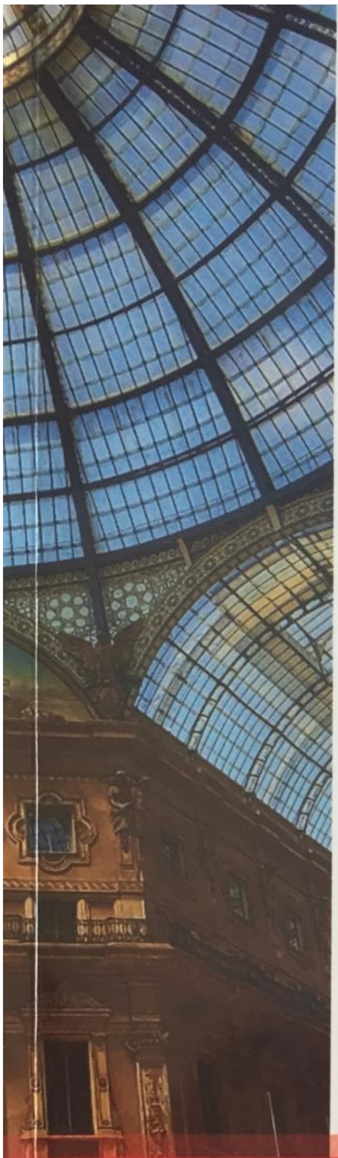

EMBC 2015 MILANO

August 25-29th 2015
Milano, Italy

Program Book

37th Annual International Conference of the
IEEE Engineering in Medicine and Biology Society
Biomedical Engineering : a Bridge to improve the Quality of Health Care and the Quality of Life

10:00-11:30 SaBPoT2.12

Validation of an Automatic Hard Tissue Segmentation Algorithm for Cone Beam CT Data

Codari, Marina* *Univ. degli Studi di Milano*; Caffini, Matteo *Polytechnic Univ. of Milan*; Rizzo, Ludovica *Politecnico di Milano*; Rocco, Giulia *Politecnico di Milano*; Tartaglia, Gianluca Martino *Univ. degli Studi di Milano*; Baselli, Giuseppe *Politecnico di Milano*; Sforza, Chiarella *Univ. degli Studi di Milano*

10:00-11:30 SaBPoT2.13

EyeBallGUI: A Tool for Interactively Viewing and Marking Multi-Channel Bio-Signals for Artefacts

Mohr, Kieran* *Trinity College Dublin*; Nasseroleslami, Bahman *Trinity College Dublin*; Iyer, Parameswaran M. *Trinity College Dublin*; Hardiman, Orla *Trinity College Dublin*; Lalor, Edmund *Trinity College Dublin*

10:00-11:30 SaBPoT2.16

Fiber-Type Hyperspectral Melanoma Screening System

Nagaoka, Takashi* *Kinki Univ.*; Nakamura, Atsushi *Waseda Univ.*; Kiyohara, Yoshio *Shizuoka Cancer Center Hospital*; Sota, Takayuki *Science & Engineering, Waseda Univ.*

10:00-11:30 SaBPoT2.17

Anisotropic Conductivity Imaging of a Postmortem Canine Brain using DT-MREIT

Jeong, Woo Chul *Kyung Hee Univ.*; Sajib, Saurav Z K *Kyung Hee Univ.*; Kim, Hyung Joong *Kyung Hee Univ.*; Woo, Eung Je* *Kyung Hee Univ.*

10:00-11:30 SaBPoT2.18

Experimental Validation of Damper Insertion Effects on Applied Strain Uniformity in Static Elastography

Sato, Takayuki* *Tokyo Metropolitan Univ.*

10:00-11:30 SaBPoT2.19

Toward Radar based Stroke Imaging by Integrating a Priori Knowledge

Schmid, Jochen* *Karlsruhe Institute of Technology (KIT)*; Doessel, Olaf *Karlsruhe Institute of Technology (KIT)*

10:00-11:30 SaBPoT2.21

Design of Unfocused Ultrasound Imaging System using Compressive Sensing

Ni, Pavel *Gwangju Institute of Science and Technology*; Park, Sangjun *Gwangju Institute of Science and Technology*; Lee, Heung-No* *Gwangju Institute of Science and Technology (GIST)*

10:00-11:30 SaBPoT2.22

Smartphone-Based Multispectral Imaging System for Mobile Skin Care

Kim, Sewoong *Daegu Gyeongbuk Institute of Science & Technology*; Dongrae, Cho *Gwangju Institute of Science and Technology*; Park, Jin Man *Daegu Gyeongbuk Institute of Science & Technology*; Lee, Boreom *Gwangju Institute of Science and Technology (GIST)*; Hwang, Jae Youn* *Daegu Gyeongbuk Institute of Science and Technology*

10:00-11:30 SaBPoT2.23

Chest Conductivity Imaging by the Electrical Exploration Method

Oda, Takaaki* *Osaka Institute of Tech.*; Uto, Sadahito *Graduate School of Engineering, Osaka Institute of Tech..*

10:00-11:30 SaBPoT2.24

Correlation of Brain Structural and Functional Connectivity Indexes

Pelizzari, Laura *IRCCS, Don Gnocchi Foundation, Milan*; Scaccianoce, Elisa *IRCCS, Don Gnocchi Foundation, Milan;Dept. of Electronics,*; Lagana, Maria Marcella *IRCCS S.Maria Nascente*; Dipasquale, Ottavia *Politecnico di Milano, Milan, Italy*; Costantini, Isa *Dept. of Electronics, Information and Bioengineering, Polit*; Baglio, Francesca *Fondazione Don Carlo Gnocchi, Milano*; Baselli, Giuseppe* *Politecnico di Milano*

