

本校的中五學生參與創製全球最高像素照片

今年暑假期間，本校的中五學生陸驊謙和李俊軒同學在香港科技大學計算機科學及工程學系的辛達德教授 (Prof Pedro Sander) 聯同科大工業工程及物流管理學系的莊納雅教授 (Prof Ajay Joneja) 共同指導下與一組研究人員合力創製了全球最高像素的數碼照片。兩位同學首先著手改進一個670億像素巴西里約熱內盧的全貌照片的質素，在低解像度的版本上進行處理工作。再利用辛達德教授研製一套軟件，自動進行高採樣程序，將這些改動移到原來的670億像素照片。處理後的照片解像度為全球最高1,500億像素，它由11,000幅1,800萬像素的照片以尖端科技縫合起來。如果以非常高的解像度列印照片可覆蓋一個足球場。若以標準解像度列印出來，照片更可以覆蓋兩個足球場。

References:

http://www.ust.hk/eng/news/press_20101208-828.html

http://www.ust.hk/chi/news/press_20101208-828.html

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科大創製全球最高像素照片



辛達德教授與他的全球+

香港科技大學（科大）計算機科學及工程學系的辛達德教授（Prof Pedro Sander）與一組研究人員合力創製了全球最高像素的數碼照片。

最高像素照片

這幅照片是巴西里約熱內盧的全貌；它的解像度為 1,500 億像素。它由 11,000 幅 1,800 萬像素的照片以尖端科技縫合起來。如果以非常高的解像度列印，照片可覆蓋一個足球場。若以標準解像度列印出來，照片更可以覆蓋兩個足球場。



研究人員在當地名勝 Sugar Loaf 使用機械人手臂來進行拍攝；整個拍攝過程歷時約四小時。縫合過程是一個挑戰，因為需要處理極大數量的數據。研究人員試驗了多個縫合方案，以求減低各幅組成照片之間的人工化元素。最後的縫合程序需時幾星期，而上載網站亦用了一整個星期。

辛達德教授解釋他照片的像素數量



這計劃由科大計算機科學及工程學系助理教授辛達德教授以及巴西里約熱內盧國立數學大學的 Diego Nehab 博士和 Luiz Velho 博士領導。這所大學旨在促進純數和應用數學的研究，是一所頂尖的研究院。縫合過程由該大學研究生 Rodolfo Lima 先生主理。



培養視像處理的未來科學人才

今年暑假期間，辛達德教授聯同科大工業工程及物流管理學系的莊納雅教授（Prof Ajay Joneja）共同指導兩位本地中華基金中學的高中生陸驊謙和李俊軒同學著手改進這 670 億像素照片的質素。由於處理這種高解像度照片有一定難度，兩位學生於是在一個低解像度的版本上進行處理工作。辛達德教授研製了一套軟件，可以自動進行高採樣程序，將這些改動移到原來的 670 億像素照片。目前，這團隊已著手改善這創造世界紀錄的 1,000 億多像素照片。

辛達德教授形容攝製世界最大數碼照片的過程



嘗試打破極限；應用多姿多采

辛達德教授說：「創造了一個世界紀錄，我們當然非常興奮。事實上，這是研究攝製及分析巨型照片的第一步。我們主要希望試驗硬件和軟件的最終能力，以及解像度的極限，看看在一個單一地點可以拍攝到多少細節。我們對這方面的前景非常鼓舞。」

辛達德教授又說：「我們的技術有多個應用範圍，例如旅遊、文物保護、科研、醫學及天文學。舉例說：遊客可以在附有文字介紹的圖片中選擇旅遊景點；科學家可以使用這技術製作非常精細清晰的影像，讓我們看到小昆蟲甚至人體的細節。另一方面，這技術亦可以用於製作天文望遠鏡的高清影像。」

在科大，辛達德教授及研究人員正在研究如何使用這些高解像照片來製作著名景點的三維模型影像，例如香港的昂平大佛。將這些景點數碼化，是文化保育的重要方式。

兩度打破世界紀錄

事實上，這並不是辛達德教授及研究人員首次打破世界紀錄。在今年七月，他們亦拍製並上載了另一幅里約熱內盧市的照片。這幅照片是由耶穌像的角度拍攝，解像度為 670 億像素，也是當時的世界紀錄，但這紀錄隨後被另一組研究人員打破。

科大計算機科學及工程學系系主任韓隸教授說：「我們對科大創造世界紀錄的能力感到自豪；這証實我們作為遠東地區排名第一的計算機科學及工程學系，是實至名歸。我們在一年內兩度打破世界紀錄，實在令人興奮。這亦顯示數碼世界競爭激烈，而科大一直表現出眾。」

關於科大的計算機科學及工程學系

科大的計算機科學及工程學系是遠東區排名第一的計算機學系。作為科大規模最大的學系之一，計算機科學及工程學系旨在培養高質素及全面的畢業生，領導香港、國內及世界計算機行業的發展。學系亦致力開創各類新技術，服務業界、政府、社會及科學界。他亦致力與工業界、政府機構、專業團體和本地社區建立緊密關係。

