NiftyWeb: web based platform for image processing on the cloud

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Synopsis

This work proposes a new way to publicly distribute image analysis methods and software. This approach is particularly useful when the software code and the datasets cannot be made open source. We leverage the use of Internet and emerging web technologies to develop a system where anyone can upload their image datasets and run any of the proposed algorithms without the need of any specific installation or configuration. This service has been named NiftyWeb (http://cmictig.cs.ucl.ac.uk/niftyweb).

Introduction

Research involving magnetic resonance imaging (MRI) produces many new methods and algorithms every year. These methods are described in different journal or conference papers, but access to the software implementations remains a challenge. When a software is available, the user is then faced with additional challenges like different system and software environments, poorly documented tools with many free parameters to tune, licensing issues, versioning issues and use of imaging databases which are not publicly available.

The lack of publicly available methods makes science less reproducible and reduces the impact that could potentially be made with a newly proposed algorithm. Recently, groups have made significant efforts towards distributing their software under open source licenses. Examples include FSL, NiftyReg, NiftySeg, Camino, and SPM. However, in most cases, these packages include intermediate tools that need to be connected inside bigger pipelines for large-scale analyses. Moreover, considerable effort has to be put in to find the parameters and reproduce the results that were presented in the original research paper.

This work proposes a new way to publicly distribute image analysis methods and software. This approach is particularly useful when the software code and the datasets cannot be made open source. We leverage the use of the Internet and emerging web technologies to develop a system where anyone can upload their image datasets and run any of the proposed algorithms without the need of any specific installation or configuration. This service has been named NiftyWeb (http://cmictig.cs.ucl.ac.uk/niftyweb).

Methods

NiftyWeb is a web service tool that provides an entry point to different image processing algorithms. NiftyWeb has a friendly interface and allows anyone to test or use different algorithms with minimal effort and with optimal algorithm configuration. The main advantages of NiftyWeb are complete data anonymisation through the use of NIFTI file format and automatic deletion of the uploaded data after 2 weeks. Additionally, the users do not need to create a dedicated account.

The service runs on a distributed network where specific nodes are responsible for their own dedicated algorithms (Figure 1). It is not constrained by location and nodes can be spread anywhere in the world, a key feature to enable MRI researchers to connect with algorithm providers developing a plethora of processing pipelines across the globe. The only requirement is that the computational nodes have to install and run a daemon service written in Python. The daemon is responsible for querying the server for datasets in the processing queue and downloading them to the specific node for analysis. The daemon service can be configured to allow for optimal balance of computational resources available at each node.

Results

NiftyWeb was officially launched on December 2014. During its first year, we received more than 2000 image processing requests (see Figure 2). Under the current implementation, 5 algorithms are available: *STEPS*[1], which computes a brain skull stripping mask or hippocampal masks depending on the user selection; *Boundary Shift Integral*[2] (BSI), which computes the atrophy between two time-points and generates a PDF report as a result, *Filling lesions*[3], which can take any image modality and a mask to inpaint lesions, *GIF*[4], which computes the brain parcellation and tissue segmentation from a T1 image, and finally *pCT*[5], which computes a pseudo CT image from a T1or T2 image.

Conclusions

We have presented NiftyWeb, a web solution that connects MRI researchers to algorithms. NiftyWeb allows algorithms to have a wider reach without intellectual property or ethical constraints. At the same time, it allows the users to access tools with their optimal configurations. Future work will enable researchers to add their own algorithms and software in a user friendly way.

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References

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Figures

Figure 1: Schema representing Niftyweb architecture

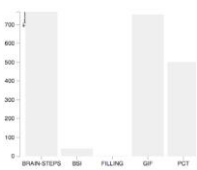

Figure 2: Graph representing the number of request per algorithm