neuGRID: A GRID-based e-infratructure for data archiving, communication and computationally intensive applications in the medical sciences

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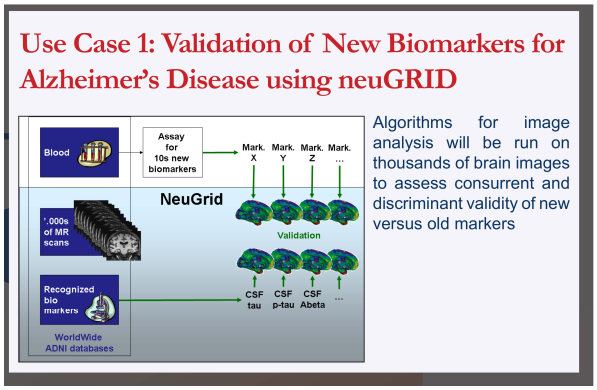
Purpose neuGRID is developing a new user-friendly Grid-based research e-Infrastructure enabling the European neuroscience community to carry out the study of degenerative brain diseases (for example, Alzheimer's disease) that requires the analysis of hundreds or thousands of MRI scans that need more than an hour of computer time per scan.

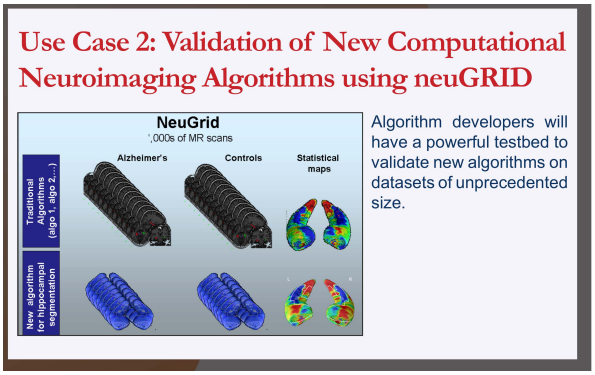
Method As part of neuGRID, cluster computers, each with more than 100 CPU's, have been installed at the FBF in Brescia, Italy and the Karolinska Institutet in Stockholm. A third will be installed at the VU University medical center in Amsterdam by the end of 2009. neuGRID is deploying a "Service Oriented Architecture" in academic neuroscientific centers to mediate between user applications, the backend system and other systems through the GRID. The clusters will make available user-facing services, such as MNI/BIC, FSL and FreeSurfer, aimed to satisfy applications (such as cortical thickness extraction and atrophy measures), with a view to making as many of them available as possible. Standard data sets will also be available on neuGRID including more than 7,000 scans from the Alzheimer's disease neuroimaging initiative (ADNI) study (Jack et al. 2008). In addition, a user will be able to process their own data and program pipelines based on the available software packages either using standard scripts or via an advanced easy-to-use graphical user interface.

Results For initial testing of neuGRID, more than 7,000 MRI scans from the ADNI study have been processed for cortical thickness using the MNI/BIC package. All the scans completed in the expected time. The results of the analysis are currently being analysed. Also, as part of its design phase, neuGRID has compiled many reports that are available to the public. These reports include discussions of the ethical issues of transporting MRI scans within Europe for research purposes and anonymization standards which must be met. Other reports detail the software packages commonly used for analysing MRI scans in Alzheimer's disease and user requirement specifications. There is also a report on the data dictionary that contains a list of variables found to be common to some trials in Alzheimer's Disease. All the reports can be found on the neuGRID web site.

Discussion neuGRID is the collaboration of several experienced research groups through out Europe. The University of the West of England (UWE), HeathGrid and the companies MAAT and Prodema all bring special expertise in computer software for medical applications. These specialties include database software, design and management of GRID infrastructures and the design of user interfaces. Several major research centers are also involved to provide guidance from a user's perspective. These centers include the FBF in Brescia, Italy, the Karolinska Institutet in Stockholm and the VU University medical center in Amsterdam.



neuGRID is compliant with acknowledged EU and international standards regarding data collection, data management, and Grid construction. Of the two deployed infrastructures, MammoGrid has provided knowledge related to the middleware and upperware interface to the Grid, while AddNeuroMed has provided the archiving and retrieval of multicentre clinical data, images and computerized image analysis.



Key research challenges that are being overcome are: 1) the gridification of algorithm pipelines for brain image analysis, 2) the development of a mid-layer of services between user-facing and grid-facing services to make the infrastructure expandable, 3) testing and validation of the prototype infrastructure.

Conclusion neuGRID provides a powerful combination of data sets from major studies, state of the art software and the processing power of hundreds of computers available through the GRID. neuGRID aims to provide a centrally-managed, easy-to-use set of tools with which scientists can perform analyses and collaborate. neuGRID will be available to the larger neuroscience community in 2011. See www.neuGRID.eu for more information.

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References Jack CR, Bernstein MA, FoxNC, et al. The Alzheimer's disease neuroimaging initiative (ADNI): MRI Methods. J Magn Reson Imag 2008:27;685-691.

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