REAL-TIME 3D MRI

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Technology Description

Researchers at Washington University in St. Louis have developed a method for real-time, high-resolution 3D MRI that can be used in diagnostic MRI and MRI-guided radiotherapy (MRgRT). MRgRT combines medical imaging with radiation therapy to provide visualization of the tumor within the patient and enable more precise radiation therapy. Existing MRgRT methods provide real time monitoring but they have difficulty tracking 3D tumor motion as they do not achieve the desired spatial resolution. This is due to limitations in the amount of time it takes to acquire high-resolution sample data and complete image reconstruction. To help overcome these limitations, the inventors have developed this method. It combines 3D dynamic keyhole imaging (for high temporal acquisition) with the deep learning-based SR generative (SRG) model (for high spatial-reconstruction) to enable high spatial and temporal resolution 3D MRIs in the presence of motion. This technology provides a much-needed method to improve real-time 3D MRgRT.

Comparison of 4 reconstructed coronal human subject images to the original image. Left to right-images with full k-space data, zero-filling, conventional keyhole with low-spatial resolution prior data (LR_cKeyhole), conventional keyhole with super-spatial resolution prior data (SR_cKeyhole), and dynamic keyhole with super-spatial resolution prior data (SR_dKeyhole).

Stage of Research

Initial validation studies have shown great promise. The inventors demonstrated that the technique's image quality was similar to the original SR images with full k-space data while achieving large accelerations in acquisition time. Additional validation studies are ongoing. Please see the inventor's publication for more information.

Publications

- Kim T, Park JC, Gach HM, Chun J, Mutic S. Technical Note: Real-time 3D MRI in the presence of motion for MRI-guided radiotherapy: 3D Dynamic keyhole imaging with super-resolution. Med Phys. 2019 Oct;46(10):4631-4638. doi: 10.1002/mp.13748. Epub 2019 Aug 27.

Applications

- MRI-guided radiotherapy (MRgRT)
- Diagnostic MRI

Key Advantages

- Method provides high spatial and temporal resolution for real-time 3D MRI
- Overcomes complications due motion- can acquire real-time MRI in the presence of respiratory motion without substantial motion artifacts
- Potential to improve patient care

Patents

- Provisional patent application has been filed

Related Web Links

- [Dr. Kim profile](#)
- [Dr. Park profile](#)