10:00-11:30 SaBPoT2.25

An Empirical Study of the Robustness of the Soft Prior Regularization in Tomographic Microwave Imaging

Golnabi, Amir H* *Montclair State Univ.*; Meaney, Paul *Dartmouth College*; Paulsen, Keith *Dartmouth College*

Design of Unfocused Ultrasound Imaging System using Compressive Sensing

Pavel S. Ni, Sangjun Park, and Heung-No Lee*

***Abstract*— Objective of this work is enhancement of spatial resolution of ultrasound medical systems. A new approach for processing of ultrasound B-mode images is proposed. The approach is based on recently developed signal processing technique known as Compressive Sensing. We demonstrate simulation results of successful ultrasound image reconstruction using the proposed method.**

I. Introduction

Spatial resolution of ultrasound imaging systems is a measure of minimum distance between two closely placed point scatterers that can be resolved separately. Traditional ultrasound systems are built on an idea of controlling an ultrasound beam through focusing and steering. The narrower beam leads to a better lateral resolution and the sorter ultrasound pulse the better axial resolution. Accurate focusing of ultrasound beam requires high center frequencies and larger transducer aperture size which directly affect on penetration depth and attenuation of ultrasound waves. The proposed framework utilizes unfocused transmission of ultrasound pulse Fig. 1. No transmit or receive beamforming are used, therefore proposed imaging model can operate on low frequencies and not physically limited by transducer size as traditional ultrasound systems. During transmission all elements of the transducer are simultaneously driven by unique randomly generated code sequences. Reconstruction of ultrasound images from measured data done by using algorithm which follows theory of Compressive Sensing [1]. Compressive Sensing is a new signal processing technique allowing to solve undetermined system of linear equations formulated for ultrasound imaging (1). Sensing matrix built using spatio-temporal impulse response of discretized ROI. In this paper we demonstrate results obtained using matlab simulation program field ii [2].

II. System description and Results

We can write ultrasound imaging model as a system of linear equations: $y = Ax + n$

*Research supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (NRF-2015R1A2A1A05001826).

P.S. Ni is with the School of Information and Communications, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea (e-mail: pni@gist.ac.kr).

S. Park is with the School of Information and Communications, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea (e-mail: sjpark1@gist.ac.kr).

H-N. Lee is with the School of Information and Communications, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea (Phone:+8262-970-2237, FAX: +8262-940-2204, E-mail: heungno@gist.ac.kr).

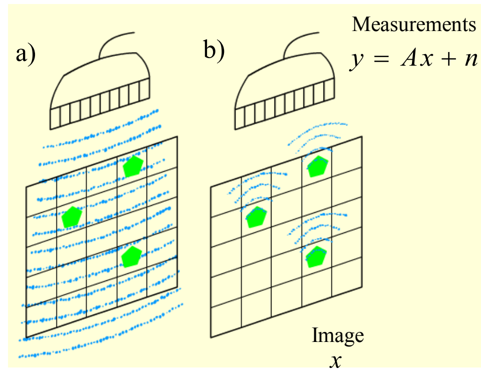

Figure 1. Schematic diagram of proposed system model. a) an unfocused ultrasound pulse is transmitted covering all ROI simultaneously. b) a backscattered signals from objects is measured by same transducer

where y is a measured backscattered signals at transducer, A is spatio-temporal impulse response matrix [3], x is the image to be estimated, n is random noise. L_1 norm minimization technique is used to estimate x from measurements y

$$\hat{x} = \min_x \|x\|_1 \quad \text{subject to} \quad \|Ax - y\|_2 \leq \varepsilon \qquad (2)$$

Fig. 2 shows successfully recovered image of two point scatterers placed at depth of 10 cm and 1 mm apart from each other. We demonstrate that proposed ultrasound system works and has resolution of 1 mm, in the future we aim to extend our work and achieve resolution of 0.1 mm.

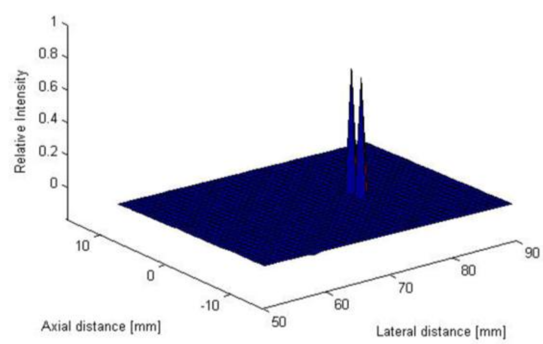

Figure 2. Reconstructed image of two point scatterers.

References

[1] R. Baraniuk, *Compressive Sensing.* IEEE Sig. Proc. Magazine 24, 2007, pp. 118-121.

[2] J. A. Jensen*, Field: A Program for Simulating Ultrasound Systems.* Conf on Biomed Imag. Vol 34, 1996, pp 351-353

[3] J. Shen and E. S. Ebbini, *A new coded excitation ultrasound imaging system – Part I: Basic principles.* IEEE Trans Ultson. Ferroelec. Freq. Cont. vol. 43. no 1, pp.131 – 140.