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The Panoramic Stereo Images Development and Validation for Surgery Endoscope

應用於內視鏡影像之廣角縫合與立體顯示技術

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作品摘要

微創手術 (Minimally Invasive Surgery, MIS) 是目前外科手術中的主流, 比較傳統的開刀方式, 微創手術能大幅降低病患術後復原的時間與費用, 並能減少手術過程中的疼痛, 因此受到醫生與病人的肯定。目前內視鏡主要用於各科的診斷與治療, 例如子宮鏡、腹腔鏡、結腸內視鏡等, 並已被多數科別所接受。

然而, 微創手術中有限的影像視野常常是醫生開刀與學習上最大的困難點。因為醫生無法直視整個手術區域, 而是透過內視鏡拍攝腹腔內部情況再傳輸顯示至平面的顯示器, 缺少了直視的物體距離感以及受限於內視鏡鏡頭視角較窄, 導致無法掌握手術區域的全貌, 尤其對於經驗較少的醫生或是較困難的手術過程裡, 因有限的內視鏡影像視角不易觀看整個手術區域的限制, 並且不容易判斷前後位置的關係, 而造成在手術時的不確定性與困難點。

因此, 我們提出「應用於內視鏡影像之廣角縫合與立體顯示技術」, 希望提供醫生視野寬廣且具有深度感的立體影像。我們作品特色在於, 結合了廣視角接合、視角合成與三維立體顯示, 將三個技術同時結合, 應用在作品中。首先, 由兩個並排的內視鏡鏡頭, 可將影像進行廣角接合以及產生兩組鏡頭間任意視角, 最後搭配三維立體影像, 不但能提供醫生具有三維立體感的影像, 讓醫生易於判別器械跟組織之間的相對距離關係, 同時也提供醫生一個全域的手術區域影像, 藉此了解手術區域的全貌。經由實驗的結果證明, 我們不但能提升影像畫面大小為原始左右畫面的130%, 並且提供一個使用裸視3D螢幕的立體影像, 同時滿足視野與深度的需求。

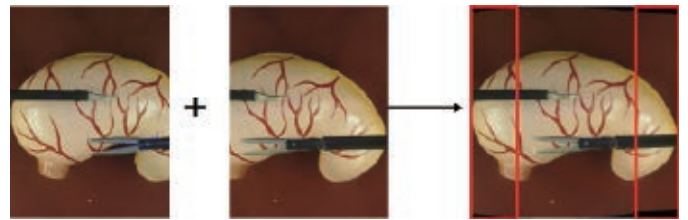


圖1 > 廣角縫合成果圖

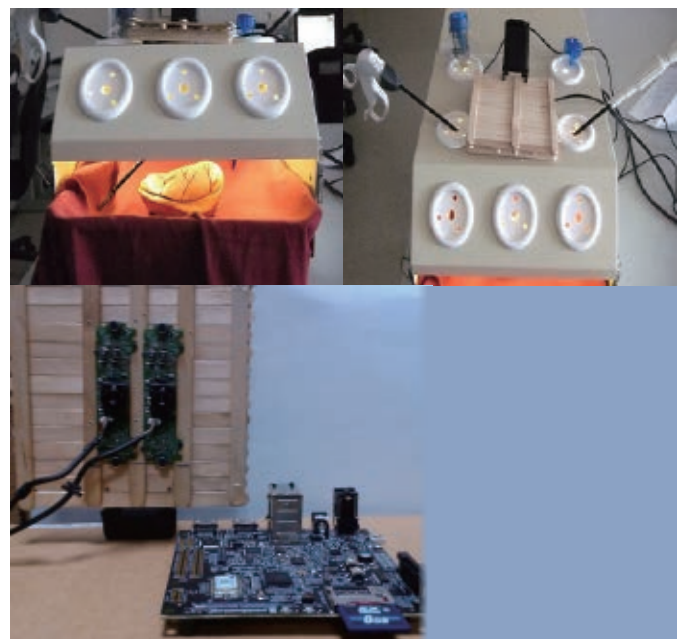


圖2 > 手術環境模擬與影像擷取設備及嵌入式系統開發板圖

指導教授**陳冠宏 / 逢甲大學電子工程學系**

畢業於中正大學電機所。曾任國家晶片中心工程師，目前任職於逢甲大學電子工程學系擔任副教授一職，並同時主持多媒體晶片實驗室。專注於多媒體矽智財與數位矽智財設計，實驗室團隊專精於影像處理技術與嵌入式系統實作。

研究領域

多媒體矽智財、晶片設計、數位矽智財設計。

鄭經華 / 逢甲大學電子工程學系

畢業於中正大學資工所。目前任職於逢甲大學電子工程學系擔任副教授一職。專注於高速動態電路與低功率電路之設計、測試與實作。實驗室團隊專精於高效能、低功率設計測試技術與晶片實作；並且在一些原創性技術（CKVdd 與 VDP）獲得很好的成果。

研究領域

VLSI design, VLSI Testing, VLSI CAD.

Abstract

Minimally Invasive Surgery is (MIS) a major surgery technique currently. Compare to the traditional surgery, minimally invasive surgery can reduce the time of recovery after surgery, the cost in patients, and the pain during surgery; therefore, affirmed by doctors and patients. Since endoscopy is mainly used for diagnosis and treatment of subjects, such as hysteroscopy, laparoscopy, the colon endoscopy and has been most hospitals to accept.

However, in MIS, the limited field of view is often the most difficult part in the doctor's surgery and learning. The doctor can't have a look directly at the entire surgical area, but through the endoscopy for abdominal cavity internal image display to the monitor. Because of the lack of a sense of distance and the narrow limited direct view of the endoscopic camera angle, the doctor can't see the entire surgical field images. Especially for the less experienced doctors or the more difficult surgical procedure, the uncertainties caused by the surgery is that the restrictions make the entire surgical area barely seen by the limited perspective of endoscope, which make the doctor unable to discriminate equipment relationship with the relative distance between the organization precisely.

Thus, we propose "The Panoramic Stereo Images Development and Validation for Surgery Endoscope", want to provide doctors with broad vision and depth sense of Three-dimensional images. Our work features a combination of bonding, Image stitching and View Synthesis and Three-dimensional display, combined with three technical applications in the works. First, the two side-by-side endoscopic lens, the image wide-angle stitching and produce any viewing angle between the two sets of lenses, not only can provide doctors with a sense of three-dimensional images, the last with a three-dimensional image, so doctor can easily to discriminate

equipment relationship with the relative distance between the organization, but also provide doctors with a global surgical field images to see the whole picture of the surgical area. Proved by the experimental results, we can not only enhance the image screen size 130% of the original left and right screens, and provide a three-dimensional image of the naked eye 3D screen, at the same time meet the needs of vision and depth.