone Insensitivity Syndrome. Such proteins have potential use as anti-diabetic and anti-obesity drug. They may be used for treatment of myotonic muscular dystrophy, HIV-associated fat redistribution syndrome, retinopathy of prematurity, and amyotrophic lateral sclerosis. rhIGFBP-3 also has excellent potential to be used as an anti-cancer agent.

Current production of rhIGF-1 and rhIGFBP-3 is mostly made in bacteria. Both the equipment cost and production cost are high. There is potential contamination with human pathogens. There is much room for improvement in the production methods.



rhIGF-1 及 rhIGFBP3 已通過 FDA 測試，証實有效治療生長激素不敏感綜合症，更具抗糖尿病及抗肥胖效用。它們亦可用於治療強直性肌肌肉萎縮症，愛滋病相關脂肪再分配綜合症，早產兒視網膜病變及肌萎縮側索硬化症。rhIGFBP-3 更具潛力被發展為防癌劑。
目前，rhIGF-1 及 rhIGFBP-3 生產大多用細菌培植方法。由於設備及生產成本高，而且更有被人類病原體污染的可能性，因此，此生產方法有待改善。



CUHK leads in the research on using rice as pharmaceutical proteins production system. In that rice has been used as a bio-reactor to produce rhIGF-1 and rhIGFBP-3. Rice possesses cellular machinery for protein folding, glycosylation and stabilization. It is suitable for large-scale production at relatively low cost. It is free from animal pathogen contamination. Furthermore, rice is easy for storage and transportation.

It has been proved in laboratory that Transgenic Rice Proteins can generate biological effects similar to its commercial counterparts. The research results at CUHK demonstrated good potential of mass production technologies to produce effective recombinant human proteins in plant at low cost.

香港中文大學領導水稻生產藥用蛋白研究，令稻米可被用作為生物反應器，生產 rhIGF-1 及 rhIGFBP-3。稻米擁有的細胞機制能令蛋白質折疊、糖基化及穩定化。此系統更適合以較低成本作大規模的生產，並避免動物污染病原。同時，稻米比較容易儲存及運輸。
實驗證實水稻所產生的轉基因蛋白與目前市場上的均具相同療效。香港中文大學研究結果顯示，利用植物生產人體蛋白的大規模生產技術具良好潛力，並保持低成本。

Funded by University Grants Committee - Area of Excellence
由大學資助委員會卓越學科領域資助

Non-Invasive Test for Nasopharyngeal Cancer
無創傷性鼻咽癌血液測試

Prof. CHAN Kwan Chee Allen
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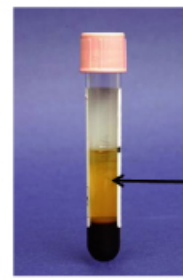
Nasopharyngeal carcinoma (NPC) is one of the commonest cancers in Hong Kong and South China. For patients with early-staged disease (i.e. stages I and II), localized radiotherapy alone can give a 5-year survival of over 85%. On the contrary, patients with more advanced disease (i.e. stage IV) require more extensive radiotherapy and systemic chemotherapy, and the survival rate is only 50%.

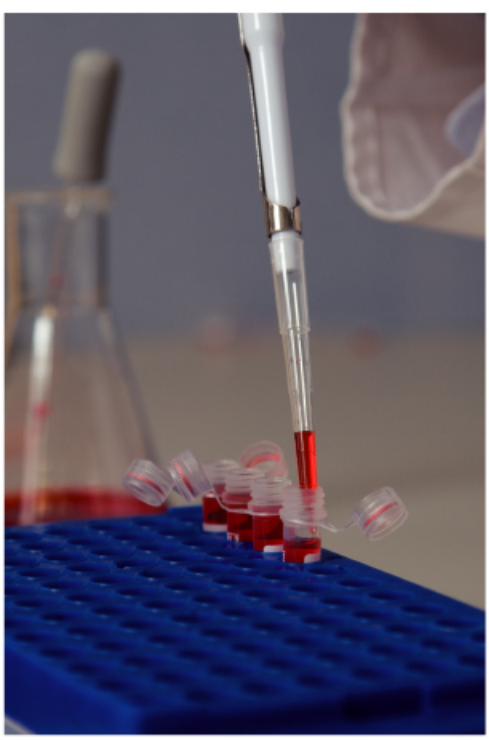
At present, there is no ideal way to prevent NPC. As there may be no or very vague symptoms of early NPC, early detection is the most important strategy to improve patients' survival. Nasal endoscopy is the current gold standard of NPC detection. However, limited by its invasive nature and availability, nasal endoscopy is not an ideal tool for screening NPC in asymptomatic subjects.

- 血漿EB病毒基因分析
  Plasma EBV DNA analysis



鼻咽癌是香港與南中國最常見的癌症之一。患有早期鼻咽癌（第一及第二期）的病人，只需接受局部放射治療，其五年存活率已可達百分之八十五。但患有晚期(第四期)鼻咽癌的病人，除放射治療外，還需接受包括化療的系統性治療，而其存活率只有約五成。

現時沒有預防鼻咽癌的方法，並且早期鼻咽癌的病徵並不明顯。對提高鼻咽癌患者生存率來說，及早診斷最為重要。鼻咽內視鏡檢查是目前診斷鼻咽癌的標準方法，但由於屬創傷性檢查，且須由耳鼻喉專科醫生操作，輪候檢查時間較長，因此並不適用於全民鼻咽癌篩查。



The development of NPC is closely linked with Epstein-Barr virus (EBV) infection. Making use of this association, CUHK research team established a blood test for the detection of NPC based on the measurement of the genetic material of EBV (EBV DNA) in plasma. The plasma EBV DNA analysis has been shown to be useful for the detection and monitoring of this cancer in patients presented with clinical symptoms. The test accuracy for NPC detection is over 95% and it is one of the most accurate blood-based tumor markers currently available.

香港中文大學醫學院成功研發一項無創傷性的測試方法，以定量分析血液中的EB病毒基因來診斷鼻咽癌。過去的研究顯示，此血液測試能為已出現病徵的鼻咽癌病人作準確的診斷和監測，其準確度超過95%，是目前其中一種準確度最高的癌症血液測試。

Funded by Sir Michael and Lady Betty Kadoorie
由米高嘉道理爵士及夫人資助

Nano-particle Contrast Agent for In-vivo Magnetic Resonance Imaging Monitoring
用於活體磁共振成像的納米顆粒造影劑

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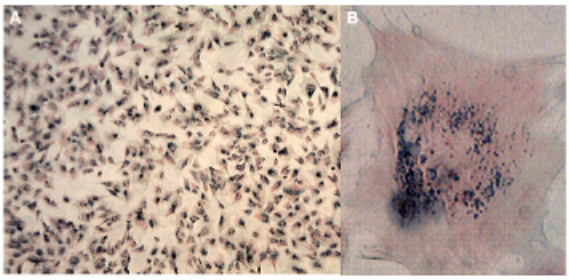
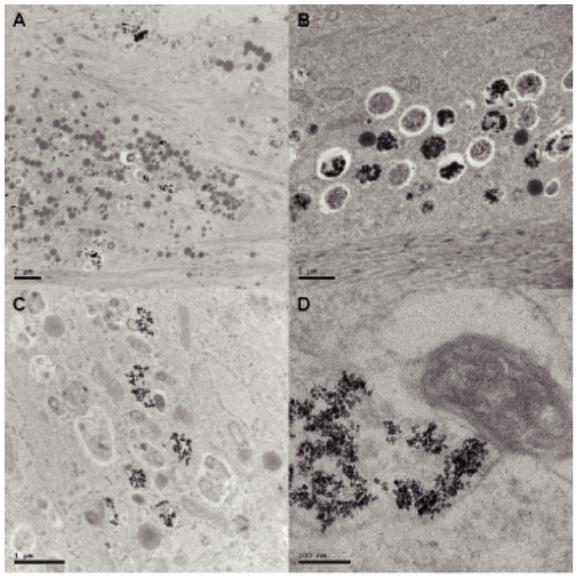
Research in stem cell therapy often requires in-vivo observation of cell engraftment. At present, Super-Paramagnetic Iron Oxide (SPIO) contrast agent has been employed to label transplanted stem cells for in-vivo monitoring using Magnetic Resonance Imaging (MRI). However, biodegradation by intracellular enzymes and acid turns SPIO into soluble iron, which becomes invisible under MRI. Furthermore, the particle size of SPIO is 120-180nm. It is too large for stem cells to carry many particles. For rapidly dividing cells, the number of SPIO particles can be quickly diluted and disappeared following cellular division and metabolism.

幹細胞研究常常需要活體觀察幹細胞的局部種植情況。現今，超順磁性氧化鐵造影劑（SPIO）用於標記移植的幹細胞以供磁共振成像活體觀察。但細胞內酶的生物降解作用及酸性物質可將SPIO轉化為可溶性鐵離子，這些離子不能在磁共振顯像。而且，SPIO的顆粒大小為120-180納米。其顆粒太大，難以使一個幹細胞標記很多顆粒。對於快速分裂的細胞，由於細胞內代謝及細胞分裂，細胞內的SPIO顆粒濃度可能快速淡化消失。



Optimal microscopy images of the mesenchymal stem cells (MSCs) with Prussian blue staining, demonstrating the SPIO-NP distribution within MSCs. Figure A shows a 100% labeling efficiency. MSCs appear as normal cell morphology. Figure B shows numerous SPIO nanoparticles in a single MSC.

間充質幹細胞(MSCs)普魯士藍染色後光鏡圖片，顯示SPIO-NPs在MSCs內的分布。圖A顯示100%標記效率，MSCs顯示正常細胞形態。圖B顯示一個MSCs內多量SPIO-NPs。



TEM images (A-D) revealed that the numerous SPIO-NP distribute in lysosomes and vesicles of MSCs while not found in the nucleus and other supermicrostructures. Mono-dispersed SPIO-NP remain well separated within MSCs. With apparently normal nuclear morphology, apoptosis and necrosis are not observed.

電子顯微鏡(A-D) 顯示多量SPIO-NPs分佈於MSCs的溶酶體及小囊，而不見於細胞核及其他超微結構。單粒分散的SPIO-NP在MSCs獨立分開。細胞核形態正常，未見細胞凋亡及壞死。

CUHK research team has developed a new kind of nano-particles (SPIO-NPs). Because of the smaller size, 7-10nm in diameter, the number of particles that can be implanted into a labeled cell can be much larger. After proliferation and differentiation, the SPIO-NPs will have sufficient particles to be distributed in the off-spring cells. Moreover, SPIO-NPs are coated with chemically inert silica. They are resistant to enzymes and acid. They will survive longer as a contrast agent. The invention has been tested by substantial intake by mesenchymal stem cells in vitro. No negative effect on cell viability, proliferation, differentiation was found. The SPIO-NPs may be extended to include specific coating for bonding with antibodies and /or other functional groups for targeted imaging using MRI, or specific cell magnetic separation.

中文大學研究小組開發了一種新的SPIO納米顆粒（SPIO-NPs）。由於其顆粒小，直徑只有7-10納米，很多顆粒的SPIO-NPs可以被標記入一個幹細胞。經細胞增殖及分化，SPIO-NPs 會有足夠的顆粒分佈於子代細胞中。而且，SPIO-NPs表面是化學惰性的矽。細胞內酸及酶難以消化矽。所以SPIO-NPs可以作為長時間標記的造影劑。此種SPIO-NPs可被幹細胞大量攝取，並對細胞的活性，增殖及分化沒有不良影響。此種SPIO-NPs可以進一步包裹以與抗體及/或其他功能團結合以應用於磁共振靶向成像或特異性細胞磁性分離。

Funded by Innovation and Technology Commission
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Novel Endotracheal Tube for Child
嶄新兒童氣管內管

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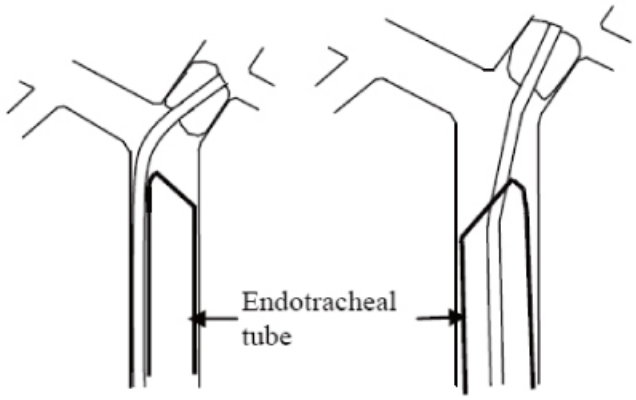


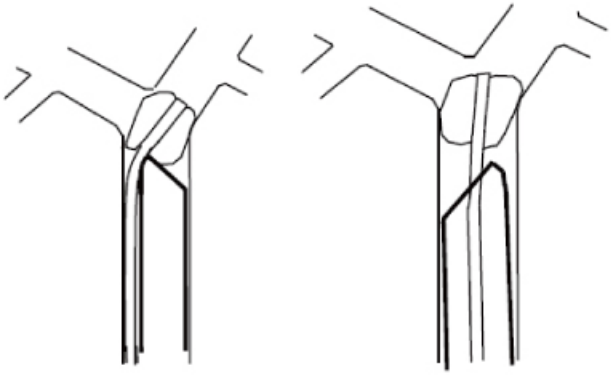
Conventional technique for lung isolation in small children (< 6 - 8 years of age).
用常規技術為兒童進行肺部分離手術

In surgery involving the chest, it is quite common that isolation of one lung is required. Such lung isolation operation is very challenging for children under the age of 6, because there is a lack of suitable apparatus. The endotracheal tube available for such purpose is too large for small children. Because of the complexity of the tube design, making special size suitable for small child is not feasible yet.

