Bioscience TECHNOLOGY

Simplifying Image Analysis Software

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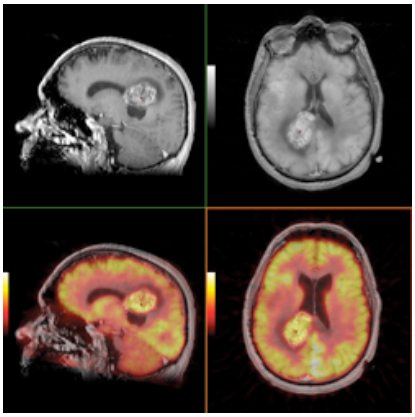
More users can now explore digitized images from molecular biology to medicine.

From academics to industry, developers create software that analyzes images. Consequently, the breadth of features in the analysis and the kinds of images that can be used keep expanding. Plus, even beginners can use today's software.

In some cases, the software is even free. In October 2006, Anne Carpenter, PhD—director of the imaging platform at the **Broad Institute of Harvard and MIT**—and her colleagues published the free and open-source CellProfiler software. Moreover, the researchers keep adding features to this cell–image analysis software. For example, Carpenter points out that CellProfiler can now "use machine learning to score complex phenotypes." She adds, "There are dozens of phenotypes that people have scored. User interaction, like playing a video game, trains the computer."



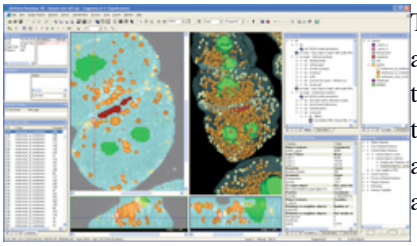
GE Healthcare's image-analysis software automatically registers and fuses PET and MR images, which provides functional and anatomical data in a single view. (Source: GE Healthcare)

This software can even find features in data that we can't see. "There are increasing instances where a computer can see things that the human eye and brain are not attuned to," says Carpenter. As an example, she says that we can't detect a 10-percent size difference between two cell samples, but CellProfiler can.

Some of today's software, though, aims at biochemistry rather than cells. For experiments that involve gels or blots, **Bio-Rad Laboratories** developed its Image Lab Software for image acquisition and analysis. "You just load the gel or blot onto a Bio-Rad imaging system, pick the application and the software does the rest," says Ryan Short, Bio-Rad's marketing manager covering the imaging product line. As part of a single automated protocol, for example, the software can image the gel or blot, find the gel lanes, detect the bands and determine the size of the bands. The software can also compare the amounts of one protein to another. Short adds: "The entire imaging and analysis takes only seconds." Bio-Rad made this software compatible with a Macintosh or PC to accommodate the wide variety of users found in most research labs today.

Combining the Images

With digitized slides, **Definiens** help to analyze them in an overlayed manner. Definiens' software accurately detects all relevant regions of interest and provides detailed measurements. "In cancer research," says Martin Baatz, Definiens's vice president of marketing, "the system separates tumor areas from nontumor areas. Within a tumor, it will detect each cell." In those tumor cells, the software distinguishes the membrane, cytoplasm, and nucleus, even measuring the amount of stain in each of those cellular components.



From digitized images, Definiens software can identify and analyze tissue structure, from tumors down to subcellular components. (Source: Definiens)

The Definiens software is available for a variety of users. "For an end-user who needs a particular application," says Baatz, "we provide specific solutions." If a user wants more control, Definiens offers that as well. "We sell a development environment for power users and have an online community for that." Those users can create custom applications. "Many cancer centers and biotechs use our software and tailor it to their research, developing new diagnostic tests," says Baatz. Definiens will develop custom applications for users when needed.

When a researcher buys a camera from **Hamamatsu**, it comes with HCimage Live software. "This allows you to capture images from the camera and process them in a way that might be as simple as saving it to disk or extracting information," says Bill Burnip, department manager for Hamamatsu's applications software development group.

The more advanced HCImage Analysis simplifies the tracking of dynamic events, like calcium imaging. It even makes it easier to colocalize

molecules with FRET. Researchers can track moving cells, and quantify how far and fast they move. This software can also be trained to find specific types of cells.

Clinical Applications

Image analysis plays an increasing role in medicine. Jennifer Dible, general manager for the Advantage Workstation (AW) from **GE Healthcare**, notes three clinical image-analysis challenges: identifying disease early and with high specificity; accessing image data and clinical applications in real time, from anywhere for collaborations; and using advanced visualization tools to guide treatments.

The AW takes on such challenges. For example, the use of a thin client lets researchers access data at a workstation or PC in the lab or on a laptop at home. The AW can even capture multi-modality information and add that to reports that can be used to compare results, say from one office visit to the next.

GE Healthcare combined a collection of capabilities across their platform. “This automates many tasks and makes them accessible where a customer needs them, and all in a seamless way,” says Dible. For more specific uses, GE Healthcare develops specialized applications across the various care areas, such as its oncology application, which can be used to facilitate diagnosis, treatment follow-ups, and even clinical trials.

“The bar has risen on image analysis,” says Jerome Knoplioch, AW’s chief engineer. “It must provide higher quality and robustness.