EIDORS Version 3.8

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Abstract: This paper announces the release of version 3.8 of the EIDORS software suite. We review its new features, and discusses recent successes and challenges.

1 Introduction

We are pleased to announce the release of EIDORS 3.8 (fig. 1)[1]. The software is available at `www.eidors.org` licensed under the GNU GPLv2 (or GPLv3).

EIDORS aims to provide free software algorithms for forward modelling and inverse solutions of Electrical Impedance and (to some extent) Diffusion-based Optical Tomography, in medical, industrial and geophysical settings and to share data and promote collaboration.

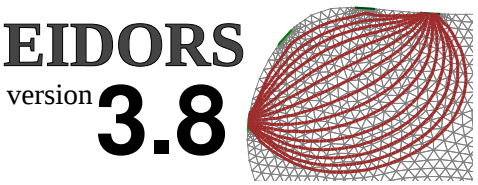

Figure 1: EIDORS 3.8: featuring flexible parametrization, meshing, absolute solver and visualization improvements. Image shows current streamlines on a thorax-shaped finite element model.

2 New Features

Release 3.8 of EIDORS builds upon a strong foundation in reconstruction algorithms, adding and improving a number of aspects.

1. More stable iterative absolute inverse solvers (both Gauss-Newton and Conjugate-Gradient).
2. Greater flexibility in parametrization choices.
3. Native handling of unit scaling (10^x, e^x, $\ln x$, $\log_{10} x$), and arbitrary units. Natural limits for $\sigma > 0$.
4. GREIT reconstructions in 3D
5. Speed optimizations: improved Jacobian calculation, faster cache handling, and faster forward solutions.
6. Improved interfaces to NetGen and visualization. Compound and point electrodes in NetGen.
7. Analytic calculation of dual-mesh interpolations (coarse to fine)
8. Support for second and third order mesh elements.
9. Support for Dräger and Swisstom file formats
10. Expanded shape library

3 Growth

EIDORS-related citations continue to grow. Current citation results are shown in table 1. The EIDORS code-base is stable with significant effort being applied to improving test coverage, refining performance and implementing new features (fig. 2). In 2012, a `dev` staging area was created for contributions in progress.

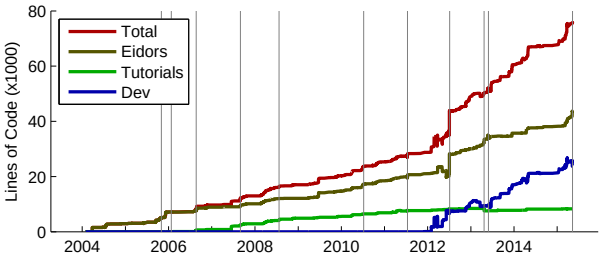

Figure 2: Lines of Code (LoC) in Matlab files in the EIDORS code-base vs. time; Total (red), Eidors (i.e. release branch, yellow), Tutorials (green), development code (blue). Releases are indicated by gray bars.

Table 1: EIDORS Citations (May 2015, scholar.google.com).

Paper	Date	Citations
[2] A MATLAB package for the EIDORS project ...	2001	159
[3] Image reconstruction algorithms for ...	2002	88
[4] A Matlab toolkit for three-dimensional ...	2002	293
[5] Uses and abuses of EIDORS: An extensible ...	2006	184

4 Successes

The structure of EIDORS has been relatively stable due, in part, to some early design choices: a modular framework and data structure, cross-platform support, integration of meshing, tutorials, and the contributed data repository. These aspects, along with an open source code-base, have enabled EIDORS to maintain research relevance.

5 Challenges

A number of challenges inherent in the implementation of EIDORS as a Matlab-based toolkit continue to recur. There is no real Object Oriented framework: no reflection, protection, or automatic management of errors. Versions of Matlab frequently vary in confounding ways that make maintaining a toolkit across multiple Matlab versions difficult. This is particularly prevalent for Windows users and “mex" file compilation. The data structure and subfunction complexity in EIDORS are a source of confusion for beginners. Despite these challenges, EIDORS continues to develop and grow: presenting version 3.8!

Acknowledgements

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References

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[2] Vauhkonen M, Lionheart WRB, Heikkinen L et al, *Physiol Meas*, 22:107–111, 2001.
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