Furthermore, when adult-size endotracheal tubes are used for small child, there is a serious problem that the bronchial blocker often pops back into the trachea, causing not only loss of lung isolation, but also complete airway obstruction. This may easily lead to interruption of surgery, increased surgical manipulation, hypoxia or even cardiac arrest.

在胸部手術中將兩肺葉分隔是非常普遍。但因缺乏合適儀器，六歲以下兒童進行此手術非常具挑戰性。現有的氣管內管對兒童來說尺寸過大。由於管道設計複雜，製作適合兒童的儀器並不可行。

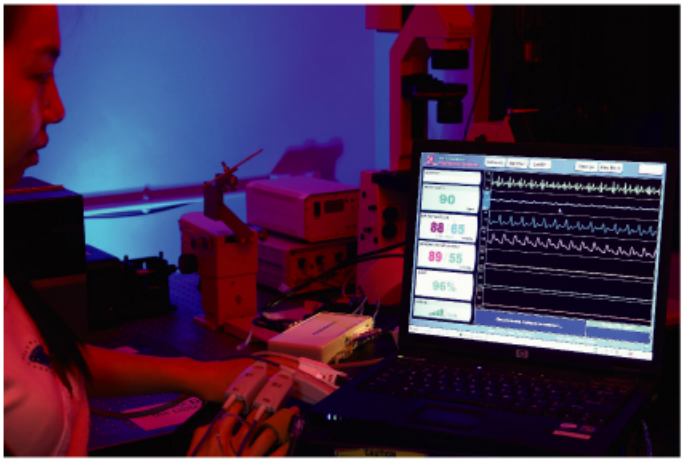
此外，當成人尺寸的氣管內管用於小孩子時，支氣管攔截器倒彈進氣管，令氣道阻塞，極可能導致外科手術中斷，增加了手術步驟、造成缺氧甚至心臟驟停。



Retrograde dislodgement of endobron- chial blocker causing loss of lung isolation and airway obstruction.
支氣管攔截器彈進氣管令氣道阻塞

To solve the above-mentioned problems, Department of Anaesthesia and Intensive Care at The Chinese University of Hong Kong has designed a novel endotracheal tube specifically for small child. The design prevents the problem of pop-back or migration of the bronchial blocker. Sizes small enough for babies undergoing one-lung anaesthesia can be made and even less experienced anaesthetists will find it very user-friendly. Prototypes modified from existing endotracheal tubes have been successfully verified on a few clinical cases. It has excellent potential for further development into clinical products.

為解決上述問題，香港中文大學麻醉及深切治療學系專為兒童設計一種嶄新氣管內管。該設計防止支氣管攔截器彈出或移位。其尺寸可供嬰兒進行單肺麻醉，亦方便經驗較淺的麻醉師使用。原型由現有氣管內管修改而成，並且在少數臨床病例上成功得到驗證。此原型極具發展潛力並轉化為醫療產品。



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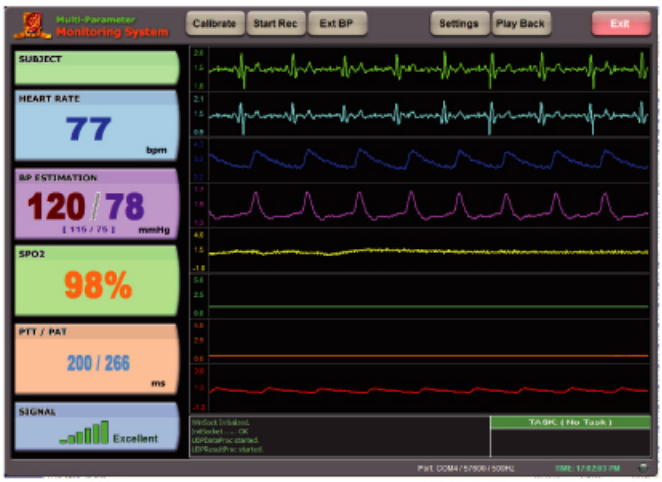
Multi-physiological Parameter Monitoring System
多生理參數監測系統

Growing aging population, skyrocketing healthcare cost and prevalence of chronic diseases are the main driving forces to propel the fundamental transformation of the healthcare system. Healthcare providers are looking for cost-effective and more responsive ways of delivering services than through large centralized institutions. The conventional hospital centered healthcare focused on diagnosis and treatment practice, is shifting towards user centered health with the focus on prevention and early risk detection. Amongst different vital signs, blood pressure (BP) is one that particularly requires personal and consistent attention. This is because high BP, which is closely associated with morbidity and mortality arising from heart, kidney and cerebrovascular diseases, usually occurs with no obvious symptoms. However, continuously monitoring is difficult to be accomplished by state-of-the-art BP measurement devices. Moreover, there is also a lack of multi-physiological monitoring system for personal and home use.

人口老化問題日漸擴張，醫療保健費用不斷飆升以及慢性或長期性疾病的普現，都是推動醫療保健體系作出根本性轉變的主要驅動力。醫療保健服務機構希望以集中模式提供具成本效益及能回應用户需求的服務。而傳統以診治為主的醫療服務正在朝向以預防和早期風險檢測的方向發展。

在眾多關鍵生理參數中，血壓特別值得關注。因為高血壓與心臟、腎臟以及腦血管相關的危疾或致命疾病都有密切關係，而這些疾病初期都沒有任何癥狀。但是現有的血壓測量技術較難實現連續測量。同時，市面上也缺乏適用於個人及家庭環境的多參數生理參數監測裝置。



In this project, we developed a low-cost multi-physiological parameter monitoring system. Vital signs, including BP, heart rate and their variability as well as blood oxygen saturation can be measured continuously using miniaturized biosensors. The system can be widely used in home care and community healthcare, performing long-term monitoring of health status of patients. It will provide great benefits for the prevention of cardiovascular diseases and early detection of adverse conditions.

本專案所研製的多生理參數監護系統通過小型化的生物傳感器連續監測心率、血壓及其變異性以及血氧飽和度等重要生理參數。本設備可廣泛地應用於家庭、社區醫療護理等場合，實現對患者日常生理健康狀況的長期監測，對心血管等疾病的預防及早期檢測有重要的應用價值。

Funded by Innovation and Technology Commission
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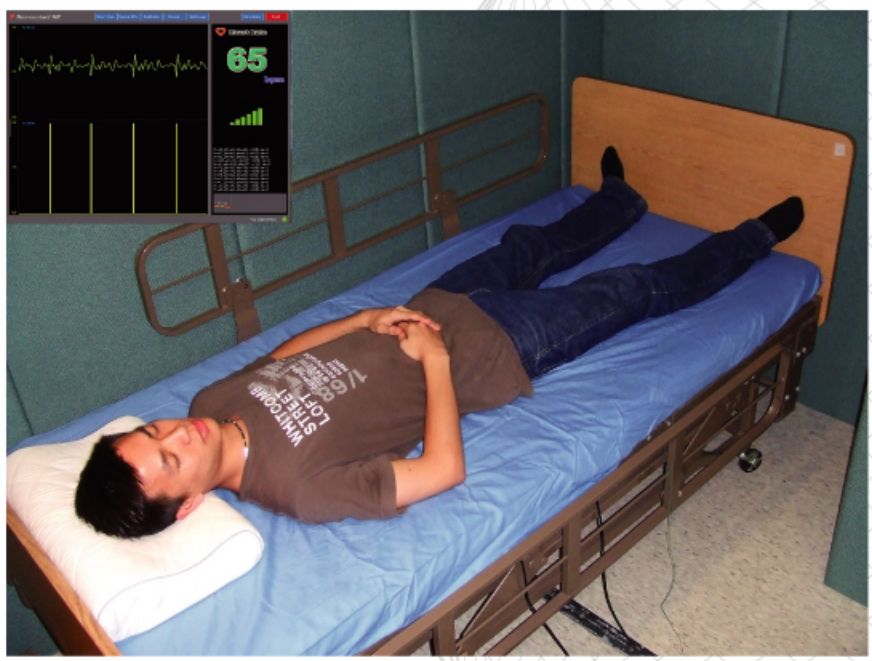
Non-contact ECG Monitoring Bedsheet
非接觸式心電監測床墊

The worldwide population is aging, and the amount of old people will approach 2 billions by 2050. The aging population has resulted in escalation of our healthcare expenditures. Currently, the healthcare system is undergoing a fundamental transformation and home healthcare has been identified as a critical part for early risk detection. Many adverse conditions occur during sleep. Moreover, the health condition monitored during sleep can also provide supplementary information for day-time monitoring. Therefore, unobtrusive and continuous sleep monitoring is very important.

全球人口漸趨老化。據預測，2050年全球老年人口將達到20億，醫療保健開支將隨之大幅攀升。目前，醫療保健體系正在經歷根本性的變革。其中家庭保健被認為是實現早期風險檢測的一個關鍵環節。一些心血管疾病患者可能在睡眠中出現突發性情況惡化，而且睡眠監測也可為日間監測提供補充資訊。因此，不妨礙使用者睡眠的連續睡眠監測是非常重要的。

In this project, we developed a simple, safe, and efficient non-contact electro- cardiogram (ECG) monitoring bedsheet. The low-cost bedsheet can help to reduce the cost of home healthcare. Conductive textile is fixed on the bedsheet as electrodes to capture ECG which is measured by capacitive sensing technology. Physiological variables, e. g. heart rate and its variability, could be obtained in the measurement. The bedsheet is convenient to operate, and its design allows the safe and continuous ECG measurement without obstructing user's normal sleep.



本項目所研制的非接觸式心電監測床墊，成本低廉，可廣泛用於家庭、社區等醫療護理場合，有助降低醫療支出。該裝置使用導電織物作為感應電極，運用電容耦合感應技術檢測使用者的心電信號，並經信號處理獲得重要生理參數，包括心率及其變異性等。本裝置操作簡便，不影響正常睡眠，可達到安全而有效的監測效果。

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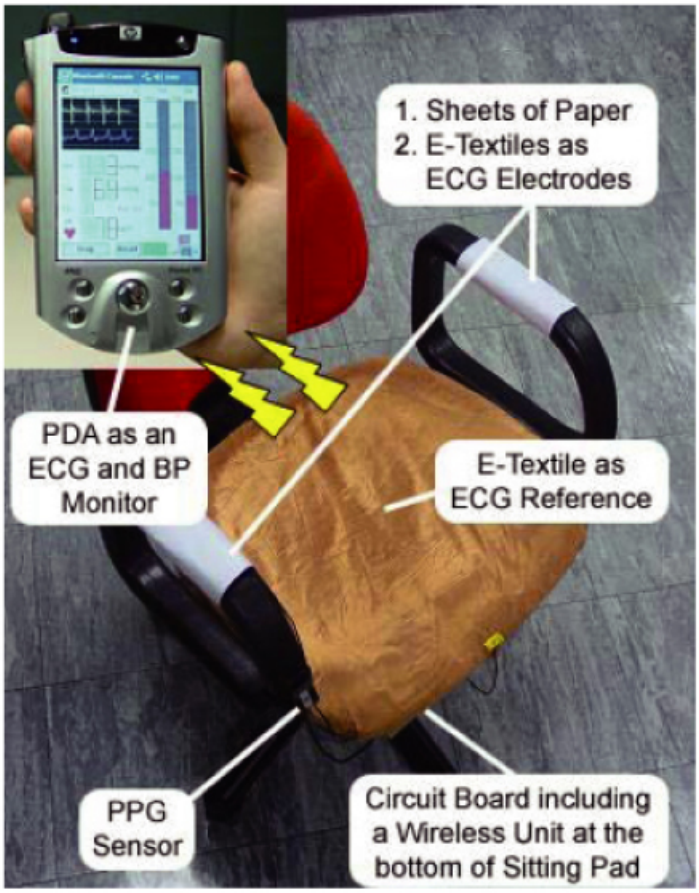
Non-contact ECG Monitoring Chair
非接觸式心電監測座椅



Due to the aging population and increasing health awareness, there is a global need for more cost-effective medical devices and diagnostics. The delivery of such healthcare presents a major challenge to all economies. With the advances in biomedical sensing, it is reasonable to expect that many types of medical checking and monitoring that currently require the patient to visit a hospital or doctor's office can eventually be performed at home.

由於老齡人口增加以及人們健康意識提高，社會需要更具有成本效益的醫療儀器和診斷手段。隨著生物傳感和智能織物技術的發展，我們預期許多目前只能在醫院進行的檢查和檢測將最終可以在家庭環境中實現。

The chair in this project contains e-textile electrodes fixed on the chair and a signal processing unit. ECG signal is captured by the e-textile electrodes in a non-contact way and sent to the signal processing unit to calculate heart rate (HR) and other physiological parameters. The parameters are then conveyed to mobile phone, PC or PDA through Bluetooth link. Continuous HR can be conveniently monitored whenever user sits on the chair. The isolation of the electrodes and human body increases the safety of operation. The non-contact monitoring technology can be integrated into the chairs used in the office or home. Its application is of great significance for the detection of sudden heart disease.

非接觸式心電監測座椅的主要構成包括固定於座椅的電子織物電極和分析電路模組。電子織物電極經電容耦合作用獲取心電信號，再由分析電路模組估算得到心率等生理參數，並採用藍牙方式將其傳送至手提電話、電腦或PDA等。該座椅使用方便，只需正常的坐姿即可及時獲得心率等資料，其非接觸運作方式可確保使用安全並實現長期連續監測。本裝置可與辦公及家用座椅結合使用，對突發性心臟病的發病監測有重要的應用價值。

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Child Obesity and Waist Circumference Measurement
兒童肥胖與量度腰圍

Prof. SUNG Yn Tz Rita
Department of Paediatrics
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The problem of childhood obesity in Hong Kong has rapidly increased in recent years. Scientific research reveals that obese children are at increased risk from a number of serious health problems more commonly found in adulthood, including cardiovascular diseases, high blood pressure, and diabetes.

