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Program BOOK

39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society

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July 11 to 15, 2017

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ThDT14-01: 16:10-17:10 Schaldach Room
Retinal Imaging (Poster Session)

16:10-16:12 ThDT14-01.1
Retinal Vessel Segmentation using Second-Order Image Moments
Tiwari, Ashwani Kumar *(Wipro)*; Kanhangad, Vivek* *(Indian Inst. of Tech. Indore)*; Pachori, Ram Bilas *(Indian Inst. of Tech. Indore)*

ThDT14-02: 16:10-17:10 Schaldach Room
Retinal Vascular Imaging (Poster Session)

16:10-16:12 ThDT14-02.1
Improvement of Retinal Vessel Segmentation by Combination of Multiple Segmentation Algorithms
Rieger, Steffen* *(TU Ilmenau)*; Baumgarten, Daniel *(Ilmenau University of Technology)*; Dutz, Silvio *(Ilmenau University of Technology)*; Klee, Sascha *(Ilmenau University of Technology)*

ThDT14-03: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Breast (Poster Session)

16:10-16:12 ThDT14-03.1
A New Modified Homographic Registration Method based on SIFT Algorithm for 3-D Automated Breast Ultrasound System with Dual Wide Field-of-View Scanners
Lee, Hojung *(Sogang Univ.)*; Kang, Jinbum *(Sogang Univ.)*; Song, Ilseob *(Sogang Univ.)*; Yoo, Yangmo* *(Sogang Univ.)*

ThDT14-04: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Doppler (Poster Session)

16:10-16:12 ThDT14-04.1
A Wide Field of View Microvascular Imaging using a Curved Array Transducer and Diverging Transmit Beams
Go, Dooyoung *(Sogang University)*; Kang, Jinbum *(Sogang University)*; Yoo, Yangmo* *(Sogang University)*

ThDT14-05: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Elastography (Poster Session)

16:10-16:12 ThDT14-05.1
Ultrasound Image Reconstruction using Compressive Sensing
Ni, Pavel *(Gwangju Institute of Science and Tech.)*; Lee, Heung-No* *(Gwangju Institute of Science and Tech. (GIST))*

16:12-16:14 ThDT14-05.2
The Feasibility of the SWE with a Transvaginal Transducer for the Evaluation of Uterine Fibroids HIFU Therapy
Kim, Heeran* *(Sogang Univ.)*; Bae, Sua *(Sogang Univ.)*; Kim, Pilsu *(Sogang Univ.)*; Kim, Kidong *(Seoul National Univ. Bundang Hospital)*; Jeong, Jiyeoun *(Seoul National Univ. Bundang Hospital)*; Song, Tai-Kyong *(Sogang Univ.)*

16:14-16:16 ThDT14-05.3
Phase Aberration Correction using Average Sound Speed for SWEI
Kim, Heeran* *(Sogang Univ.)*; Bae, Sua *(Sogang Univ.)*; Yoon, Changhan *(Inje Univ.)*; Song, Tai-Kyong *(Sogang Univ.)*

16:16-16:18 ThDT14-05.4
A Multimodal Biomicroscopic System based on High-Frequency Ultrasound Elaostography and Multispectral Imaging Techniques for Tissue Characterization Ex Vivo
Kim, Jihun* *(DGIST)*; Kim, Jun-Young *(Kyungpook National Univ. Hospital)*; Seo, Anna *(Kyungpook National Univ.)*; Kim, Eunjoo *(Daegu Gyeongbuk Inst. of Science & Tech.)*; Hwang, Jae Youn *(Daegu Gyeongbuk Inst. of Science and Tech.)*

ThDT14-06: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Interventional (Poster Session)

16:10-16:12 ThDT14-06.1
Analysis of X-Ray Induced Acoustic Waves for a New Intratherapy Dosimetry
Park, Eunyeong *(Pohang Univ. of Science and Tech. (POSTECH))*; Kim, Chulhong* *(Pohang Univ. of Science and Tech.)*

ThDT14-07: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Other Organs (Poster Session)

16:10-16:12 ThDT14-07.1
A New Synthetic Aperture Technique using Plane Waves: Exact Solution and Experimental Verification
Song, Hyunwoo* *(Sogang Univ.)*; Song, Tai-Kyong *(Sogang Univ.)*

