Point Sets for Higher-Quality MRI

View U.S. Patent No. 9,234,952 in PDF format.

WARF: P120355US01

Inventors: Cheng Koay

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing optimal point sets that define MRI acquisition parameters.

Overview

The problem of constructing a set of points uniformly distributed across the surface of a sphere dates to the early 20th century. The problem is of great importance to modern biomedical imaging and maximizing sampling coverage for magnetic resonance imaging (MRI). Specific applications include 3-D projection reconstruction and diffusion-weighting imaging.

There remains a need for a deterministic approach to the problem that is practical for such applications. Current methods may take hours to complete because they are iterative and inefficient. In particular, to determine diffusion-weighting directions, the point sets should be diametrically opposed through the center of the sphere ('antipodally symmetric') to yield the best results. Existing methods cannot provide this for large amounts of data points.

A better method would help improve the quality of MR images.

The Invention

A UW–Madison researcher has developed a new approach for generating uniformly distributed and antipodally symmetric point sets on a sphere. The point sets are useful for defining certain MRI acquisition parameters, specifically, diffusion-weighting directions and 3-D radial k-space trajectories. The point sets are efficiently computed using constrained centroidal Voronoi tessellation.

Applications

- 3-D projection reconstruction of medical images
- 3-D selective radiofrequency pulse design in MRI
- Diffusion MRI
- Modeling spherical optical lenses

Key Benefits

- Helps improve final MRI reconstructions
- Accurate, robust and efficient
- Works with points sets of large size
- Works where state-of-the-art iterative methods are not feasible

Additional Information

Related Technologies

- WARF reference number P110109US01 describes a deterministic approach to generating optimal ordering of MRI measurements.

Publications

- Koay C.G. 2013. Pseudometrically Constrained Centroidal Voronoi Tessellations: Generating Uniform Antipodally Symmetric Points on the Unit Sphere with a Novel Acceleration Strategy and its Applications to Diffusion and Three-Dimensional Radial MRI. Magn.

Tech Fields

- Medical Imaging : MRI

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846