For adults, a simple formula for calculating body mass index (BMI) is used to determine whether an individual is overweight. However, since children are growing, simple BMI is not an easy measure to use as age and sex should be taken into account. Thus, it may be difficult for parents to determine obesity of their children by simple height and weight measurements at home.

近年，香港兒童肥胖問題日趨嚴重。研究顯示，肥胖兒童成長後某些疾病風險大增，包括心血管疾病，血壓高和糖尿病等。

成年人只需利用簡單公式計算身體質量指數(BMI)，便能判斷是否超重。不過，因兒童在成長過程中身高體重不斷改變，身體質量指數也相應隨年齡有所改變，所以如沒有醫生、護士或營養師之協助，家長很難在家中從量度其子女之身高體重而確定他是否過胖。

Age年齡	Boys男孩 (cm 厘米)	Girls女孩 (cm 厘米)
6	67.3	61.5
7	69.1	63.1
8	70.9	64.8
9	72.8	66.6
10	74.9	68.4
11	76.7	70.1
12	78.3	71.7
13	79.8	72.9
14	81.3	73.8
15	82.8	74.4
16	84.1	74.8
17	85.3	75.1
18	86.3	75.4

Table of reference standand of waist circumference for Hong Kong boys and girls aged 6-18.
香港 6-18 歲男孩女孩的正常腰圍參考圖表

Research at Department of Paediatrics reveals direct and significant correlation between children waist circumference and various risk factors relating to cardiovascular diseases. According to research data accumulated over years, researchers suggest a reference standard of waist circumference for Hong Kong boys and girls aged 6-18. Child obesity can then be alerted by a simple measurement of waist circumference.

How to measure:

1. Participant should stand straight with feet 25-30cm apart and keep normal breathing.
2. Measurement should be taken at the midpoint between the lower part of the last rib and the top of the hip as shown in figure1.
3. According to the sex and age of participant, find the corresponding reference standard. If your waist circumference is over the reference standard, it means that abdominal fat is too thick which increases risk in suffering cardiovascular diseases. Participant exceeded the reference standard should do more aerobic exercise and maintain a balanced diet.

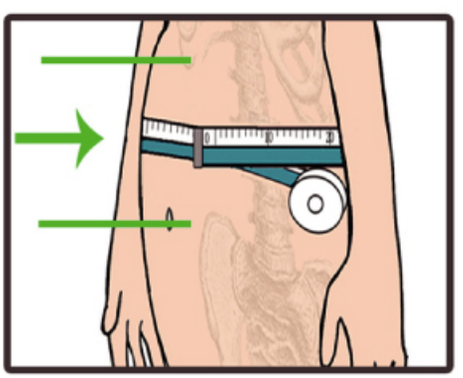

Fig. 1 圖1

從兒科學系一項有關於兒童腰圍及各項心血管風險指標之研究中，證實腰圍與患上心血管疾病有著密切關係。根據多年研究數據，研究人員建議為香港6 –18歲男孩及女孩而設的正常腰圍參考標準，由此，兒童肥胖問題就可以用簡單的量度腰圍方法來評估。

量度腰圍方法 ：

1. 被量者應站立，雙脚分開約一呎或廿五公分，正常呼吸。
2. 如圖1示：腰圍尺應沿水平面圍繞在肋骨底與盤骨頂中間的腰部。
3. 根據被量者的性別及歲數，在尺上找出相對的刻度，如腰圍超過上述的刻度，即表示腹內脂肪過厚，患上心血管疾病的風險相對較高。建議超標者多做帶氧運動，保持均衡飲食。

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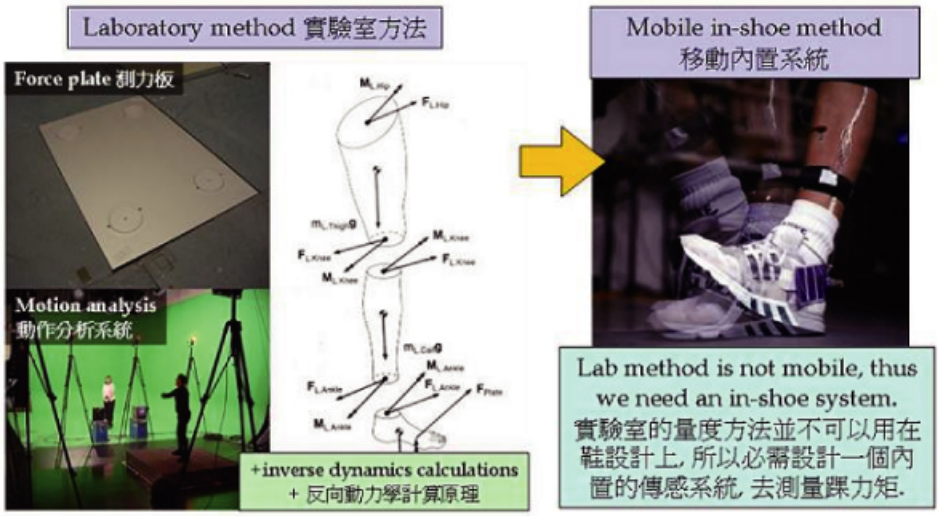
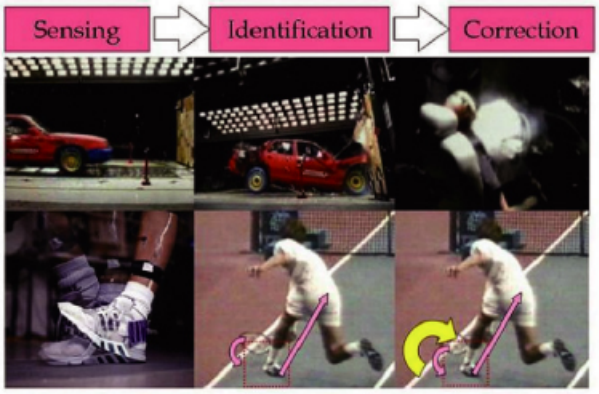


Sensor System for Ankle Sprain Recognition
防足踝扭傷感測系統



Ankle sprain is an injury commonly encountered in many sports. The injured may take a few days or even a couple of weeks to recover.

足踝扭傷在運動中非常常見，傷者可能需要數天至數星期才能復原。

CUHK research team proposed an innovative sprain-free shoe that can prevent ankle sprain with a 3-step mechanism, namely (1) sensing, (2) identification, and (3) correction.

Pressure and motion sensors are installed at selected positions in the shoe to monitor the biomechanics of the foot.

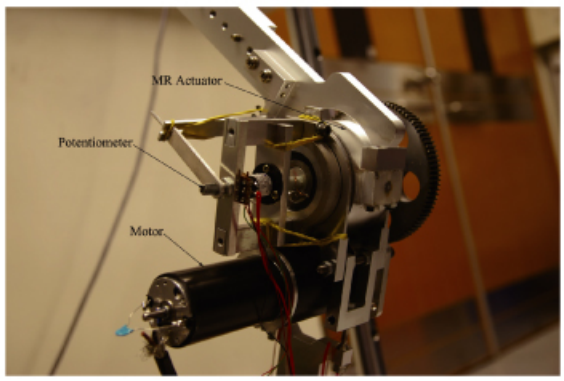
A microcomputer embedded in-shoe analyses the continuous stream of biomechanical data and identify potential sprain with its artificial intelligence database.

The embedded computer will then drive corrective mechanism to protect against the sprain causing action.

Prototypes of the shoe has been developed demonstrating the functions of sensing and identification of potential sprain. Development of corrective mechanism is being planned.

香港中文大學的研究小組正設計防足踝扭傷智能運動鞋，其機制可分為（一）感應，（二）識別，及（三）修正。
壓力及運動感應器分別安裝在運動鞋內選定位置，監察腳部運動力學。
嵌入式微電腦分析連續運動力學數據，從數據庫資料中找出潛在扭傷危機。
內置計算機將驅動糾正機制，以防足踝扭傷。
原型鞋已製成，並展示其遙感及確認潛在扭傷功能。現正計劃發展糾正機制。

Funded by Innovation and Technology Commission
由創新科技署資助
Collaboration with Hong Kong Polytechnic University(Prof. ZHANG Ming, Health Technology and Informatics), Sengital Limited ,Dr Kong Footcare Limited
合作夥伴為香港理工大學醫療科技及資訊學系張明教授、Sengital Limited 以及 Dr Kong 足健科研開發有限公司



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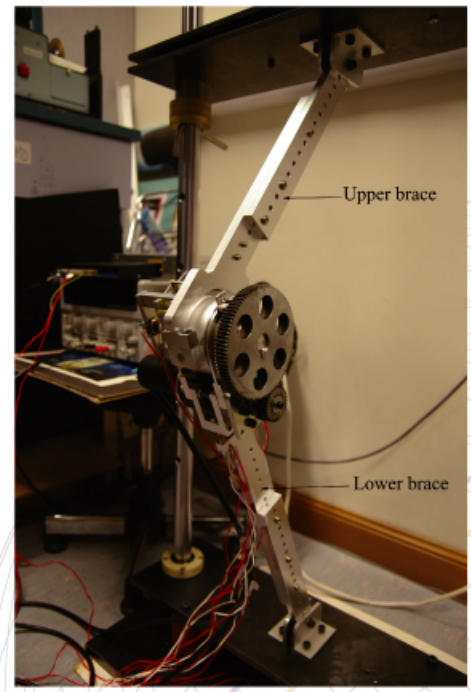
Hybrid Assistive Knee Braces with Smart Actuators
智能混合助力膝架

The percentage of aged persons in society is increasing and their physical deterioration has become a socioeconomic problem. For example, in late 2004, the population of aged persons in China has reached 143 million. Osteoarthritis (OA) is very prevalent in old people. Studies showed that adequate exercises would generate positive effects to OA patients. Therefore, devices that can help people with weak muscle strength or OA are in great need.

Researches were conducted to develop exoskeletons that can provide assistance for elderly and disabled people. These exoskeletons have two limiting factors that prevent them from practical applications:
(1) Lack of safety: the leg exoskeleton usually uses motor to directly drive a leg to move, so that has the potential danger;
(2) Short life: it is not energy efficient to only use motor to provide assistance. Actuators with higher energy efficiency are desirable.



現代社會人口老化問題日趨嚴重，老齡人口身體衰退給社會帶來了巨大的經濟負擔。在2004年底，中國的老齡人口已達到了1.43億。在老齡人口中，關節炎非常普遍。研究顯示，適當的運動對關節炎患者有著正面的作用。因此，社會極大的需求能夠幫助那些肌肉衰弱或者有關節炎的人的器件。
人們對於能夠幫助老年人以及行動不便者的支架進行了大量的研究。兩個主要因素限制了這些支架投入到實際應用中：
（1）缺乏安全性：由於腿部支架通常用馬達直接驅動，因而產生潛在危險；
（2）使用時間短：單純使用馬達作為動力能量消耗會很大，令至電池使用時間短。為了增加使用時間，更高能效的驅動器是必須的。

In this project, a new hybrid assistive knee brace will be developed utilizing a magneto-rheological (MR) actuator. The MR device can function as a clutch or a brake as needed. While functioning as a clutch, the output inertia can be made small and the system is much safer than the direct use of motor; while functioning as a brake, the MR device can produce large torque and consume little power.

本項目將會開發一種新式採用磁流變驅動器的混合助力膝架。本磁流變器件根據需要既可以作為離合器也可以作為制動器。作為離合器作用時，輸出慣性能量能夠做得很小，從而系統比直接使用馬達驅動更安全；而作為制動器使用時，磁流變器件能夠在消耗很少能量的情況下產生很大的力矩，從而產生更高的效能。

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由信興高等工程研究所資助

訊息科學
Information Sciences

A Compiler for High Performance Computing on Array Technologies
陣列技術高性能計算編譯器

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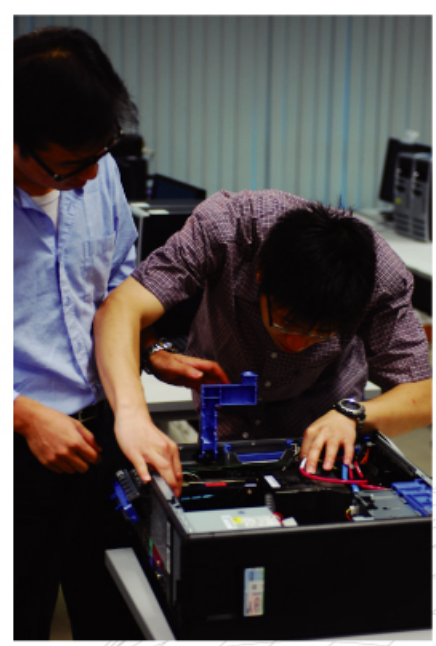
New processors that are multi-core and have reconfigurable computing and graphics processing unit are based on a new technology, referred as Array Technologies (AT). These processing units improve the cost-performance ratio of conventional high performance computers (HPC). Widely regarded as future direction in developing HPCs, the technology enables the development of highly specialized processors that sustain higher numbers of floating point operations per second.

Array technologies significantly reduce the HPC's demand in space and electricity for cool-down purpose, which is advantageous for Hong Kong and Mainland China industries where office space and air conditioning are limited. However, the main barrier for the adoption of array technologies is that it is difficult to program even for experts. A general solution has not been reached even after decades of compiler research.

