



MRI susceptibility calculation methods

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A bundle of software implemented in both Matlab and Python that includes several implementations of current methods for calculating MRI susceptibility. These are: KD - truncated k-space division, iterTik - iterative fitting with Tikhonov regularisation, dirTik - closed-form k-space inversion with Tikhonov regularisation

MRI susceptibility calculation methods including TKD, iterTik and dirTik

In the past few decades, a range of Magnetic Resonance Imaging (MRI) techniques have been developed that exploit the properties of the phase component of the complex MR signal including the increasingly important Quantitative Susceptibility Mapping (QSM) technique. The phase of an MR image provides complementary information to its magnitude (which is usually used in clinical MRI). The phase is related to the underlying susceptibility of the tissue which depends on its composition including blood oxygenation, iron content and calcification.

Susceptibility calculation is the last step of the QSM pipeline and inverts the local field variations to produce a tissue magnetic susceptibility map. In recent years, an increasing number of susceptibility calculation methods have been invented, and there is growing interest in comparing these techniques and investigating their properties.

MRI susceptibility calculation methods is a bundle of software that includes several implementations of current methods for calculating MRI susceptibility. These are:

- TKD - truncated k-space division
- iterTik - iterative fitting with Tikhonov regularisation
- dirTik - closed-form k-space inversion with Tikhonov regularisation

The methods are implemented in both Matlab and Python.

*****Please note that the licence requires the software authors to be acknowledged in the publication of any work that uses, or results that are achieved through, the use of this software.**

For the TKD software implementation, the following citation shall be included in the acknowledgements: *Shmueli, K et al. (2009). Magnetic susceptibility mapping of brain tissue in vivo using MRI phase data, Magnetic Resonance in Medicine vol 62 issue 6, 1510-1522 and Schweser, F et al. (2013). Toward online reconstruction of quantitative susceptibility maps: superfast dipole inversion, Magnetic Resonance in Medicine vol 69 issue 6, 1581-1593.*

For the dirTik and iterTik software implementations in the package, the following citation shall be included in the acknowledgements: *Karsa, A., Punwani, S., & Shmueli, K. (2020). An optimized and highly repeatable MRI acquisition and processing pipeline for quantitative susceptibility mapping*

in the head and neck region. Magnetic Resonance in Medicine, 84(6), 3206-3222 and Schweser, F et al. (2013). Toward online reconstruction of quantitative susceptibility maps: superfast dipole inversion, Magnetic Resonance in Medicine vol 69 issue 6, 1581-1593.

References

1. Shmueli, K.(2009) , <https://onlinelibrary.wiley.com/doi/10.1002/mrm.22135>, Magnetic Resonance in Medicine, 62 (6), 1510-1522
2. Karsa, A., Punwani, S., & Shmueli, K.(2020) , An optimized and highly repeatable MRI acquisition and processing pipeline for quantitative susceptibility mapping in the head and neck region., Magnetic Resonance in Medicine,, 84(6), 3206-3222.