16:12-16:14 ThDT14-07.2
Ultrasound Harmonic Imaging using Narrow-Band Signal Synthesis
Lee, Kunkyu* *(Sogang Univ)*; Bae, Sua *(Sogang University)*; Song, Tai-Kyong *(Sogang University)*

16:14-16:16 ThDT14-07.3
Fermat's Spiral Scanning for 3D Plane Wave Ultrasound Imaging
Bae, Sua* *(Sogang Univ.)*; Song, Tai-Kyong *(Sogang Univ.)*

16:16-16:18 ThDT14-07.4
Reconstruct Ultrasonic Muscle Image to Analyze Muscle Density for Sarcopenia
Song, Yu-Lin* *(Asia University)*

ThDT14-08: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Prenatal (Poster Session)

16:10-16:12 ThDT14-08.1
A New High Definition Multi-Planar Reconstruction Method with Voxel based Beamforming in 3-D Ultrasound Imaging
Kim, Sung Chan *(Sogang Univ.)*; Kang, Jinbum *(Sogang Univ.)*; Song, Ilseob *(Sogang Univ.)*; Yoo, Yangmo* *(Sogang Univ.)*

ThDT14-09: 16:10-17:10 Schaldach Room
Ultrasound Imaging – Vascular Imaging (Poster Session)

16:10-16:12 ThDT14-09.1
Characterization of Atherosclerotic Plaques in IVUS Image using Co-Occurrence Matrix and Gabor Filter with Random Forests
Huang, Zhijie *(Institute of Medical Information, School of Biomedical Engineeri)*; Wang, Qing* *(Southern Medical Univ.)*

16:12-16:14 ThDT14-09.2
Laser-Induced Thermal Strain Imaging for Lipid Differentiation
Choi, Changhoon *(Pohang Univ. of Science and Technology)*; Ahn, Joongho *(Pohang Univ. of Science and Technology)*; Jeon, Seungwan *(Pohang Univ. of Science and Technology)*; Kim, Chulhong* *(Pohang Univ. of Science and Technology)*

ThDT14-10: 16:10-17:10 Schaldach Room
Functional Image Analysis (Poster Session)

16:10-16:12 ThDT14-10.1
Altered Resting-State Functional Connectivity in Adolescent Major Depressive Disorder
Han, Kiwan* *(National Center for Mental Health)*; Lee, Hyeongrae *(National Center for Mental Health)*; Park, Subin *(National Center for Mental Health)*

16:12-16:14 ThDT14-10.2
Development of a Method for Assessing the Function of Pulmonary Mucociliary Transport using Magnetic Particle Imaging
Murase, Kenya* *(Osaka University)*

16:14-16:16 ThDT14-10.3
Discrimination Analysis of Patients with Major Depressive Disorder using Resting-State Functional Connectivity
Lee, Hyeongrae* *(Natl. Center for Mental Health)*; Lee, Dong-Kyun *(Natl. Center for Mental Health)*; Sim, M. *(Natl. Center for Mental Health)*; Lee, J.H. *(Natl. Center for Mental Health)*

16:16-16:18 ThDT14-10.4
Temporal Functional Network Connectivity Dynamics in Fibromyalgia Patients – An Exploratory fMRI Study
Jarrahi, Behnaz* *(Stanford Univ.)*; Martucci, Katherine *(Stanford School of Medicine)*; Nilakantan, Aneesha *(Stanford School of Medicine)*; Mackey, Sean *(Stanford Univ. School of Medicine)*

Ultrasound Image Reconstruction using Compressive Sensing

Pavel S. Ni*, and Heung-No. Lee, *Gwangju Institute of Science and Technology*

***Abstract*— In conventional sonography best resolvable resolution considered to be equal to two wavelengths. For ultrasound systems that operate at frequencies ranging from 3~15 MHz the finest resolvable resolution would be equal to 1~0.2 mm respectively. The diffraction limit determines resolution of conventional sonography systems. However, we show that it is possible to use interference of ultrasound waves to improve spatial resolution in medical ultrasound. Our work motivated by the fact that ultrasound fields can be accurately described using Huygens-Fresnel principle. Then, received by the array of elements RF signals can be considered as a superposition of reflected back, from inhomogeneity in the medium, ultrasound fields. We propose a new ultrasound imaging method that provides much greater details of small structures that usually cannot be observed in conventional sonography.**