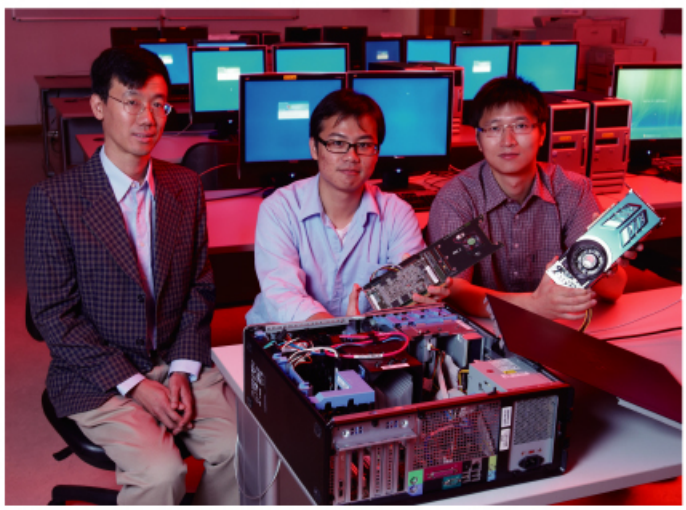


以新一代「陣列技術(AT)」設計的處理器包括了多核、可重構計算、以及圖形處理器(GPU)等多種技術，大幅提高了傳統高性能計算機(HPC)的性能價格比。AT技術能支持更高速的浮點運算，已獲公認為高性能計算機的主要發展方向。

陣列技術能大幅降低計算系統的降溫耗電和所佔空間 ，尤其適合香港和中國大陸的工商業界。可是就算是專業人員也認同編寫陣列技術程式是十分困難，亦成了推廣陣列技術的主要障礙。科研界經過數十年的努力仍然未能找出一種可以普遍通用的辦法使編寫陣列技術的程式變得容易。

To alleviate the difficulty in using AT in local industries, we focus on an important class of problems that includes Monte Carlo Simulation (MCS) and optimization. A self-checking, self-tuning, source-to-source compiler for the utilization of array technologies is under development.

The resulting tool can be applied in many major industries, including derivative pricing, risk management, portfolio optimization, time series prediction and enterprise resource management. The solution will lower the entry barrier both in terms of cost-performance and user-friendliness and enable the widespread use of array technologies.



傳我們針對香港業界的需要，正發展一套專門為Monte Carlo模擬及優化計算的陣列技術解決方案，其核心是一套能進行自我檢驗、自我調校、源到源的編譯器。研發出來的編譯器適用於香港不同行業，包括衍生工具定價、風險管理、投資組合優化、時序預測、企業資源管理等。我們的解決方案亦同時提高了HPC的性能價格比及令AT更易於使用，有助香港工商業界更廣泛使用新一代的陣列技術。

Funded by Innovation and Technology Commission
由創新科技署資助

Wiring Optimization Techniques for Digital Circuits Electronic Design Automation
用於數碼集成電路設計的接線優化技術

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With the continuous advancement of sub-micron semiconductor technologies, functional elements in digital circuits are operating in increasing speed. Major causes of signal delays in digital circuits are no longer due to circuit elements. Over 80% of signal delays are attributed to delays in the interconnection wires.

Whereas the circuit optimization techniques adopted in current Electronic Design Automation tools are still focusing on circuit elements. The optimization result can be significantly improved if wiring-based considerations are included. However, to create such fundamentally new design flow, a novel set of theories and algorithms are required to analyze and solve the optimization puzzle.

隨着微米以下半導體技術不斷改進，數碼電路的運算速度越來越高。造成信號傳送延遲的主要原因已不再源於電路元件，八成以上的阻延是發生在元件之間的接線中。

可是，現時通用的微電子設計系統主要將運作速度優化功能聚焦於電路元件身上，若果在接線方面多下功夫，速度優化效果應大幅提升。若要配合這種全新方向的設計優化流程，一套嶄新的接線優化算法就不可或缺了。

A research group at CUHK has successfully developed a number of efficient wiring-based logic transformation and re-wiring engines. The subject algorithms can be applied in combinational and sequential circuits. Such functions are not found in any Electronic Design Automation tools available in the market.

The re-wiring engines have been successful demonstrated in Field Programmable Gate Array (FPGA) design platform. Significant circuit speed improvement (>10%) as well as gate count savings (>10%) have been achieved.

香港中文大學一個研究小組成功開發了一連串的優化接線及與之配合的邏輯變換算法，這技術可應用於組合或時序邏輯電路上，這種優化功能在市面的微電子設計系統上尚未出現。

這套接線優化技術已成功應用於可程控邏輯閘陣列 (FPGA) 的開發平臺上，在運算速度及元件數目都比傳統的做法取得百分之十以上的改進。

Funded by Innovation and Technology Commission
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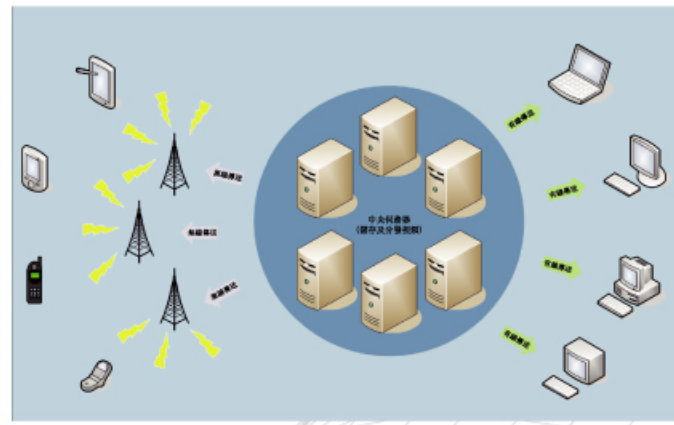
Peer-Assisted Video on Demand
互助式視頻點播

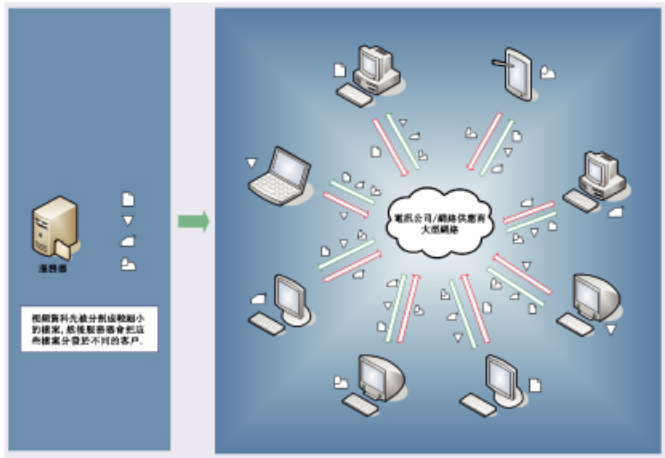
Video streaming is getting hot nowadays and its applications spread across the Internet. YouTube is the most noticeable one where around 1.7 billion video streams are viewed every month. Besides the video sharing service provided by the web portals like YouTube, many traditional Media Corporations begin to embrace streaming technology and are putting their programs on the Web for on-line viewing. For example, both of the News and the Program Notes are available for viewing on the websites of TVB, ATV, RTHK and etc.

Video sharing websites and Media Corporations that provide on-line video-streaming service are all suffering from high operational costs. YouTube's bandwidth costs are estimated at approximately $1 million a day even through it only provides low-quality video clips. Media Corporations are lack of server farm to support millions of users in rush hours. The surge of demands will bring down the servers of those corporations. Therefore how to provide Video on Demand service has been a big concern in both of the Media industry and the IT industry.

網絡視頻串流是時下非常熱門的互聯網應用模式。其中最為人熟悉就是YouTube，一個非常受歡迎的視頻分享網站，其每月流量超過17億次。除YouTube外，傳統媒體如無綫電視，亞洲電視，香港電台等，亦通過設立網站，播放新聞及電視劇集。

視頻分享網站及提供在綫視頻傳播服務的傳統媒體都同樣面對營運成本高企的問題。儘管YouTube只提供低質素視頻分享，估計每日已需要近百萬美元的運營費用。大部份媒體機構都缺乏足夠資源甚至經濟誘因來建構龐大伺服器群組來支持繁忙時段數以百萬計的網絡觀衆量，因此，如何提供高質低價而又擴容性強的網絡視頻傳播服務已成爲傳媒業非常關注的課題。





Traditionally, servers can become severely overloaded as the number of simultaneous clients' requests increases. By exploiting the unused capacities of user computers it is possible to build a very large video-on-demand system without the need of a correspondingly large server infrastructure. Moreover, this kind of peer-assisted architecture is inherently scalable as more users not just generate streaming demands, but also bring in additional resources. This project develops such a peer-assisted video-on-demand architecture so that content providers can seamlessly migrate and deploy their on-line and off-line contents to the substantially more cost-effective platform.

傳統的伺服器面對客戶端要求不斷增加，引致伺服器不勝的負荷。我們嘗試探討在不增加大型伺服器的基礎下去建立充分利用用戶端電腦未用的資源去解決這問題。系統若建構於這類"點對點輔助網絡系統"，不僅能提供串流廣播的功能，更可在客戶數目不斷提升的情況下相對性地增加從用戶端而來的額外資源。本項目便是要開發一個點對點輔助的隨選視聽系統，讓內容提供者提供更流暢及高效低本的方案去傳送在線或離線的內容給客戶。

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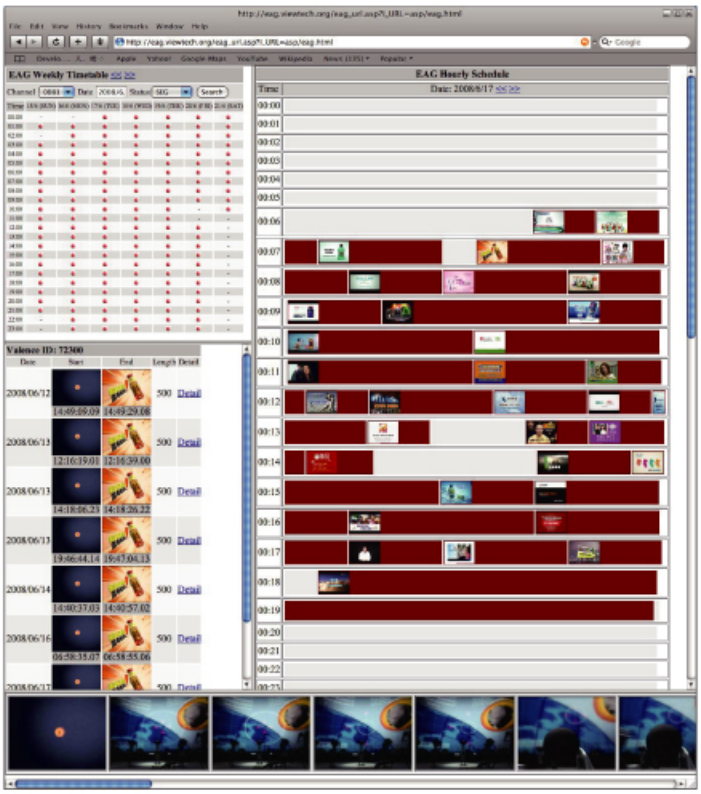
ADVertisement Invariant Signature Engine (ADVISE)
廣告監察引擎

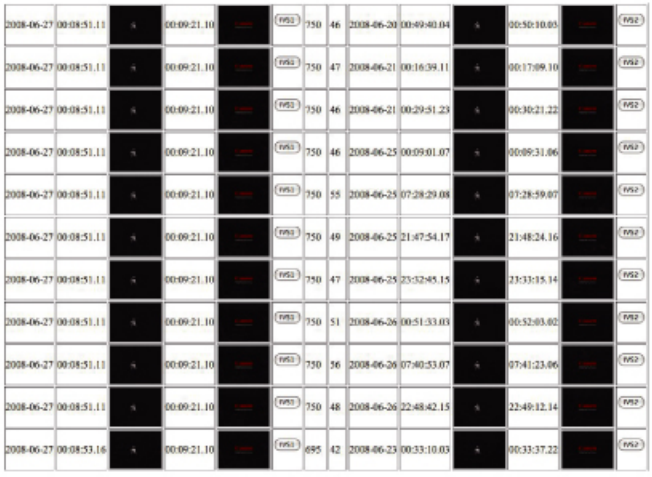


ADVertisement Invariant Signature Engine (ADVISE) is a video processing system for monitoring advertisements broadcast in the TV channel. Advertisement will be segmented automatically and air-time for individual advertisement will be recorded.

廣告監察引擎是一專門監察電視廣告播放的視像處理及分析系統。通過此系統之電視廣告會被自動分段而所有播放的時間亦會被記錄。

Electronic Advertisement Guide (EAG) is produced according to the output of ADVISE. EAG is similar to the EPG (Electronic Program Guide) of the HDTV in Hong Kong and the only difference between EPG and EAG is EAG only shows the past record but not the future timetable.

