Remote Visualization, Collaborative Annotation, and Automated Analysis of High-Resolution Bioimages Through Internet

Raphaël Marée, Benjamin Stévens, Loïc Rollus, Olivier Stern, Louis Wehenkel

GIGA Bioinformatics and Modeling, University of Liège

Belgium

raphael.maree@ulg.ac.be   http://www.montefiore.ulg.ac.be/~maree/

Abstract

We will present the development of a rich internet application for remote visualization, collaborative annotation, and automated analysis of high-resolution, high-throughput biological images. With our application, high-resolution images in various formats (e.g. from whole-slide scanning devices) that are usually too big to fit into traditional computer memory can be visualized at multiple resolutions in web clients through fully Javascript interfaces, caching mechanisms and distributed image tile servers. Our underlying relational data model allows to create projects which contain users with permission lists, images, ontologies with domain-specific terms, and layers of annotation geometries (e.g. polygons) drawn on top of original images. All project data are stored in a relational database and can be visualized and edited through the web interface, and they can also be retrieved or updated by third-party softwares through a RESTful API (two client libraries in Java and Python have been developed). In addition, we are integrating ImageJ/Fiji/OpenCV image processing routines and our general-purpose machine learning algorithms to facilitate image annotation and quantification.

At this stage of development, our application already delivers about one thousand whole-slide images (roughly 1.5Tb of data) and more than six thousand regions of interest were annotated by our collaborators in the context of ongoing studies on lung cancer and inflammation, and Zebrafish toxicology. Overall, the proposed web software is generally applicable and its methodological choices open the door for large-scale distributed and collaborative image annotation and exploitation projects. Acknowledgments: This work is funded by the research grant n°1017072 of the Walloon Region (DGO6).

Keywords

Bioimage, high-resolution, visualization, tiling, rich internet application, web-based, REST, annotation, collaborative, machine learning, decision trees