jMRUI Version 4 : A Plug-in Platform

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Introduction

The software package jMRUI with Java-based Graphical User Interface [1] is being developed for user-friendly *time-domain* analysis of Magnetic Resonance Spectroscopy (MRS) and Spectroscopic Imaging (MRSI), and HRMAS-NMR signals. Its algorithms are based on singular value decomposition (SVD) and nonlinear least squares model fitting. In addition, the package contains a quantum-mechanical signal simulator NMR-SCOPE. This software package is presently developed in the context of the European Marie Curie project *FAST*. It is free for Academia and hospitals. The version 3.x has been distributed in 1200 groups or hospitals world-wide, see Fig.1. The new version 4.x is a plug-in platform enabling the users to add their own algorithms. Moreover, it offers new functionalities compared to the versions 3.x [2].

Method

The plans within the context of the project *FAST* are to go from the jMRUI to the eMRUI Software Package by adding a collaborative training layer [3]. In other words, we will go from single users to a community. In a first step, the source code of version 3.x has been completely refactored into a plug-in platform, see Fig.2. This was a major programming task. The plug-in platform enforces a modular approach to software development. As a result, it is more maintainable and upgradeable. In other words, it facilitates the developing and integration of new features, while keeping a robust application kernel. The plug-in configuration tools will also enable filtering and rearranging the loaded features, providing a more personalized experience or simply a lighter and more focused application.

Results

Version 4.x offers new main features:

- It is a **plug-in platform,** see Fig.3, and one of its aims is to give the users more power to adapt it to their taste. Plug-in templates (conversion, preprocessing, quantitation, custom) are provided. Users can then extend/simplify the Graphical User Interface (GUI) and add their own plug-ins using the Eclipse Platform (http://www.eclipse.org).
- The function calls are generic.
- Memory has been optimized for processing of large MRSI/time-series data-sets. An improvement by a factor of 6 has been achieved.
- The GUI code of NMR-SCOPE based on Quantum Mechanics for generating the metabolite basis-sets, has been refactored and offers more possibilities (direct simulation of series of signals as a function of MR pulse-sequence parameters, phase cycling, etc).

Implementation of Plug-ins

Pug-ins can be implemented using Eclipse and the jMRUI Plug-in template project enabling users to extend the software. A template will enable users to easily add their own favoured applications like latest file-conversion, preprocessing. Even, addition of alternative quantitation algorithms is possible and planned. In fact, contributions by users to new plug-ins are highly appreciated.

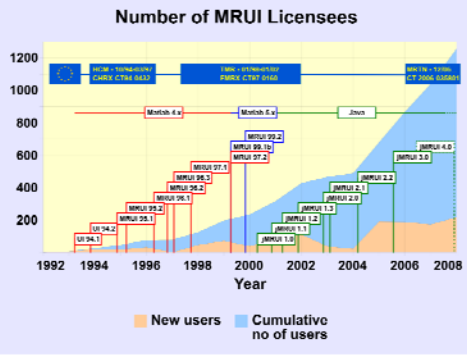

Fig.1. Number of jMRUI users world wide.

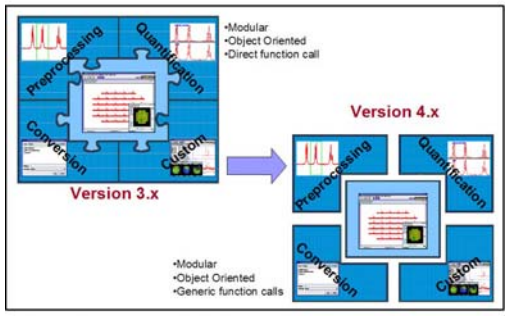

Fig.2. Changes in the architecture of the jMRUI software package between the version 3.x and the new version 4.x.

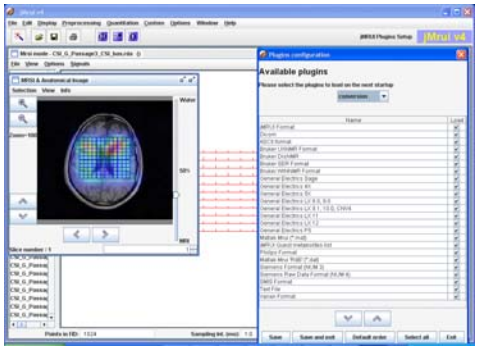

Fig.3. jMRUI version 4.x. The list of the presently available conversion plug-ins is shown in the right window as an example.

Conclusions

Version 4.x of the jMRUI software package based on Java is a plug-in platform offering advanced Signal Processing for medical Magnetic Resonance Spectroscopy. It gives more power to the users and offers advanced new features. *FAST*'s plans are to go from the jMRUI to the eMRUI by adding a collaborative training layer enabling distance interaction between users for training and consultation. In combination with this layer, new unforeseen developments are then to be expected.

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