電子廣告時間表是基於廣告監察引擎的結果而產生的一個時間表。電子廣告時間表跟電子節目表的唯一分別是：紀錄已播出的廣告而不是預告將會播映的時間表。



Enabling "Face-to-Face" Entertainment Computing Technology (EFFECT)
"面對面"娛樂運算技術

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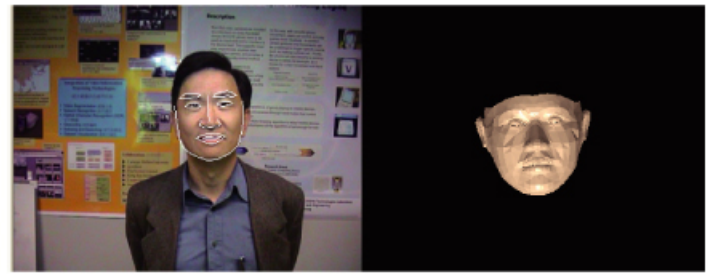
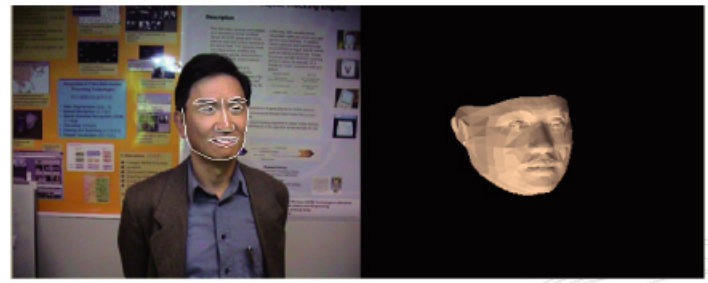
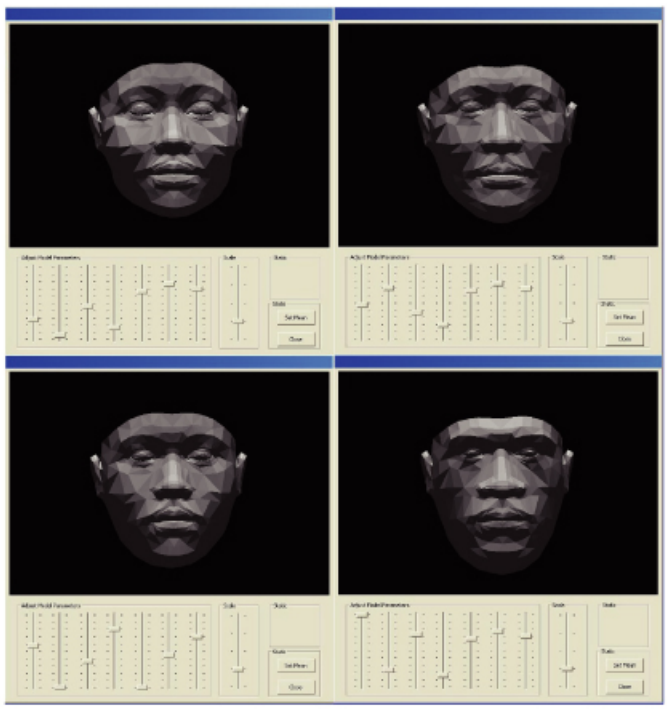




EFFECT is a software development kit (SDK) for video based face 3D tracking, 3D face modelling and texture capturing to support "Face to Face" digital entertainment applications. It enables the face of the user to appear in the screen and interact in real-time with the computer animation or videos.

EFFECT是一套視像人面三維追蹤、三維人面模型和素材捕捉的娛樂運算技術的軟件開發工具。它支援三維人臉素材在畫面上出現，與電腦動畫及視像作即時互動，從而做出不同數碼娛樂效果。



Features

1. To enhance the augmented reality entertainment effects on human face via the advancement of face tracking capability from 2D to 3D
2. To enable the use of personal 3D face model in various digital entertainment applications
3. Users can employ their unique face identities to represent themselves in digital entertainment environments

特點

1. 提高人面三維追蹤的能力從而加強擴充現實的娛樂效果
2. 使個人三維人面模型可在各種數碼娛樂中使用
3. 用戶能使用他們獨一無二的面部特徵於數碼娛樂環境中代表其身份

Funded by Innovation and Technology Commission
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Video Processing Toolkit for Visual Perception Technology (VPT^2) in Computer Games
數碼遊戲視覺感觀技術視像處理工具

The VPT^2 oolkit is a fundamental building block for new entertainment experiences. Computer game developers can explore into a new game perception area and introduce new game-playing experience to end-users.

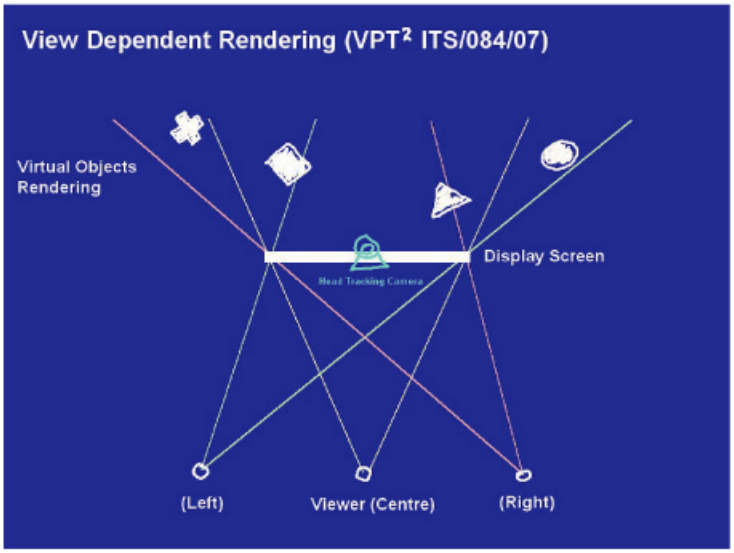
Single User View Dependent Rendering Visual Perception Technology allows the users to perceive a pseudo 3D object being rendered behind the normal display monitor, when the relative viewing direction between the viewer and the monitor is changed.

VPT^2 工具是一令人有新娛樂體驗的基礎開發的元件，它引進了新視覺感觀技術，使電腦遊戲開發者可以探索更新的遊戲感觀領域，為玩家帶來嶄新的遊戲體驗。

單人視線依據顯像的視覺感觀技術－當觀賞者在普通的顯視屏前用不同的角度觀看，都可看到該物件的虛擬立體映像。為數碼遊戲提升視覺觀感技術的視像處理工具。

Tele-Sharing Visual Perception Technology allows user to share real object with other users to create communal game-playing experience.

遙距分享的視覺感觀技術-可供用者與其他人分享同一真實物件，帶出共有的遊戲體驗。



Funded by Innovation and Technology Commission
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Chelsea: Automatic Detection and Analysis of Salient English Mispronunciations by Chinese Learners

「矯聲」— 面向中國人學英語過程中常見錯誤發音的自動檢測系統

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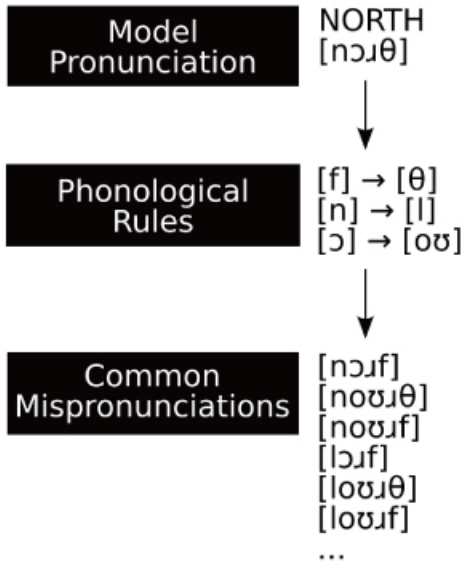
Chelsea is a prototype of a computer-assisted pronunciation training (CAPT) application with automatic mispronunciation detection and diagnosis for English pronunciation improvement. The system utilizes automatic speech recognition (ASR) technology and a pronunciation lexicon extended with common mispronunciations of Chinese learners of English. The common mispronunciations are derived from a phonological analysis of Cantonese and English to predict possible phonetic confusions (e.g. [f] and [θ]). These confusions are formalized as a set of rules which can generate common mispronunciations for any set of English words (e.g. north [nɔʊɹθ] → [nɔʊɹf]). Using this extended pronunciation lexicon, the ASR engine is tasked with word pronunciation recognition. Chelsea translates the recognition results into comprehensible feedback by highlighting the mispronounced words and providing a phonetic transcription of both the model pronunciation and the learner's own pronunciation.



這是一套初步研發完成的電腦輔助發音訓練（CAPT）系統，兼備教學和矯正的指引，幫助改善英語發音，別具成效。系統目前的設計是運用自動語音識別（ASR）技術，能夠即時自動檢測中國人常犯的英語發音錯誤。研究方法是比較中（粵語）英語音體系，分析兩者的差異，據此預測凡足以令人在學習英語為第二語言時發音錯誤的混淆音素（例如：[f] 及[θ] ），然後將這些容易混淆的音素結合成一套包含更多可能產生發音錯誤的詞彙（例如：north [nɔʊɹθ] → [nɔʊɹf] ），即可以透過ASR技術進行發音錯誤的自動檢測。因此，系統能夠針對中國人學習英語時常犯的發音錯誤，提供改善的指引。

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Technology Development and Application for Geometric Modeling of Developable Freeform Surfaces
可展自由曲面的幾何造型技術開發與應用

The project aims at developing geometric modeling techniques for freeform products fabricated from two-dimensional patterns of sheet material (e.g. metal in ship industry, textile in apparel industry, and leather in shoe industry) in sheet manufacturing industries. During fabrication, the 2D pieces are warped and stitched together to build final product, which is ideally stretch-free to prevent elastic energy produced in the product from debasing fitness and creating material fatigue.

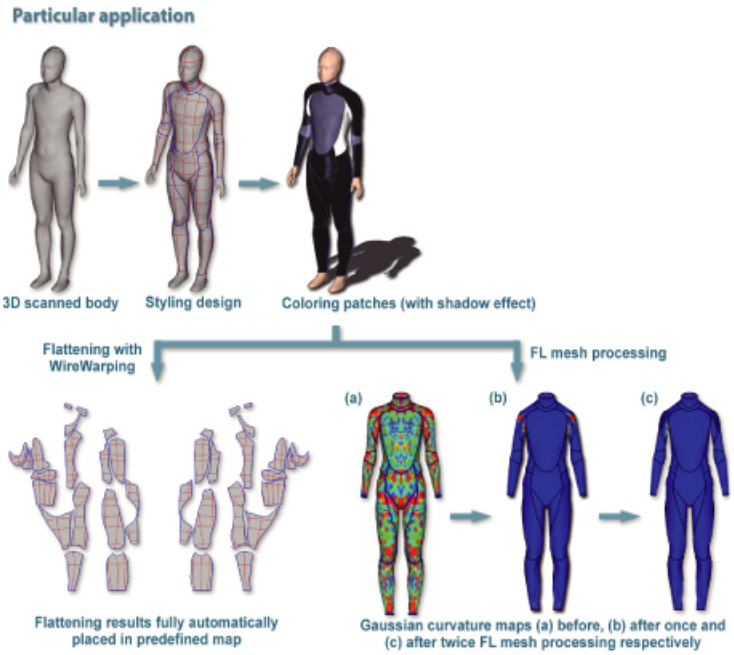
Traditional design process in sheet manufacturing industries, which is conducted in a trial-and-error manner, is inefficient and the product made from the design on 2D pieces may not approximate the desired 3D shape well. Besides, current commercial CAD/CAM systems do not have the function for modeling developable freeform surfaces, which are freeform patches flattened without stretching, and existing approach about developable surfaces in literature are weak at modeling freeform surfaces.

本項目旨在開發於各類板材製造工業中由二維的板材(例如： 船舶工業中的金屬板材、服裝工業中的紡織品及製鞋業中的皮革等)所製的自由型態產品的幾何造型技術。在製造的過程中，工業產品由一些二維板材彎曲縫合而成。在理想的狀態下，這樣的彎曲和縫合不會產生任何材料延伸，因為這樣的材料延伸通常會在產品中形成彈性變型態，而彈性變型態則會影響最終產品的形狀及導致材料的疲勞損傷。

各類板材製造工業的傳統設計過程是以一種反覆試驗的方法進行的，而這種方法不但欠缺效率，且根據二維設計圖製造出來的產品更有可能與心目中的立體型態很不一樣。另外，現有商業CAD/CAM軟件未能提供自由可展曲面的幾何造型功能，而現存關於可展曲面的文獻也無法解決自由曲面的可展問題。

Three new 3D geometric modeling techniques have been developed in this project and they include shape optimization for the developing ability of 3D freeform surface patches, surface flattening with length-preserved feature curves and variational subdivision modeling for freeform developable mesh surfaces. The developed techniques help automate shape optimization of 3D products and speed up the generation of 2D pieces for the products of all sheet manufacturing industries.

本項目開發了三種新的三維幾何造型技術，當中包括了基於三維自由網格曲面可展性的曲面形狀優化；保持特徵線長度的曲面展平；和可展自由網格曲面的變分細分造型。這些技術不但有助三維產品的形狀優化，同時亦加快了所有板材製造工業中用以製造最終產品的二維片的生產速度。



Funded by Innovation and Technology Commission
由創新科技署資助

Development of a Small Autonomous Helicopter
無人自主小型直升機

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Not being disturbed by possible complication on the terrain, aerial vehicles including helicopters have better accessibility to the site and maneuverability than ground vehicles. Autonomous aerial vehicles have many potential applications in environmental monitoring, surveillance, tracking, rescue missions in hazard circumstances, etc. This project aims at developing a small autonomous helicopter that automatically controls its flying, approaches targets, and tracks moving objects using visual information from its on-board cameras.

Automatic control of small helicopters is one of the most difficult problems in robotics. First, the dynamics of a small helicopter is highly coupled, under-actuated, nonlinear, and subject to uncertainties due to aerodynamics, so designing a stable flying controller is highly challenging and no solution has been developed so far. Second, it is crucial and difficult to develop a sensing system that accurately measures position and orientation of a small helicopter regardless of various noises in measurement or generated due to vibration of the engine. Finally, to recognize and trace targets, it is another important and challenging task to effectively integrate visual information from the on-board cameras with the flying planner and controller.

相對於地面車輛而言，包括直升機在內的空中飛行器受地面複雜地形的影響較小，因此具有更好的機動性和更容易接近目標區域。空中自主飛行器在環境監測、安防、跟蹤、以及危險環境下的救援等領域有廣闊的應用前景。本科研項目的目的是研究能夠自主飛行和導航，並利用攝影機的視覺反饋跟蹤移動目標的小型無人自主直升機。

小型直升機的自動飛行控制是迄今機械人學之中最棘手的難題之一。首先，直升機的動力學屬於高偶合、低致動性的非線性系統，加上空氣動力的不確定性，令其自動控制問題至今仍沒有完整的解決方法。其次，如何利用感應器準確測量直升機的位置及姿態，並克服各種噪音及振盪的干擾是另一個非常重要的難題。最後，如何集成視覺系統和自動控制器實現視覺反饋飛行控制也非常具挑戰性。

We, at the first stage, have successfully developed a novel algorithm that fuses data from on-board IMU sensors, GPS and vision to localize the position and orientation of a helicopter. A ready-to-fly platform has been developed on an off-the-shelf commercial model-sized helicopter. We have implemented a new controller on the platform and achieved automatic balance of the helicopter in the air. Another innovation to be achieved is to design a vision-based controller that can stably fly the helicopter to approach targets on the ground and to trace moving targets in the air or on the ground. We will also use this helicopter to explore novel applications in searching and rescuing missions, real-time traffic monitoring, and tracking.

