

Proposal of Scientific Project for validating Benke

Title :

Correction and registration of hyperspectral medical images

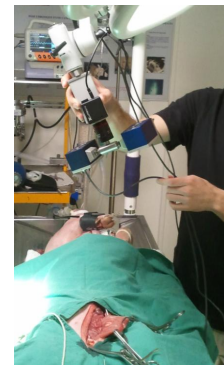
Supervisors : Sylvie TREUILLET, Yves Lucas

Laboratory : PRISME, Image & Vision Team, <http://www.univ-orleans.fr/prisme/image-vision>

Internship period : From February till May 2014

Abstract :

An new hyperspectral imaging system is being developed to assist the surgeon with tissue detection and diagnostic capabilities during an intervention in operating room [1]. The objective is to offer sharper vision to the surgeon by multispectral imaging processing including near infrared waveband sensing (400-1100 nm). Among the targeted advances of a such Computer-Aided-Diagnostic (CAD) system, we can cite with underlying anatomic structure location, tumour margin evaluation and tissue ischemia detection. To build a 3D hyperspectral image cube from a 2D imager overlaid with liquid crystal tuneable (LCTF) filters with up to hundreds of spectral bands, providing time-multiplexed data scanning. The correctness of the spectral curve of each pixel in the physical scene is directly related to the alignment of the images captured over different bands in the 3D hypercube. Most of multispectral image alignment algorithms have been dedicated for decades to the field of earth remote sensing. A recent solution based on Random Sample Consensus (RANSAC) estimates many mechanical and optical system model parameters with high immunity against the spectral reflectance variations, noise, motion-blur, blur etc [2]. But in the case of medical imaging, the difficulty lies in the image registration not only by the limited resemblance for feature matching over the spectral bands but also because of the occurrence of soft tissue movement. Some elastic image registration is then required [3]. Inspired by previous work, the main objective of this internship is to develop an efficient hyperspectral registration algorithm for elastic image alignment over the spectral bands. The proposed solution will be tested on several real hyperspectral image cubes.



References

[1] Calibration and Test of a Multispectral Imaging Prototype for Intra-Operative Surgical Assistance, D. Nouri, Y. Lucas, S. Treuillet, Proceedings of SPIE Medical Imaging 2013.

[2] Image registration software data correction algorithm for hyperspectral imager, Pradip Mainali & al., Proc. SPIE 8550, Optical Systems Design 2012.

<http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1486609>

[3] Reflectance and fluorescence hyperspectral elastic image registration, H. Lange & al., SPIE Med. Img 2004
<http://www.sti-hawaii.com/docs/SPIEMEDIMG2004/SPIE%205370-38.pdf>

Required skill

- C/C++ programming
- image processing



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