主题: SPIE Paper Number 10137-28 Acceptance and Manuscript Information
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Dear Hui Hui,

Congratulations! The chairs of the upcoming "Biomedical Applications in Molecular, Structural, and Functional Imaging" conference have accepted your paper, "**A fast image registration approach of neural activities in light-sheet fluorescence microcopy images**," for Oral presentation to be presented 13 February 2017.

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PAPER TITLE: A fast image registration approach of neural activities in light-sheet fluorescence microcopy images
PAPER NUMBER: 10137-28
PRESENTATION DATE: 13 February 2017
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Thank you for your contribution.

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A fast image registration approach of neural activities in light-sheet fluorescence microcopy images

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Abstract: The ability of fast and single-neuron resolution imaging of neural activities enables light-sheet fluorescence microscopy (LSFM) as a powerful imaging technique in functional neural connection applications. The state-of-art LSFM imaging system can record the neuronal activities of entire brain for small animal, such as zebrafish or *C. elegans* at single-neuron resolution. However, the stimulated and spontaneous movements in animal brain result in inconsistent neuron positions during recording process. In this work, we address the problem of real-time registration of neural positions in stacks of LSFM images. This is necessary to register brain structures and activities. To achieve real-time registration of neural activities, we present a fast rigid registration architecture by implementation of Graphics Processing Unit (GPU). In this approach, the image stack was preprocessed on GPU by mean stretching to reduce the computation effort. The present image was registered to the previous stack that considered as reference. A fast Fourier transform (FFT) algorithm was used for calculating the shift of the image stack. The calculations for image registration were performed in different threads while the preparation functionality was refactored and called only once by the master thread. We implemented our registration algorithm on NVIDIA Quadro K4200 GPU under Compute Unified Device Architecture (CUDA) programming environment. The experimental results showed that the registration computation can speed-up to 550ms for a full high-resolution brain image. The registration can be accelerated using more GPUs in the architecture. Our approach also has potential to be used for other dynamic image registrations in biomedical applications.

Keywords: Image registration, GPU implementation, Light-sheet microscopy

Purpose: To address the problem of real-time registration of neural positions in image stacks of light-sheet fluorescence microscopy (LSFM) images, we presented a fast image registration algorithm for functional imaging of neural activities. A fast rigid registration architecture is implemented by Graphics Processing Unit (GPU) under Compute Unified Device Architecture (CUDA) programming environment.

Methods: Our registration algorithm consists of three parts: image reading, registration pipeline setting up and iteratively implementing registration algorithm [1]. To accelerate the registration algorithm, we calculate the shift of the image. The vector multiply function is predominant for the computation performance. To realize real-time registration, the calculations in registration algorithm, i.e. FFT, IFFT, are performed on GPU, see Figure 1.

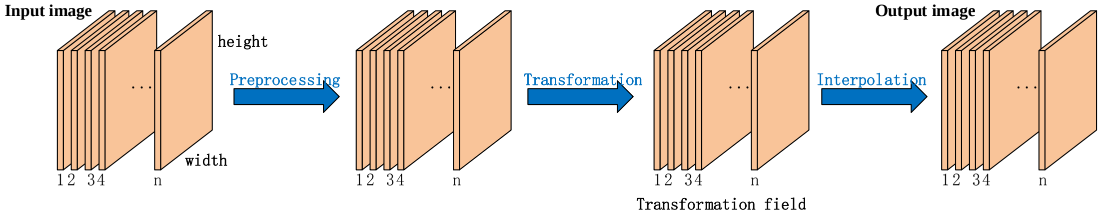

Figure 1. Design of the registration algorithm. In the registration framework, we select an input image at each time step. A series of transformations for the input images are computed in parallel and stored in the intermediate transformation field after preprocessing. After these transformation kernels have finished, the result is interpolated and stored in the output image.

The framework of parallel computation implemented by GPU, as shown in Figure 2.

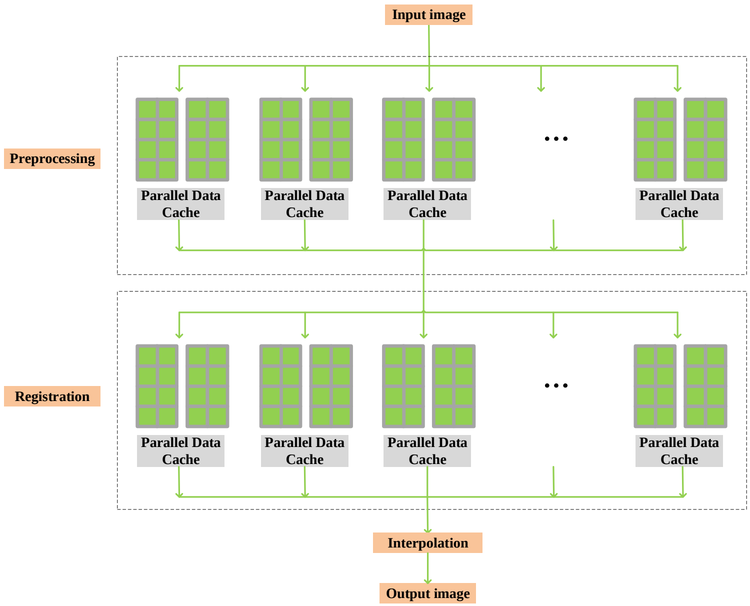

Figure 2. The framework of parallel computation based on GPU. Parallel computation was implemented at several places, namely for preprocessing and for performing the translation of each pixel. Parallelization can be performed here by threads (green grid) working on disjoint parts of the vectors.

Results: The experiments are performed on a computer with a CPU E5-1620 4 cores @ 3.50GHz processor, 32GB of RAM, and NVIDIA Quadro K4200 graphics cards. A GPU implementation accelerates the image registration. To evaluate the registration performance, three parameters point density, square size and max shift value of the image are taken into account. The runtimes of image registration with point density, square size and max shift value equal 80, 112, 12 respectively for different numbers of images are listed in Table 1.

Table 1. Runtime of the registration algorithm

Image size (height x **width** x **numbers)**	t(s)
2048 x 2048 x 100	55.052
2048 x 2048 x 500	268.027
2048 x 2048 x 1000	539.052

New or breakthrough work to be presented:

Our approach can achieve light-sheet fluorescence microscopy image registration in neural activity time-scale which can be extend to other applications of *in vivo* functional imaging.

Conclusions: In this work, we have presented a fast rigid registration architecture by implementation of Graphics Processing Unit (GPU) to realize real-time registration of neural positions in stacks of LSFM images. We have calculated the shift of the image stack performed the calculations in parallel. The deformable registration algorithm [2] on local images were obtained efficiently. The experimental results demonstrated that our approach can achieve fast image registration in millisecond scale which can be applied for *in vivo* functional imaging.

References

[1] Denis P. Shamonin, Esther E. Bron, Boudewijn P. F. Lelieveldt, Marion Smits, Stefan Klein, Marius Staring, for the Alzheimer's Disease Neuroimaging Initiative. "Fast parallel image registration on CPU and GPU for diagnostic classification of Alzheimer's disease." *Frontiers in Neuroinformatics* 7.50(2014):50-50.

[2] Muyan-Ozcelik, P., et al. "Fast Deformable Registration on the GPU: A CUDA Implementation of Demons." *International Conference on Computational Sciences and ITS Applications* IEEE, 2008:223-233.