Imaging System for Diagnosis of Cancer Lesions Using Diffusion-Weighted MRI

Fast Displaying of a Color-Encoded Diagnostic Map for Malignancy Covering Entire Tumors

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Invention

Researchers at Kyoto University have developed a new semi-automatic evaluation system to characterize cancer lesions detected with Magnetic Resonance Imaging (MRI) based on measurement of the diffusion properties of water and blood microcirculation in tissues.

Blood microcirculation is known as an important parameter to establish tumor grading and treatment efficacy. Conventionally, it is assessed by MRI after injection of contrast agents, but those agents may lead to severe complications or death in patients with renal failure. On the other hand, diffusion MRI is known to provide sensitive information on tissue structure at a microscopic level, by detecting diffusion of water hindered by tissue features such as cell membranes or cell density. From those information, modulated tissue status (malignant or benign) could be detected, but there has been no such precise detection system to date.

The invention provides for an approach where water diffusion parameters (e.g. the average diffusion coefficient and the kurtosis, an index of hindrance) and perfusion parameters (e.g. the flowing blood volume fraction) can be directly derived from a single MRI acquisition based on the intravoxel incoherent motion of water in tissues without using contrast agents. A diagnostic threshold has been established for each parameter to provide the highest sensitivity/specificity to malignancy detection. Combining all parameters thresholds and calculating a quantitative diagnostic score (from benign to malignant), a color-scale visualization either for whole lesions or on a pixel-by-pixel basis is made possible.
Apart from grading on tumors without using a contrast agent, this new MRI approach can also show lesions heterogeneity to guide biopsy sites, and to monitor therapy efficacy.

Advantages

- Fast, 1-step quantitative assessment of the diffusion and perfusion parameters to characterize entire lesions
- Imaging without any use of contrast agents
- High sensitivity/specificity from a multiparametric diagnostic score
- Easy diagnosis with color-encoded diagnostic maps that clearly shows biopsy sites

Applications

We are seeking a company to license the technology for its application in the following areas:

- MRI and medical imaging device
- Medical imaging software

Research Status

- Correlation of diffusion and perfusion parameters with tumoral tissue structure is verified in a rat brain tumor model.
(Iima et al. Investigative Radiology 2014. In Press)
- Superior performance of the new image processing method is verified in a small cohort of breast cancer patients.
- Ongoing validation study with a prospective study for breast cancer.
- Ongoing investigation for the use with the other cancer lesions.

Intellectual Property

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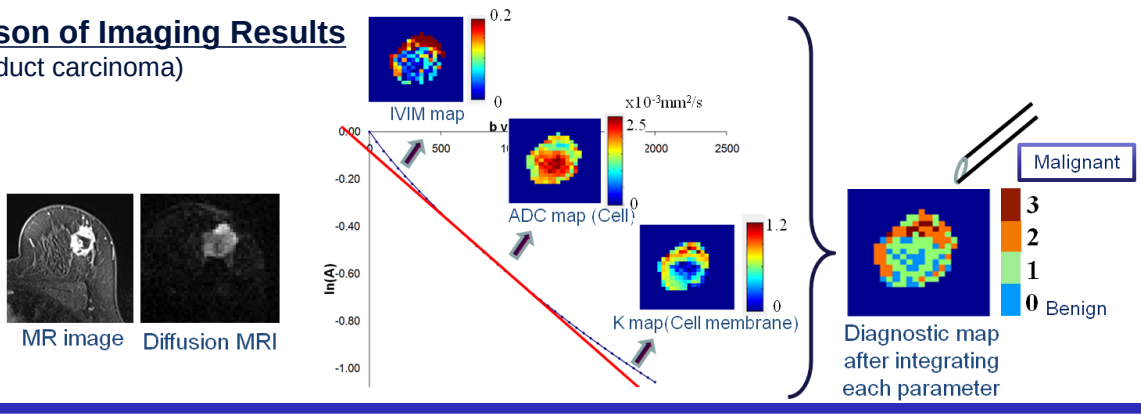
Comparison of Imaging Results

(Infiltrating duct carcinoma)



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