I. METHOD

The underlying principle of sonography imaging based on array beamforming. Beamforming process used in transmit phase to focused ultrasound pulse and or in receiving phase to focus received ultrasound waves. In focused B-mode imaging transmit and receive beamforming used to acquire 2D ultrasound image. Likewise, in plane wave imaging only received beamforming used to focus ultrasound waves in post processing dynamically. Many different beamforming techniques have been proposed in past decades. However, ability to focus ultrasound waves have fundamental limit and imposes limit on the best achievable spatial resolution.

During transmission, all array elements simultaneously excited with code sequences. Then received at array signals can be modeled as

$$f_r(t) = \sum_{i}^{N_i} \sum_{j}^{N_j} \sum_{s}^{N_s} a_{i,j,r,s} h_s(t - t_{i,j,r,s}) \,. \qquad (1)$$

where $a_{i,j,r,s}$ is an amplitude of a point target at location (i, j), h_s is shape of transmit ultrasound signals, $t_{i,j,r,s}$ is round trip time of ultrasound echo's arriving to receiving element.

Ultrasound image can be reconstructed by following Compressive sensing framework as in

$$\min_x \|x\|_{w,1} + (1/\nu)\|Gx - f\|_1 \quad s.t.\ x \geq 0 \qquad (2)$$

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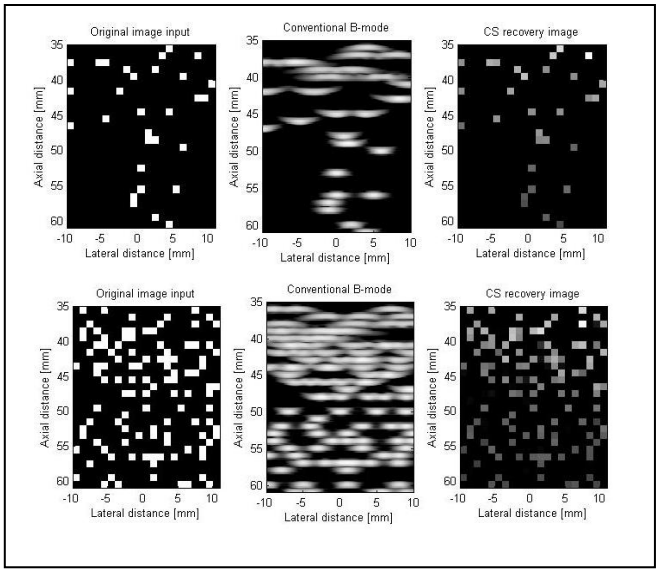

Figure 1. Simulation results for synthetic phantom with randomly placed point targets. (top) phantom consists of 30 randomly placed point targets with minimum separation of 1 mm. (bottom) phantom consists of 110 randomly placed point targets with minimum separation of 0.25 mm.

II. RESULTS

In this work we used field II ultrasound simulation software. The simulation experiment presented here includes a study on a phantom with randomly placed scatterers. In Figure 1. Ultrasound images reconstructed using CS were compared with conventional focused B-mode images.

REFERENCES

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[2] J.A. Jensen*: Field: A Program for Simulating Ultrasound Systems*, Paper presented at the 10th Nordic-Baltic Conference on Biomedical Imaging Published in Medical & Biological Engineering & Computing, pp. 351-353, Volume 34, Supplement 1, Part 1, 1996.

[3] Pavel S. Ni, Sangjun Park, and Heung-No Lee, "*Design of Unfocused Ultrasound Imaging System using Compressive Sensing*", 37th Annual Internatioinal Conference of the IEEE Engineering in Medicine and Biology Society, Milan, Italy, August 24-29, 2015.

[4] David G, Robert JL, Zhang B, Laine AF, "*Time domain compressive beam forming of ultrasound signals*", J Acoust Soc Am. 2015 May;137(5):2773-84