Form 1

2017 Report Form for Collaboration with Research Center for Biomedical Engineering

Year/month/date	
Number	2009

20 /March/2018

date:

To Chairman, Board of Directors, Research Center for Biomedical Engineering

Applicant

Affiliation Beckman Laser Institute(BLI), University of California, Irvine
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Report Form for Collaboration Research

Research Theme	（和） 血行動態･血流イメージング用小型マルチアパーチャカメラの開発 （English） Compact multi-aperture camera for hemodynamics and blood flow imaging
Research Area	1. Biomaterials X2. Bioengineering 3. Functional molecules 4. Chemistry/Electrical Engineering/Mechanical Engineering/Materials Science
Research Period	From: Date/month/Year 01/ 06/2017 To: Date/month/Year 31/ 03/2018

Applicant Organization			
Name	Department	Title	Role
Bruce Tromberg	Beckman Laser Institute, The University of California, Irvine	Professor, Director of BLI	General management
Mohammad Torabzadeh	Beckman Laser Institute, The University of California, Irvine	Doctor course student	Evaluation of camera
Ata Sharif	Beckman Laser Institute, The University of California, Irvine	Project Scientist	Protocol development
Jun Tanida	Graduate School of Information Science and Technology, Osaka University	Professor	Camera system design
Collaboration Partners in the Research Center	Keiichiro Kagawa (Associate Professor, Research Institute of Electronics, Shizuoka University)		

Research Results (Including Purpose, Results, Figures, etc.)

Purpose: In this project, a compact camera head that provides multi-spectral SFDI and laser speckle imaging (LSI), called SFLS-TOMBO, is developed. The TOMBO module has nine lenses, to each of which any optical filter can be attached.

Results: Fig. 1 shows a photograph of a prototype multi-spectral TOMBO with a fixed sinusoidal pattern projector. Fig. 2 shows an image acquisition and signal processing flow. In a preliminary experiment, an arm was captured by changing the phase of projected sinusoidal pattern at 3 steps. After image registration with the phase-only correlation method, the maps of absorption coefficient and reduced scattering coefficient were retrieved as shown in Fig. 3. In summary, the whole flow of image capturing and signal processing has been established.

Filter asignment

730nm	650nm	520nm
450nm	785nm	450nm
970nm	920nm	850nm

Fig. 1

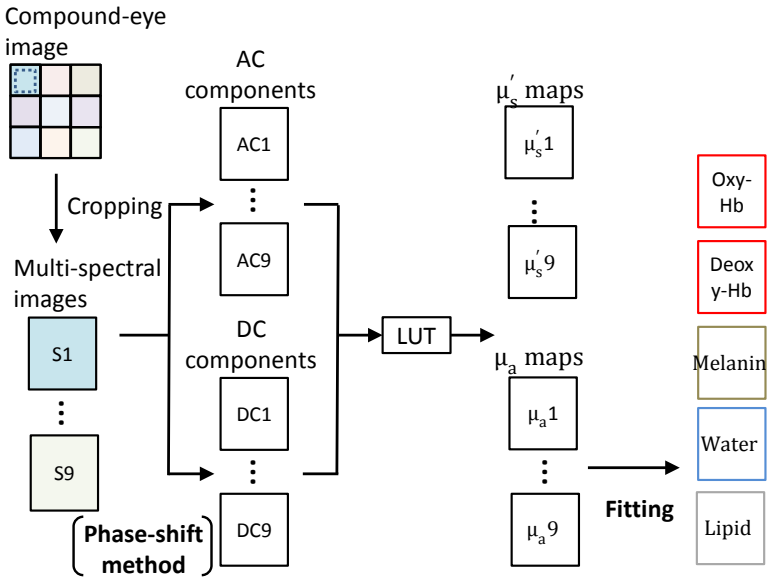

Fig. 2.

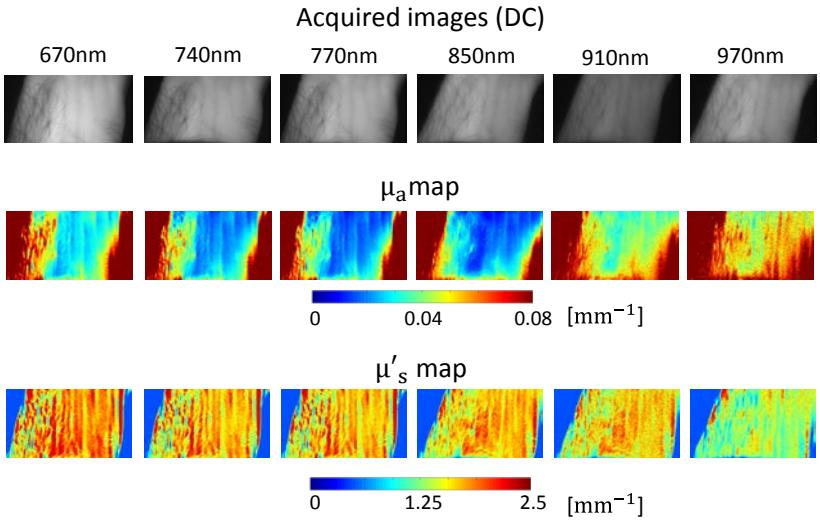

Fig. 3.

List of Publications Related to the Collaboration Research
None
List of Presentations (Conference, Meeting, etc)
1. K. Kagawa, T. Omura, M. Torabzadeh, R. Saager, A. Sharif, A. Durkin, B. Tromberg, and J. Tanida, “Compact compound-eye camera with sinusoidal pattern projector for multi-spectral frequency domain imaging,” in Proc. Optics and Photonics Japan (OPJ) 2017 (2017). 2. K. Kagawa, T. Omura, M. Torabzadeh, A. Sharif, A. Durkin, B. Tromberg, and J. Tanida, “A handy compound-eye camera with sinusoidal pattern projector for multi-spectral spatial frequency domain tissue imaging,” in Proc. 2nd Int’l Symp. On Biomed. Eng. (2017).
List of Awards
None

Research plan for the next year (from April 1, 2018 to March 31, 2019), if the collaboration research is continued. Prior consent from the collaboration partner in the Research Center is necessary.
None