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Improved MRI Signal-to-Noise Ratio with Digital Beam Forming (20120248, Dr. Emad Ebbini)

Technology No. 20120248

Increased signal-to-noise ratio (SNR)

This technology is algorithms implemented in software on magnetic resonance imaging (MRI) scanners. The method is expected to increase signal-to-noise ratio (SNR), which enhances image fidelity, reduces tissue heating (SAR), and enables image acceleration. It comprises the beam forming invention: Receive-only, Transmit (B1 shimming) and Receive, and Synthetic Aperture. The latter is expected to improve SNR even though computational complexity and scan time may increase.The method is expected to be compatible with most 3T clinical scanners.

Beam forming and synthetic aperture radar

To improve signal-to-noise ratio (SNR), current magnetic resonance imaging (MRI) scanners borrow phased arrays techniques from radar. However, when this approach digitizes image data it does not use certain information (e.g., geometric information pertaining to the directivity of each individual MR coil element) and may lose other information (e.g., phase), which could further improve SNR. This new software adapts the advanced radar techniques of beam forming and synthetic aperture radar to MRI, improving image contrast and SNR on a voxel-by-voxel basis.

Phase of Development

- Prototype developed. Human brain images with 8-channel head coil on 7T MRI system.

Benefits

- Increases signal-to-noise ratio (SNR)

- Enhances image fidelity
- Increases diagnostic capabilities
- Reduces tissue heating (SAR)
- Enables image acceleration

Features

- Receive-only, Transmit (B1 shimming) and Receive, and Synthetic Aperture embodiments
- Image reconstruction
- Software upgrade or sold with new scanners

Applications

- Magnetic resonance imaging (MRI)
- 3T MRI clinical scanners
- Potential for future low-cost MR systems, (e.g. enables systems with inexpensive, inhomogeneous magnets and no gradient coils)

Researchers

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Publications

Digital beam forming in MRI
2014 IEEE Benjamin Franklin Symposium on Microwave and Antenna Sub-systems for Radar, Telecommunications, and Biomedical Applications (BenMAS), 26-26 Sept. 2014

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