Bachelor's Thesis:
Rational Approximation of Golden Ratio Sampling Schemes in Radial MRI

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Overview

During a magnetic resonance imaging (MRI) experiment data is collected in frequency space. This also called k-space can be sampled in various different ways: Cartesian, radial, spiral, etc. each with its own advantages and disadvantages. Radial sampling patterns have advantages for dynamic MRI and often make use of angular increments based on the golden ratio. Sampling schemes based on the golden ratio provide homogeneous sampling when retrospectively binning a different number of individual spokes for the reconstruction of individual time frames, thus enabling a retrospective choice of the temporal resolution. Golde-ratio sampling also has several disadvantages: It requires detailed knowledge of the measurement angles to make sense of the data which complicated data handling, may lead to numerical errors when using a large number of spokes, and prevents efficient computation because pre-computed tables can not be used.

To address these practical issues, the aim of this bachelor thesis is to implement and analyze sampling patterns based on a rational approximation of the golden ratio.

Specific Tasks

- Literature review
- Analysis of sampling patterns based on rational approximation for golden ratio
- Understand existing simulation code (C language)
- Implementation in an MRI sequence (C++)
- Measue data on the MRI scanner
- Reconstruct the acquired MRI data
- Documentation and illustration of the results

Recommended Knowledge

- Python, C and C++
- Familiarity with the Linux operating system
- Basic git workflow

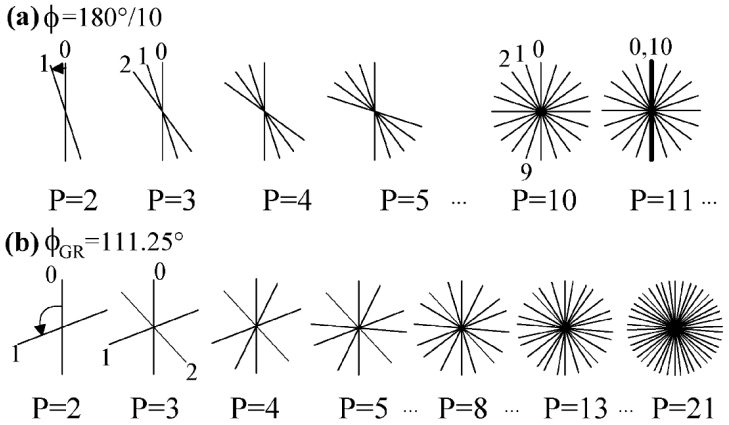

Figure 1: a) Profile ordering using fixed increment and b) golden ratio (Winkelmann et al., IEEE TMI, 2007)

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