Development of multi-static scattering field inverse analysis theory and next-generation breast cancer diagnostic imaging technology

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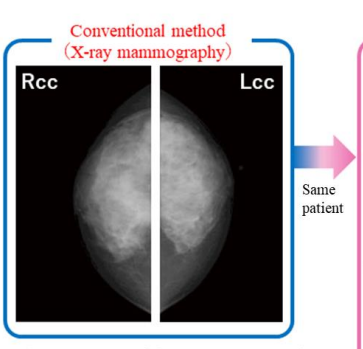
Currently, X-ray mammography, ultrasonic imaging, magnetic resonance imaging, and positron emission to mography are widely used for breast cancer diagnosis. Among them, X-ray mammography is most recom mended as a breast cancer screening device worldwide. In principle, X-ray mammography visualizes areas with higher tissue density and lime particles which are related with breast cancer. However, in the case o f women with high-density breasts, X-ray is blocked at a large amount of collagen fibers existing in the normal breast tissues, which greatly hinders early detection of young breast cancer patients. High-density b reasts are common in women under the age of 50 tissue, which is 79% of Asian women, 61% of white women, 57% of black women, and 55% of Hispanic women. In recent years, the realization of mammog raphy using microwave has been attracting attention as an effective method for high-density breasts, an d various research groups around the world have studied on mammography using microwave. However, due to mathematical reconstruction problems (uniqueness and calculation time), low resolution (ultra-wid eband (UWB) antenna performance problems), dielectric dispersion problems, etc., devices that take adv antage of the characteristics of microwaves have not yet been realized. In this talk, we discuss about o ur research that overcome these mathematical problems and engineering problems, and show cases of su ccessful visualizations of breast cancer tissues, which are difficult to detect with conventional techniques [1,2,3].



Same patient

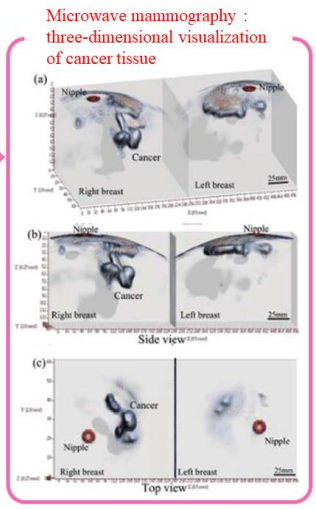


Fig1. Breasts of breast cancer patients taken with x-ray mammography. The features of high density breasts are seen in which the entire breast appears white. Making it difficult to distinguish between cancerous tissue and normal tissue.

Fig2.Microwave scattering field imaging system

[1] Kenjiro Kimura, Akari Inagaki, Seishi Kono, Hirokazu Tanino, Tomohisa Hashimoto, Toshiko Sakuma, Mayuko Miki, Shintaro Takao, Natsuko Watanabe, Yutaka Konishi, Koji Okamoto, Hajime Matsumoto, Ka zuhiko Yamagami, Yuki Mima, Kyoji Doi, Noriaki Kimura, “Development of Microwave Scattered Field Tomographic Imaging System and Clinical Trial Results”, the 26th Annual Meeting of Japanese Breast Ca ncer Society, May 2018.

[2] Kenjiro Kimura, Noriaki Kimura, “Multi-static Inverse Wave Scattering Theory and Microwave Mam mography”, SISTEMS, CONTROL AND INFORMATION, Vol.64, No.3, pp.87-91, 2020

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