TECHSIGHTING
SOFTWARE

Plugging in to Visual Data

Scientific data can be stored in several ways. A popular format used by NASA and other scientific groups worldwide is the Hierarchical Data Format (HDF). HDF provides a flexible file environment to store data in many ways, including database and image formats. HDF also supports superimposition of data onto maps or images, a popular method used by Earth scientists and others to display geographic and related information.

Several software products enable opening and viewing of HDF-formatted files, but until recently users have been unable to access and manipulate HDF data with common software applications. The recent availability of a mountain of NASA's Landsat 7 data in HDF format (http://edcwww.cr.usgs.gov/) has made this shortcoming apparent. Fortunately, Fortner Software, developers of Noesys, has released a tool for importing HDF data into Adobe Photoshop (www.adobe.com). The HDF Import Plug-in consists of two files that users install easily by dragging them into the import/export folder within the Adobe Photoshop plug-ins folder.

HDF Import Plug-in
Fortner Software, LLC
Sterling, VA
$149; upgrade, $79
703-478-0181
www.SciSpy.com

Upon starting Photoshop, HDF files can be brought into Photoshop easily by selecting HDF Import from the import submenu of the file menu. Visual HDF data formats (called data objects) supported by the plug-in include 8- or 24-bit raster images, two-dimensional (2D) datasets, and 2D projections (called slices) of data from a multidimensional dataset. Up to seven dimensions of data can be "sliced" by the HDF Plug-in and shown as a 2D image.

Figure 1 illustrates how Photoshop can be employed to display three-dimensional HDF data using the red, green, and blue (RGB) color channels. The gray-scale images in the figure represent intensities of light seen by a satellite sensor as it viewed Earth through three different ranges of wavelengths. The top left image depicts data taken at a wavelength at the blue end of the visual spectrum. The top right image is the same view in the middle of the visual spectrum (green). The bottom left image is at the red end of the spectrum. By assigning each of these views to a red, green, or blue channel in Photoshop, the three-colored image (lower right) can be easily created. Because the user controls which data are displayed in which channel, specific features can be colored as desired. For example, the water in the image could be shown as shades of red instead of blue. It is a distinct advantage to be able to open HDF images in Photoshop. Dozens of Photoshop options for manipulating and enhancing visual features give users the ability to present data in almost any way they choose.

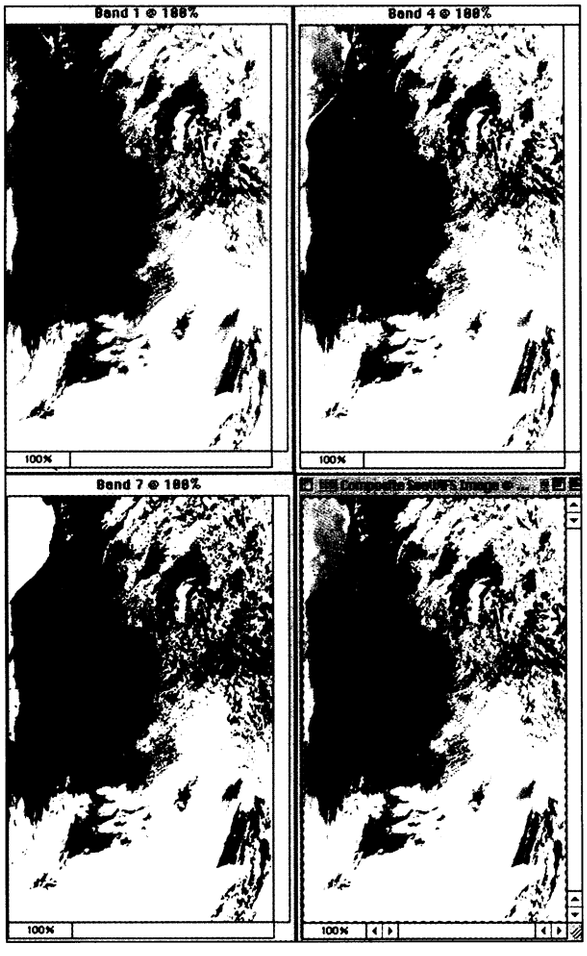

Fig. 1. Satellite views of Earth. The color image is a composite RGB image made by loading the other three images into the RGB channels of Adobe Photoshop.

The HDF Import Plug-in only works to visualize data; Photoshop contains no tools for analyzing data. Still, the HDF Import Plug-in will be welcomed by anyone trying to optimize presentation of visual data using Adobe Photoshop. The plug-in works well, installs easily, and showed no bugs in this testing with Photoshop 5.0 on a Macintosh.

—KEVIN AHERN

TECHSIGHTING
CELL BIOLOGY

Sorting on Silicon

One of the most useful technologies in a cell biologist's toolbox is flow cytometry, usually performed by a machine called a fluorescence-activated cell sorter (FACS). Flow cytometry assesses cellular properties (shape, stainability, and so forth) that can be used to distinguish among cells in mixed populations, which can then be sorted into different collection bins.

The core concept behind any cell sorting system is the ability to route cell types by physical characteristics. In a typical FACS machine, the input cell suspension moves through tubing that ends in a droplet, which is then ionized. An electrical field is then used to force the path of the droplet from this point forward. In a simple example, the collection bin may be to the left and a waste bin to the right. Sensors in the FACS are used to detect the size, fluorescence, or other property of the cell in question. Software interprets the signals from each cell and determines the direction of the electrical field, and hence, the left or right flow of the droplet.