關於辛達德教授

辛達德教授是科大計算機科學及工程學系助理教授。他於 2003 年在哈佛大學取得博士學位，2006 年加入科大。他的研究範圍包括計算機圖像、實時表現、幾何處理和圖像硬件。他原籍巴西，早期居於里約熱內盧市郊。



科大辛達德教授所攝製的 1,500 億像素照片，展示巴西里約熱內盧市的風貌



連結：

2010 年 7 月的世界紀錄：

從耶穌像拍攝的里約熱內盧市 (67 GP) : <http://www.gigapan.org/gigapans/60536/>

2010 年 12 月的世界紀錄：

從 Sugar Loaf 拍攝的里約熱內盧市 (150 GP) : <http://www.gigapan.org/gigapans/58857/>

A computer scientist at the Hong Kong University of Science and Technology (HKUST) Prof Pedro Sander has worked with a team of researchers to develop the world's largest digital photograph.

This photograph, depicting the city of Rio de Janeiro, Brazil, has a resolution of 150 billion pixels. It is the result of using cutting-edge technology to stitch together 11,000 photographs each of 18 megapixels. If printed in very high quality it would occupy the size of a football field, and if printed in standard acceptable quality it would have at least twice that size.

The researchers used a GigaPan robotic arm to position and take the photographs from The Sugar Loaf - a landmark in Rio de Janeiro - and the entire process took about 4 hours. The stitching process was challenging due to the large amount of data processing involved. Many stitching solutions were attempted in order to reduce the seam artifacts across images and the final process took several weeks. It took another full week just to upload the picture to the website over the Internet.

The project was led by Prof Sander, Assistant Professor in the Department of Computer Science and Engineering, HKUST and researchers Dr Diego Nehab and Dr Luiz Velho from the Instituto Nacional de Matematica Pura e Aplicada (IMPA), in Rio de Janeiro - a leading research institute promoting high-level scientific research in Mathematics and its applications. The stitching operation was managed by Mr Rodolfo Lima, a graduate student at IMPA.

Involving future scientists in the image processing

During the last summer break, Prof Ajay Joneja of the Department of Industrial Engineering and Logistics Management co-advised, along with Prof Sander, two local secondary school students on a project to improve the quality of the 67 billion-pixel photo. Since it is a very challenging to operate efficiently on such a high-resolution image, students Luk Kevin Rachim and Lee Chun Hin from The Chinese Foundation Secondary School worked on a low resolution manageable version of the image using a standard image editor. Prof Sander developed a software to automatically upsample these changes to the 67 billion-pixel image, improving its final quality. The team is now working on the 150 billion-pixel image and is now researching on tools to better process these images and remove artifacts caused by the stitching process.

Testing the Limits: Exciting Applications

Prof Sander said, "We are naturally very excited about setting a world record. In fact, this is the first step in our research on capturing and analyzing giant photographs. We were mainly testing the limits of the hardware and software, and the limits of resolution - to see how much actual detail can be captured from a single location. We were certainly impressed by the potential."

"There are numerous exciting applications in a wide range of fields, such as tourism, heritage preservation, scientific research, medicine and astronomy. For instance, an annotated image can be used for tourists to navigate through potential tourist destinations. Scientists have used these techniques to create highly detailed images of tiny insects and even detailed representations of the human body. On the opposite end of the spectrum, similar techniques have been used to produce high resolution images of the universe using images taken from telescopes," he added.

At HKUST, Prof Sander and his fellow researchers are also investigating how to map such gigantic images to 3D model representations of a landmark, such as the Big Buddha in Hong Kong. Using a few of these gigantic images, they hope to be able to make extremely accurate 3D representations of these objects. The digitalization of these landmarks is an important approach for the preservation of cultural heritage.

Setting a World Record Twice

This was not the first time Prof Sander and his co-researchers broke a world record. In July this year they produced and uploaded a giant photo - also of Rio de Janeiro but taken from the famous statue of Christ the Redeemer - measuring 67 billion pixels. This was a new world record at that time, but was subsequently broken by another team of researchers.

Prof Mounir Hamdi, Head of the Department of Computer Science and Engineering, said, "We are extremely proud of this record-breaking achievement, which testifies to our Department's ranking as No.1 in the Far East, as well as our leadership in the academic arena. Indeed, it is truly exciting to set a world record twice in a year. This shows how competitive the digital world is, and how well we are doing at HKUST."

About the HKUST Department of Computer Science and Engineering

HKUST's Department of Computer Science and Engineering is now ranked No.1 among Computer Science departments in the Far East.

As the University's largest academic department, the Department of Computer Science and Engineering aims to produce highly qualified and well rounded graduates who can provide leadership and service to Hong Kong, the Mainland, and the world. It also endeavors to pursue creative research and new technologies across disciplines to serve the needs of industry, Government, society, and the scientific community. It also aims to develop strong partnerships with industrial and government agencies, professional societies, and local communities.

About Prof Pedro Sander

Prof Sander is an Assistant Professor in the Department of Computer Science and Engineering at HKUST. He received his PhD from Harvard University in 2003, and joined HKUST in 2006. His research interests include computer graphics, real-time rendering, geometry processing, and graphics hardware. He is a native from Niteroi, Rio de Janeiro, Brazil.