我們的研究在初步階段已能成功整合來自姿態感應器、全球定位儀及視覺器的訊號，並從而準確得知直升機的位置及姿態。而整套由商用模型直升機改裝的飛行平臺，亦已能隨時隨地進行各種測試，並因此成功開發一套能令直升機在空中自動平衡的控制系統。目前正在開展的研究包括基於視覺反饋的自主飛行和導航、地面目標的接近、移動目標的跟蹤，以及小型無人自主直升機在搜索和救援、實時交通監視及跟蹤等領域的新應用。

Funded by Research Grants Council
由研究資助局資助

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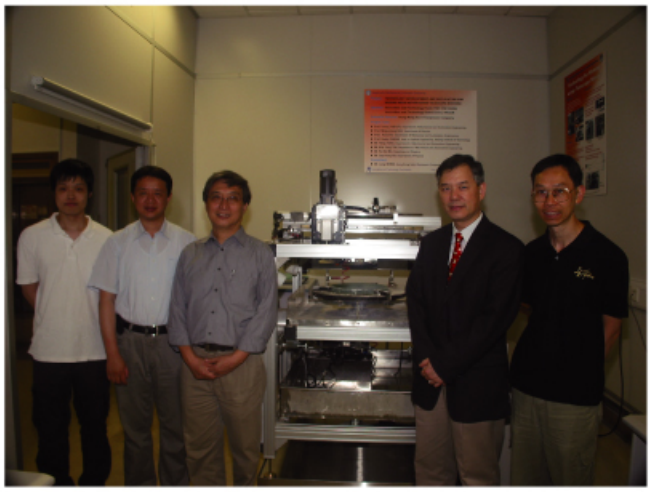
Technology for Making Large Telescope Mirrors
大型望遠鏡鏡頭製造技術

This project is aimed at the research and development of relevant technologies to make near meter-range telescope mirrors. This includes the design and construction of a new control mechanism in the grinding, polishing and figuring processes, and the development of computer-based automated optical testing procedures. The project will serve to significantly upgrade the technological know-how of the Hong Kong optical industry.

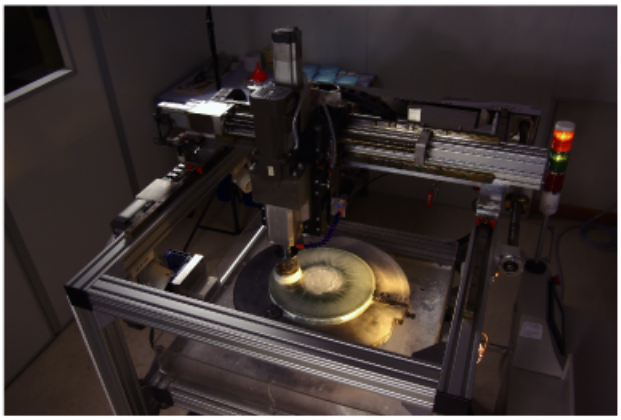


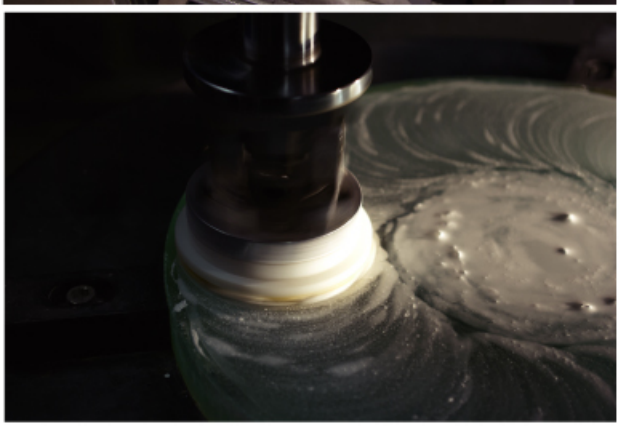
Features

1. A specially designed mechanism for mirror grinding and polishing of near meter-range size telescope
2. A computer-based assembly for automatic optical test and pattern interpretation enabling closed loop figuring of large mirror
3. Machine as developed presently accommodates the making of 0.6 m diameter mirror and is readily scalable to bigger version

Target Users

1. Upgrading the technological know-how of the Hong Kong optical industry to stay competitive and to migrate towards upscale markets
2. Promoting astronomy and space sciences in high schools, universities, and the general public in Hong Kong and China





本項目旨在研發近米級別望遠鏡鏡頭，包括針對打磨、拋光及計算過程的全新控制機械的設計及製造，以及提升以電腦為基礎的自動化光學測試過程。此項目將能有效提高香港光學工業的專業技術水平。

特點

1. 針對近米級別望遠鏡主鏡面打磨與拋光的特殊機械結構設計
2. 系統的電腦化和閉環控制技術提供了光學製造上的自動測試和形狀驗証
3. 現有機械裝置可用於製造0.6米望遠鏡的主鏡，其技術也可直接用於近米級望遠鏡的主鏡製造

目標用戶

1. 有效提高香港光學工業專有技術水準，使其保持競爭能力，並向高端光學工業發展
2. 在中學、大學以及公眾推廣天文學與空間科學

Funded by Innovation and Technology Commission and The Hong Kong Astro Equipment Company
由創新科技署及香港天文器械有限公司資助
Collaboration with the Beijing Institute of Technology
合作夥伴為北京理工大學

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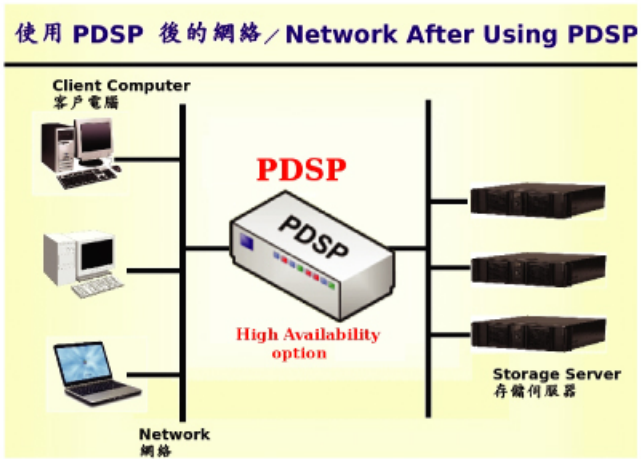
Plug and Play Data Security Platform
即插即用數據加密平台

Nowadays, data security is becoming more and more important. As the amount of data stored in network storages increases, the risk of data breaches also increases. Now people are willing to invest more resources to improve the data security. For example, they buy expensive firewalls and employ security experts to maintain the firewalls, trying to prevent invasions from outside.

However, not many people are aware of the security within the firewall. Actually, over 50% of security breaches in USA were happened within the firewall. Among those security breaches, each of them leaded to an average of USD$5M lost to the company. Moreover, the IT administrators can easily access all the data in the storage. There must be measures to prevent them from stealing the data.

隨著網絡存儲的快速增長，數據泄漏的風險正不斷增加，因此數據安全變得日益重要。現在，人們已愈來愈願意投放更多資源去改善數據保安，例如，愈來愈多人願意購買昂貴的防火牆及聘請保安專家來防止外來的入侵。

可是，很多人並沒有注意到防火牆內的保安。事實上，超過一半的數據泄漏發生在防火牆以內，當中平均每宗數據泄漏為公司帶來五百萬美元的損失。另外，公司內的IT管理員隨時可以輕易地讀取存儲服務器內的所有數據，我們必需設法防止他們偷去公司的機密數據。



To solve all these problems, we encrypt the data before they reach the storages. No data is stored in the data storage in plain text format. If the data are lost, all access from unauthorized users will fail since no data can be read without the encryption key. Even the IT administrator cannot read the data if he is not authorized by the security administrator.

為了解決以上問題，我們在數據抵達存儲伺服器前就先把它們加密，因此沒有數據會以明文形式保存在儲存器內。如果數據不幸被偷走，由於所有數據已被加密，未被授權的讀取都會失敗。即使公司的IT管理員，如未獲授權，也不能讀取被加密的資料。

Funded by Innovation and Technology Commission
由創新科技署資助

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Behavioral-signature based P2P Traffic Classification
以使用模式為基礎識別P2P交通

We demonstrate the integration of RFID and speech technologies to achieve location-sensitive delivery of dynamic information via the speech medium. Location-awareness is achieved through a portable RFID reader integrated with a Pocket PC. Pertinent, textual information related to the location is retrieved from the data source via wireless communication network. The textual information is transformed into a speech waveform (possibly via text-to-speech synthesis) for audio-based delivery to the user. We have realized this system integration in the context of an audio tour of our laboratory. This integrated system has significant potential in applications that call for location-dependent information delivery, e.g. digital homes, shopping arcades, etc.

本專案把 RFID 技術與語音結合應用於導遊系統。Pocket PC 作為可 RFID 標籤的展覽物品，通過無線網路連接下載相應的語音資訊。遊客只需將 Pocket PC對準所要觀賞的物品按下快捷鍵，就可通過耳機收聽到對於此物品的解說，代替了傳統的導遊的解說，為遊客提供更加個性化、更加便捷的服務。圖片展示的RFID語音導遊中用戶通過RFID獲取對應的索引值回饋給系統資料庫，查找到與此索引值對應的檔，若此檔在本地便合成語音並播放，否則無線連接伺服器下載對應檔案合成語音播放。

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Crystal: A Chinese Text-to-Audiovisual-Speech Synthesizer
「晶瑩聲」視覺化語音合成系統

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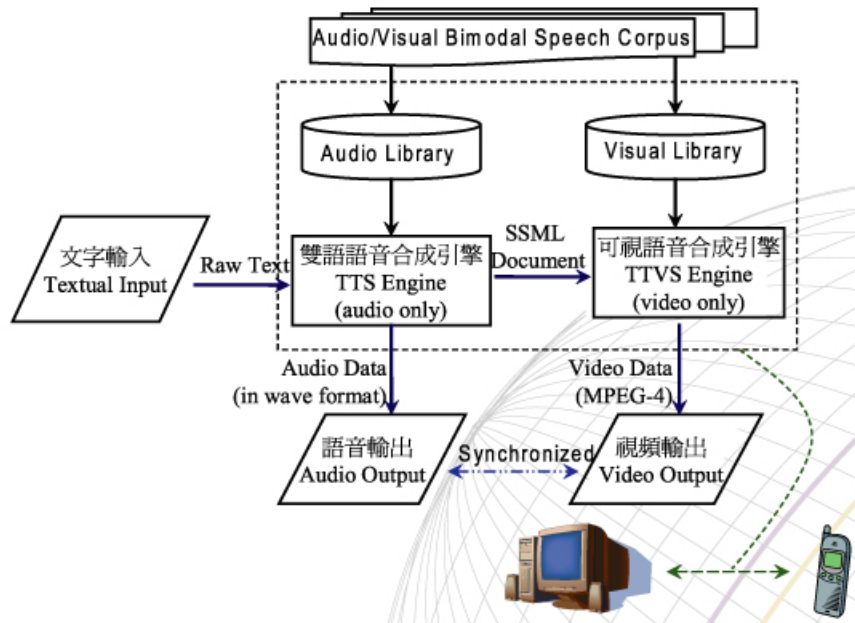

"Crystal" is a real-time Chinese Text-to-Audiovisual-Speech (TTAVS) Synthesizer. It accepts Chinese textual input and generates natural sounding Cantonese or Putonghua speech as audio output, as well as synchronized, animated lip movements of a talking avatar as visual output. The Chinese dialects may be synthesized with a consistent voice. Crystal can also exhibit facial expressions and head movements that are conducive to communication. The original version of Crystal runs on a desktop machine. We are developing an embedded version that can run on the WinCE platform, in support of mobile and multimodal multimodal applications such as reading SMS on a mobile phone. We are also developing a web-based Crystal. It is a platform and browser independent version with some advanced features, including download of the synthetic result in MP3 or MP4 format, and the support of asynchronized streaming output.

「晶瑩聲」是一套即時地將中文文本轉換為音/視頻語音輸出的合成系統。它以一個三維立體化的動畫化身人物「晶晶」說出自然流暢的粵語及普通話，她的嘴唇動作亦能同步配合。而且，普通話和粵語這兩種中文方言會以同一個說話人的聲音合成出來。同時，「晶晶」亦擁有面部表情及頭部動作，對溝通大有裨益。「晶瑩聲」的早期版本是運行在桌面作業系統上的，我們目前正在開發運行於WINCE系統的嵌入式版本，這個版本可以支援很多移動設備上的應用，例如在流動電話上朗讀短信。我們還開發了網絡版本的「晶瑩聲」，這是一個跨平台和跨瀏覽器的版本，可以讓用戶以MP3或者MP4格式下載合成結果，並且支援異步的流式音頻及視頻輸出。

Funded by Innovation and Technology Commission
由創新科技署資助
Collaboration with Tsinghua University
合作顆伴為北京清華大學

Behavioral-signature based P2P Traffic Classification
以使用模式為基礎識別P2P交通

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邱達民教授

Accurate identification of network applications is important in many areas such as network planning, quality of service (QoS) and access control. Peer-to-peer (P2P) refers to the sharing of files across personal computers connected to the Internet. It is believed that usage of the P2P protocol accounts for a significant amount of Internet traffic. Classifying P2P traffic from mixed traffic trace is now a hot research area and remains a big challenge in the field.

