Software-enabled Image Correction Shimming Tool for MRI Scanners

Software for correcting main magnetic field drift in MRI scanners through improved shimming techniques, improving image quality.

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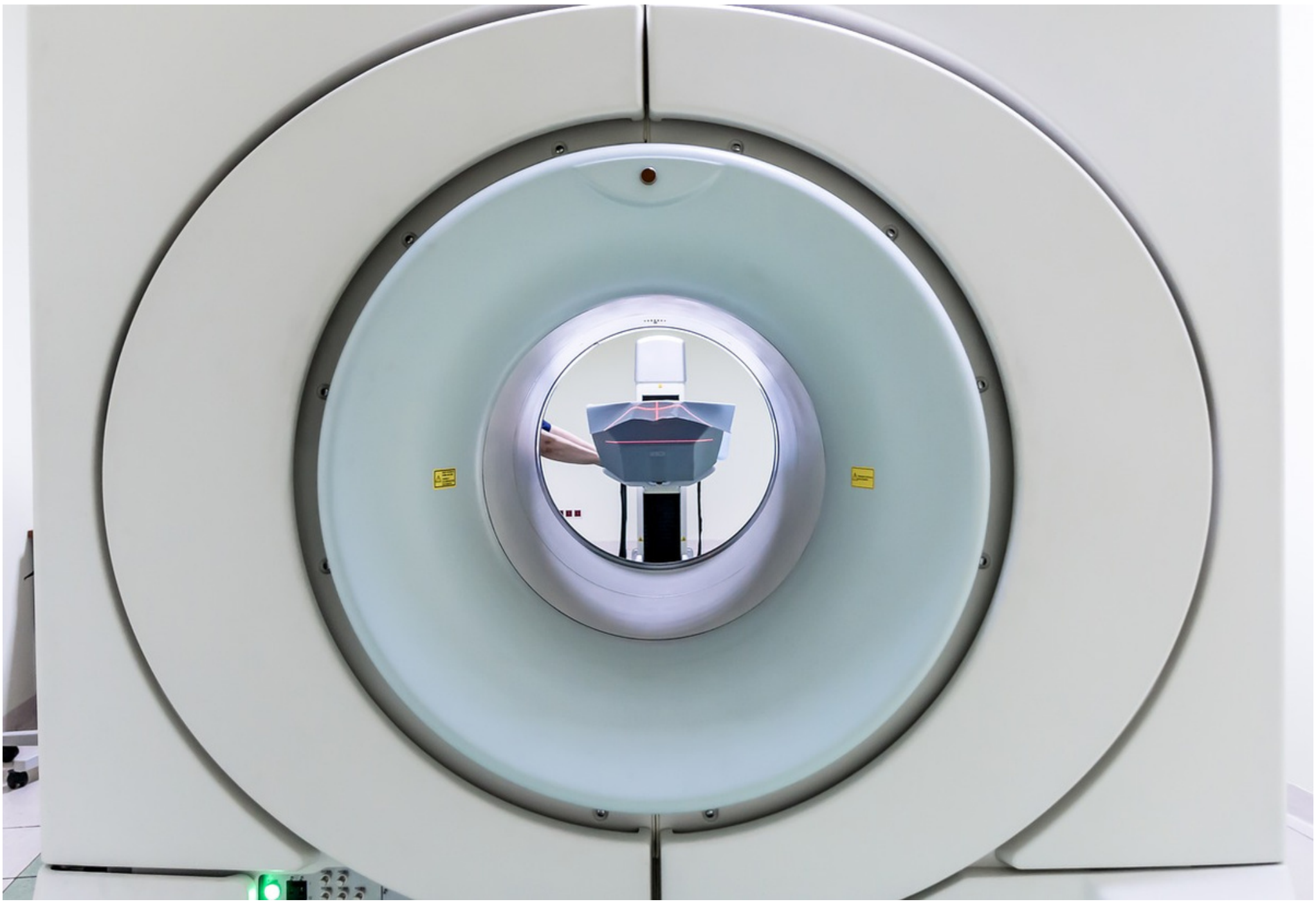

Please note, header image is purely illustrative. Source: jarmoluk, pixabay, CC0

Background

A Magnetic Resonance Imaging (MRI) scanner applies magnetic fields to a human or animal in order to generate an image of a specific region of the body. Due to a number of internal and external effects these fields are never completely homogeneous. Distortion of the magnetic fields may lead to defective images which could potentially lead to false diagnoses. Also, during the course of an MRI scan there is typically a level of magnetic drift which reduces the image quality, particularly during long scans.

It is therefore important to estimate and correct for inhomogeneity in the magnetic field. Modern scanners adjust for this through a process called shimming. The shim correction device in most MRI scanners includes a number of coils that produce small magnetic fields which are superimposed on the main magnetic field. Shimming of the magnetic field is typically performed once before the scan sequence begins. However, during a long scanning period, the initial shim prepared by the scanner could be compromised, rendering the final MRI images inaccurate.

Technology Overview

This innovation is in the form of software that runs on an MRI machine which estimates and corrects for main magnetic field drift by using a double volumetric sequencer navigator to measure and adjust shim over selected regions in a “slab-by-slab” fashion.

A 3D navigator pulse is interleaved in the scanning sequence after the acquisition of each volume. A second navigator is introduced, with a different echo time to the first, before the next volume is acquired. The two corresponding navigator images are obtained and a magnetic field map is determined via complex division of the images. This magnetic field map is then used to determine the parameters required to adjust the system central frequency of the MRI scanner to compensate for drift.

The method ultimately improves the quality of images produced by imaging scanners such as MRI’s.

The technology has been jointly developed by the University of Cape Town and the Massachusetts General Hospital (MGH) in the United States. The patents are co-owned.

Benefits

- No hardware requirement - innovation is simply uploaded as software onto existing MRI shim correction devices / integrated into the pulse sequence
- Useful particularly to smaller, cheaper MRI scanners where cheaper magnetic coils are used, or applications where “software tricks” allow for cost advantage over competitors
- Measure, report and correct for all changes in magnetic field throughout an MRI scan
- Improved image quality
- Ability of the double volumetric navigator sequence to measure and adjust shim over selected regions in a ‘slab-by-slab’ or ‘slice-by-slice’ fashion
- Integratable into any MRI pulse sequence, including functional MRI (fMRI) and diffusion tensor imaging (DTI)
- Higher order shims can be implemented if the hardware of the particular MRI scanner permits this

Applications

Hospitals, medical practices, MRI instrument manufacturers and veterinary practices that require accurate images in order to investigate the anatomy or physiology of a human or animal body.

Applicable particularly to smaller, cheaper MRI scanners where cheaper magnetic coils are used, or applications where “software tricks” allow for cost advantage over competitors

Further Details

Technology Readiness Level 5 - System Validated in a Relevant Environment

Opportunity

UCT and MGH are looking for a licensee.

Patents

- US Patent 10,018,700 (granted)
- South African Patent: 2015/04963 (granted)

IP Status

- Patented

Seeking

- Licensing
- Commercial partner