Traditional approach becomes less effective because many new P2P applications like Bit-torrent, PPLive can change their port numbers and obfuscate their content. New techniques that do not rely on well-known port numbers and packet payloads must be developed in order to identify P2P applications from mixed traffic trace accurately.

網絡商若能準確地識別網絡中應用的程式，便能更有效地規劃網絡、控制服務質量(QoS)及存取控制等等。點對點(P2P)是指個人電腦以互聯網連接後進行檔案分享。一般相信在現時互聯網的數據流量中，點對點的使用正佔了非常顯著的比重。要從混合的網絡交通中，分辨點對點流量是非常具挑戰性的。該範疇的研究已成了一個熱門的研究領域。

傳統的方法多依賴應用程式使用的特定連接埠號碼及數據的內容來識別數據是否屬於點對點，但新的點對點應用程式如Bit-torrent, PPLive均可更改連接埠號碼或加密數據的內容。網絡交通由不同程式的數據混合組成，舊式方法難以識別點對點應用程式的數據。要準確地識別網絡中點對點應用程式的數據，必須要找出不再依賴特定連接埠號碼及數據內容的新識別方法。

The University has developed a behavioral-signature based method that not only can identify P2P applications, but also specific P2P software such as P2P content distribution applications like Bit-torrent, Bit-comet and P2P streaming applications like PPLive, PPStream. The method can identify P2P traffic without accessing any packet payloads (content of the packet) nor using well-known port numbers, only packet header information is required.

根據使用程式的模式，中大開發了一個以使用模式為基礎的識別P2P應用程式方法。這個新方法不僅可以識別的P2P應用程式，更能詳細區分不同的種類的程式，包括P2P分享檔案應用程式例如Bit-torrent, Bit-comet及P2P串流媒體應用程式如PPLive和PPStream。新方法更無需檢查數據包的內容或是連接埠號碼，只需數據包的標題(Header)便能識別出不同的P2P應用程式及其交通。

Funded by Innovation and Technology Commission
由創新科技署資助

A Universal Media Transcoder for Mobile Networks
手機網絡的多媒體轉碼程式

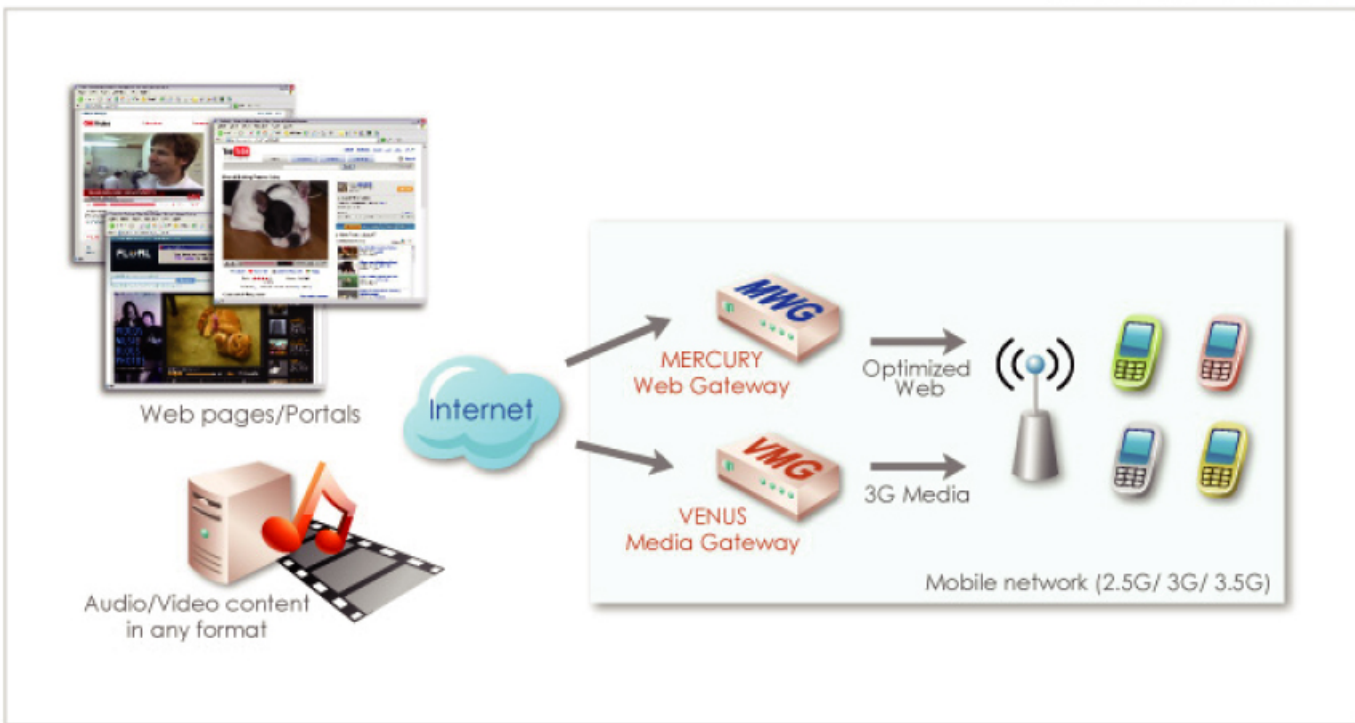
Prof. LEE Yiu Bun Jack
Department of Information Engineering
訊息工程學系
李耀斌教授

Video Transcoding is the procedure to convert a compressed video into another one with different format (i.e. different bit rate, different frame size and even different coding standard). To make high quality video streamable and playable in mobile devices, we need to perform transcoding to adapt the bit rate, spatial resolution and/or temporal resolution to match the mobile network and device capabilities.

The new technology enables mobile users to view essentially any video available on the internet anytime anywhere. To make high quality video streamable and playable in mobile devices, we need to perform transcoding to adapt the bit rate, spatial resolution and/or temporal resolution to match the mobile network and device capabilities.

視像轉碼程式是一個將壓縮視像格式轉變為另一種不同形式的程序（即不同位元率、不同畫面大小、甚至不同編碼標準）。由於目前大多數手提式電訊器材的運算速度及視像播放功能有限，並不適合高質量視像解碼和播放。要在流動器材中播放高品質視像，我們需要透過轉碼方法來配合視像源不同的編碼傳輸率、解像度和畫面轉換速度等。

新科技能使手提電話用戶隨時隨地利用手機在網上瀏覽短片。為使短片能在手機內播放及畫面更流暢，我們利用轉碼(transcoding)技術，去改變位元率(bit rate)、空間的解析度(spatial resolution)及時間的解析度(temporal resolution)，以配合手機裝置及網絡的功能。



Funded by Research Grants Council and
Mobile Technology Centre
由研究資助局及移動通訊科技中心資助

地球信息與地球科學
Geoinformation and Earth Sciences

Development of the Disaster Monitoring and Warning Information System for the Fishery Industry in the Pearl River Delta Region
珠江三角洲地區漁業災害監測和預警信息系統開發

Prof. LIN Hui
Institute of Space and Earth Information Science
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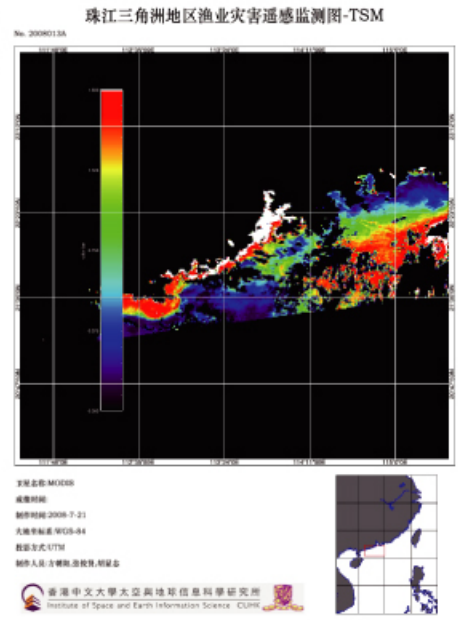
林珲教授

Fishery accounts for 23% of agricultural production in PRD. However, with the increasing environmental crises in Southern China, ocean disasters such as red tide, oil spill and other ocean pollution problems become serious threats to the fishery.

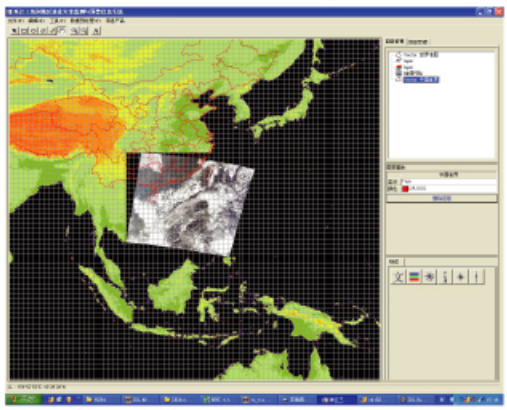
This project is a co-operation between the Chinese University of Hong Kong and the South China Sea Institute of Oceanology (SCSIO) of Chinese Academy of Sciences. It aims to develop innovative technologies for near real time monitoring and warning of ocean disasters.

漁業佔珠江三角洲農業總產量高達23%。但隨著日益嚴重的環境問題，海洋災害如赤潮、海面溢油和海水污染等對漁業構成嚴重威脅。

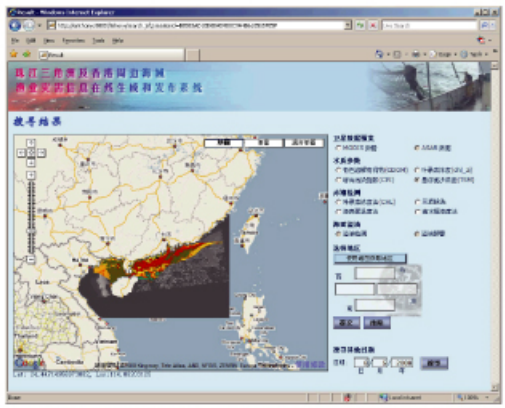
本項目由香港中文大學及中國科學院南海海洋研究所(南海所)合作提出，目標是開發海洋災害即時監測和預警的創新技術。



Total Suspended Matter (TSM) Report
懸浮泥沙（TSM）信息產品報告表



Main system interface of the Disaster Monitoring and Warning Information System for the fishery industry in the Pearl River Delta Region
珠江三角洲漁業災害與預警信息系統主界面



Web-based disaster information dissemination for fishery industry in the Pearl River Delta Region
珠江三角洲漁漁業災害在线生成和發布

With the CUHK's Satellite Remote Sensing Receiving Station and SCSIO's disaster warming models as the foundations, the Project Team will develop new multi-dimensional dynamic monitoring methods, scientific workflow management and intelligent information extraction techniques. We will also integrate the technologies and develop ASP services for near real time ocean disasters analysis and warning.

This project not only develops innovative technologies for the fishery in PRD, as the Remote Sensing Data are captured and distributed in CUHK, the project also helps the Hong Kong Information Technology Service Providers to open the new market of fishery / ocean information services.

新技術以中大衛星遙感地面接收站及南海所災害預警模型為基礎，引入災害多維動態變化監測方法、基於科學工作流的海洋災害信息智慧化提取技術。我們並將集成各種新技術以ASP方式為不同用戶提供漁業災害分析及預警發佈服務。

項目不單為珠江三角洲開發創新的漁業技術，亦因遙感數據在中大接收及發放，有助本港資訊科技行業打開漁業/海洋資訊服務市場。

Funded by Innovation and Technology Commission
Collaboration with South China Sea Institute of Oceanology, Chinese Academy of Sciences
由創新科技署資助
合作夥伴為中國科學院南海海洋研究所

Development of the Advanced Radar Satellite Remote Sensing Technology for Monitoring Urban Ground Deformation
開發應用於城市地表變形監測的先進雷達衛星遙感技術

Prof. LIN Hui
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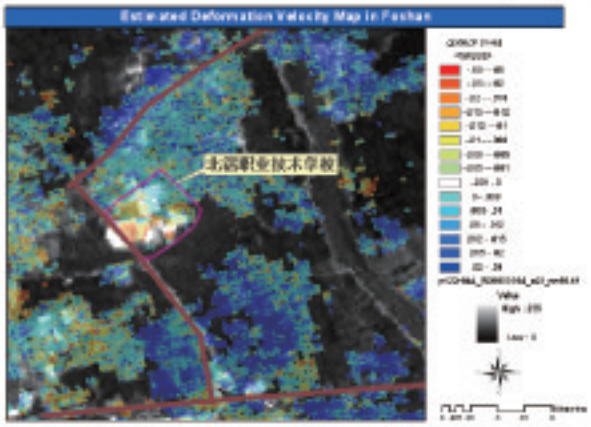
太空與地球信息科學研究所
林珲教授

Urban ground deformation is a serious environmental hazard in Hong Kong and in Mainland China. More than 70 cities in China are undergoing natural or human-induced subsidence. The disaster can lead to significant damage and, driven by safety and legal liability, construction and civil engineering industries have great demands on land surface movement monitoring, especially in major cities of China.

Satellite Permanent Scatterers Interferometry, (PSI) is a promising technology that offers low cost, large-coverage deformation monitoring and up to sub-millimeter accuracy. However, due to insufficient archive images available to many China and Asian cities, PSI can hardly be widely applied in the region.



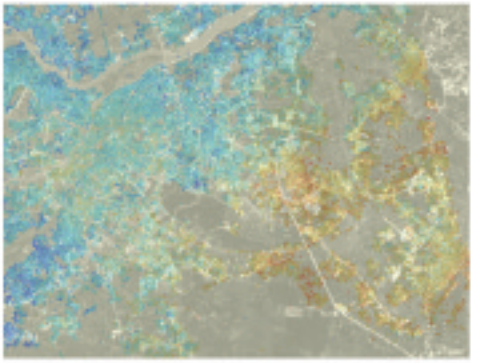
The Fushan city government spent 80 million RMB to establish the Beijiao Vocational & Technical College. Serious settlement occurs in the college four years after the establishment (Source: xkb.com.cn).
新快網報導：佛山市耗資 8000 萬元建造順德區北滘職業技術學校，該校四年後出現嚴重的地面沉降

城市地面變形是本港及國內城市的嚴重環境地質災害，全國已有70多個城市發生了不同程度的地面沉降。地面沉降能引致重大損失，基於安全及法律責任，建造業對地面沉降監測(尤其在主要城市)有很大需求。

衛星雷達遙感永久散射體干涉測量(PSI)擁有低成本、大範圍監測及毫米級準確度等優點，但很多中國及亞洲城市只有少量雷達遙感存檔影像，使PSI很難普遍應用。

This proposed project aims to develop the Advanced PSI (A-PSI) to overcome PSI's limitations in the region. A-PSI relaxes the PSI's constraints and can be applied in linear or non-linear deformation (e.g. landslide) scenarios. Moreover, A-PSI can also be applied to areas of interests even with a limited radar archive images (e.g. China and other countries in Asian). The developed technologies and services can be adopted by the various players in the local construction industry including public and private organizations and will bring new business opportunities to the local industry to engage the engineering consultancy business in China.

本項目目標是建立衛星雷達遙感地面沉降監測的高級技術(A-PSI)。A-PSI並不局限於線性地表形變亦可應用在非線性形變(如山泥傾瀉)，並且A-PSI可以在只有小量雷達影像的地區推廣應用（如中國和亞洲城市）。項目所開發的系統方法和資訊服務也可被政府，及私營建築公司採用，並可為香港本地公司開拓更多商業機會。



Using Radar Remote Sensing to analyze settlement velocity for a city in Pearl River Delta Region
雷達遙感分析圖像顯示珠三角其中一個城市不同地區的沉降速度

Funded by Innovation and Technology Commission and SOL Data (Asia) Ltd.
由創新及科技署及儀速豐控集團資助

Noise Simulation in Virtual Environment for Urban Design and Planning
虛擬環境的噪音模仿與城市設計

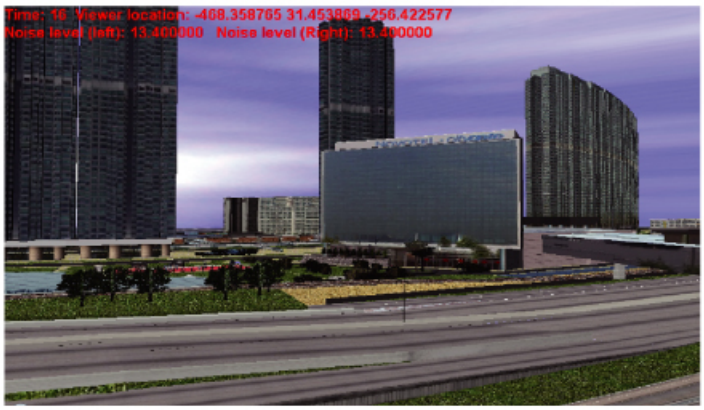
Prof. HUI Kin Chuen
Department of Mechanical and Automation Engineering
機械與自動化工程學系
許健泉教授

Traffic noise, construction noise, noise from commercial and industrial premises are major concerns in the design of new constructions such as highways, stadiums, and public utilities. An estimation of the noise in the environment as a result of the new constructions is essential in the design stage. Although there are existing tools for estimating noise level in a given landscape model, their results are not comprehensive to the general public. An effective means for experiencing the effect of noise is thus essential.

Existing tools for predicting noise levels in a given landscape computes a set of noise levels in the form of raw numerical data. Estimating the effects of these noises to different land users relies on the experience of the designers and architects, and may not be comprehensive to the general public. This project is to develop a technique to simulate the noise effect in a virtual environment such that users can experience the noise level without referring to the numerical data.

來自交通、建築工地、和各種工商業活動的噪音是策劃公路、會堂、公共設施等的重要考慮因素。因此，在設計階段評估策劃中的建築物對環境噪音做成的影響是改善環境的重要考慮。一般計算噪音的軟件能準確計算其會產生的噪音，但公眾較難理解這些噪音數據。因此，一個能使用戶體驗噪音的技術尤為重要。

現有計算噪音的軟件能計算城市內的噪音。但這類軟件只能提供一系列噪音數據。要估計這噪音對周邊環境的影響，則需依賴設計師及建築師的經驗。一般公眾對這噪音的影響較難理解。本項目就是要開發一個在虛擬環境內模擬環境噪音效果的技術，使用戶可直接感覺環境噪音，而無需查閱噪音數據。



A technique for simulating the noise effects based on a data base of pre-computed noise data will be developed. These pre-computed noise data are to be determined using precise noise models. Integrating this noise simulation with an immersive graphics display system provides a virtual environment for non-experts to experience the noise effects induced by new constructions before they are built. Architects and designers may enhance their design based on this virtual experience to reduce possible noise pollution in the environment.

本項目就是要開發一個利用噪音數據庫模擬噪音效果的虛擬環境。數據庫內的噪音數值以準確的噪音模型計算，再結合噪音模擬技術，配合可提供一虛擬環境的投入式繪圖系統讓非專家用戶也可感覺新建設將會做成的噪音。建築師及設計師可跟據這虛擬經驗改良設計，從而減低環境中的噪音污染。

Funded by Innovation and Technology Commission
由創新科技署資助

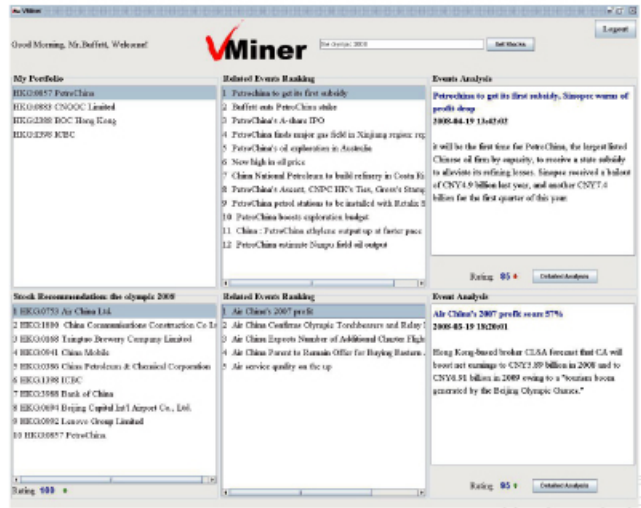
經濟與金融
Economics and Finance

Financial Information Value Mining (VMiner)
智慧金融資訊價值挖掘

Prof. YU Xu Jeffrey
Department of Systems Engineering and Engineering Management
系統工程與工程管理學系
于旭教授

Although stock price analytics have been developed by leading investment banks and hedge funds for in-house use, they are not sold to retail investors. Retail investors can only rely on personal analysis of news feeds and advice of equity analysts in making their decisions.

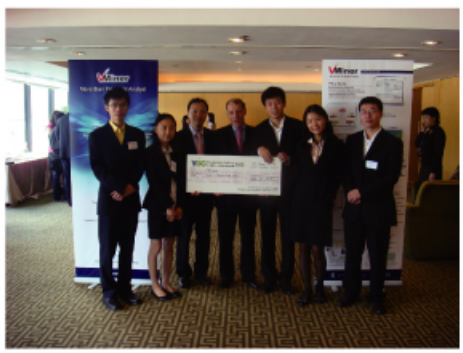
Stock prices react rapidly to news. But an investor using news feeds faces masses of information, which take hours to read. This procedure delays their investment decisions and makes them miss a lot of potential opportunities. On the other hand, equity analysts on which retail investors rely on are often the brokers who are selling investors' stocks. The advice is often delayed and biased.



當今證券交易市場，投資銀行和對沖基金都擁有專業的分析師團隊去分析股票價格的走勢，而散戶投資者卻只能通過自己閱讀財經新聞和股評來作出個人投資決策。

在市場新聞快速影響股票走勢的今天，花費大量的時間來閱讀和分辨形形色色的財經新聞會嚴重耽誤買賣決策，錯過投資機會。另一方面，股評家通常受雇於證券營業所，他們的評論通常落後於股票市場的變化並且未必客觀。

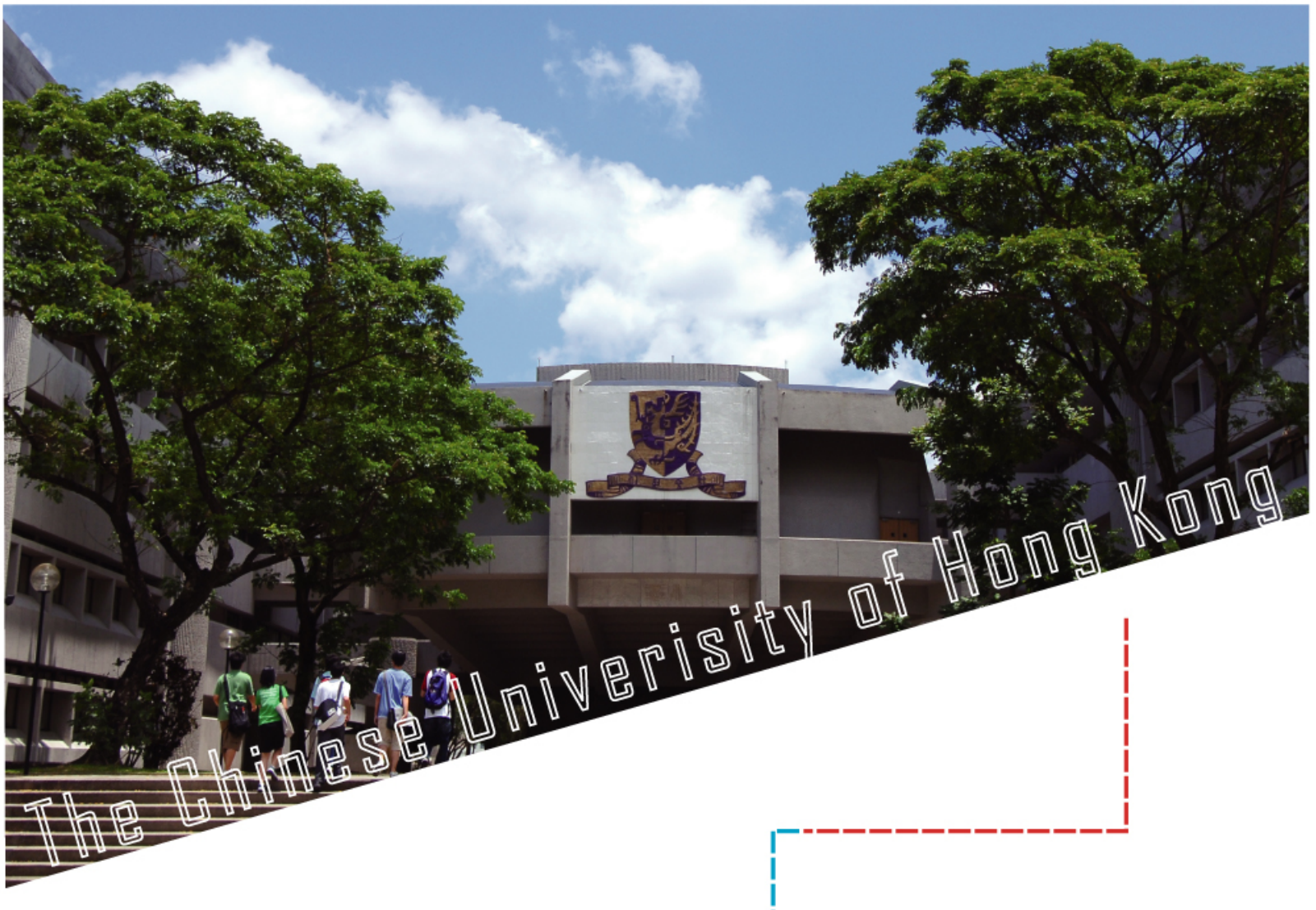
Based on machine learning and text mining technology, VMiner instantaneously analyzes masses of news and predicts the impact on stock price. VMiner includes four analysis components: (1) sentimental module decides whether a news is positive or negative; (2) topic module classifies each news into 50 different topics, including merge and acquisition, change of management team, release of financial report; (3) relevance module decides the relevance of news to the stock; (4) news freshness module decides the freshness of news. Based on these analyses, VMiner mines and analyzes real-time, textual news-feeds to give investors buy and sell recommendations.



作為一項人工智慧技術，智慧金融資訊價值挖掘(VMiner)使用機器學習及文本挖掘的方法自動判斷即時新聞對股票未來走勢的影響。VMiner的分析由四個部分構成：(1)新聞觀點分析：負責分辨正面和負面新聞；(2)新聞主題分析：自動對文本進行分類；(3)新聞相關度分析：可以判斷新聞和某隻股票的聯系程度；(4)新聞新鮮度分析：判斷新聞的及時性。基於這些分析，VMiner為散戶投資者提供即時的股票投資建議。

Awards
Champion, Vice Chancellor's Cup for Student Entrepreneurship (VCCE), 2007
Champion, Young Entrepreneurs Development Council
Entrepreneurs' Challenge business plan competition (YDC E-Challenge 2008)

獎項
2007年「香港中文大學校長杯學生創業比賽」冠軍
2008年「青年企業家發展局創業比賽」冠軍



If you are interested in any of the projects listed in the booklet
please contact the Centre for Innovation and Technology
The Chinese Univerisity of Hong Kong

如閣下對目錄內任何科研項目有興趣
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