While FACSs are quite useful, they are not without problems. First is cost. An average machine may run up to $250,000. Add to this figure the constant maintenance and repairs, and the scientist has a considerable drain on resources. Next, the mechanism by which modern FACS technology operates is prone to error. The droplet-generating orifice can become clogged or can carry-over contamination from a previous run can prevent effective sorting. Also, cell size can induce significant variation in the operation. And, finally, it is technically difficult to generate identically charged droplets; errors in deflecting a selected cell are common. Given these issues, a better way of sorting cells would be welcome.

A group of scientists from California Technical Institute (*1*) have constructed a microfabricated version of the FACS machine, which they call mFACS. The

mFACS was designed as a prototype of a small and inexpensive alternative to the FACS machines used today. Let's look under the hood of the mFACS and examine some preliminary experiments that hint at its utility.

The Cal Tech group designed a simple mFACS device that consisted of a silicone elastomer chip with three small channels that came together in the shape of a "T." The channels were made by first creating a master negative mold from a silicon wafer. Onto this mold was placed liquid silicone elastomer that was baked in to a solid form. Once made, the master wafer could "stamp" out an unlimited supply of forms.

The T-shaped channels were 100 mm wide but narrowed to only 3 mm at the junction. A glass coverslip was placed over the chip and a seal was made. The sample to sort was added to the channel at the base of the T and capillary action filled the entire channel system. Then, electroosmotic flow was used to move the sample from the base of the T to one arm that was used as the waste reservoir. To collect objects of interest in the sample, they needed a way to detect the objects and a way to divert the flow to the other arm of the channel, the collection reservoir.

In one proof-of-principle experiment they added a mixture of fluorescent red and blue beads as input and collected only red beads. They used a laser to excite the beads and a photomultiplier tube–detection system to measure only red fluorescence. When red beads passed the T-junction, the device temporarily reversed its voltage to allow the red bead to move down the collection arm. An 80- to 96-fold enrichment could be achieved with one run through this setup. They went on to sort live bacteria to show that the apparatus could be used on cells.

The benefits of mFACS over traditional FACS are many. The small volumes allow high numerical aperture optics that can increase sensitivity of detection. Also, because no droplets are created, the physical problems inherent in manipulating droplets are avoided. As an added bonus, the system should be safer when dealing with biohazardous materials because no aerosol is produced. Finally, the setup of the entire mFACS system costs only $15,000.

But there is still much work to be done before you are likely to see a mFACS in your lab. Throughput is only about 20 cells per second, so you would wait an awfully long time to get enough cells for most experiments. Nevertheless, the results from this prototype are encouraging.

—ROBERT SIKORSKI AND RICHARD PETERS

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TECHSIGHTING

NET TIPS

Y2K or Bust

When this column is printed, only 2 weeks will remain to ensure that your computer is ready for the new millenium. As with all other deadlines for grants, abstracts, etc., we know that many of us have an almost pathological tendency to procrastinate before getting to work. We anticipate that it will be no different for Y2K readiness, and we are writing this column with those of you (who by now must be starting to panic) in mind. We cannot guarantee that your computer will end up being Y2K bug-free by following the advice given here, but it should give you a good start in the right direction.

The Y2K bug will affect systems that use a two digit–date format instead of the four-digit format. A computer that uses the two digit–date format will interpret 1 January 2000 as 01/01/00 and will mistakenly think it is 1 January 1900. The confusion can cause disruptions as simple as arithmetic errors in spreadsheets that have dates within formulas or as devastating as the inability to boot your computer.

We will dissect the various ways that your system can experience Y2K glitches and will take into account both the Mac and the PC platform. There are three aspects you need to consider when trying to get Y2K ready: the hardware, the operating system, and the software (applications). We will start with the easiest and least risky issues and then move to the most challenging.

First, let's review the applications that run on your system. This is relevant whether you have a Macintosh or a PC. Although most Mac users think that the Macintosh is generally Y2K ready, they should realize that the applications themselves that are installed on the computer may not be ready for the New Year. To find out whether your applications are ready, create a list of all the applications that are installed on your computer. Then log on to the World Wide Web site of each vendor to see whether the version of the software you have is indeed Y2K ready. If not, each vendor will provide you with a plan of action. For some, installing a solution (commonly referred to as a patch) is all you will have to do; for others, you may have to upgrade to the latest version of the software.

The next steps will focus on the operating system and on the hardware. Here, Mac users are in luck: both the Mac hardware and operating system are Y2K ready. The only thing you need to do is change the date standard to the "yyyy-mm-dd" format in the Control Panels. For PC users, you will have to first determine which version of Windows is installed on your computer. On the Microsoft Web site, you can find upgrades (called Service Packs) that you can install to get your operating system Y2K ready. The Microsoft site also offers a wizard feature that you can download and run to diagnose your system. This Microsoft Product Analyzer determines which version of Windows and which version of any other Microsoft application are installed. A report is generated with a diagnosis, recommended action, and hyperlinks to the Web site where you can download patches. Remember, though, that this wizard only diagnoses Microsoft products. Finally, you should also change the Short Date format in the Regional Settings (in the Windows Control Panel) to one that includes a four-digit year ("yyyy").

The final and riskiest step is to upgrade the hardware. Every time your computer boots up, it runs a number of tests, one of which checks the date. This sequence of events is under the control of Basic Input/Output System (BIOS). Some older computers were equipped with BIOS that can only handle two-digit dates. If that is the case, you will need to upgrade the BIOS or even install a new Real Time Clock (RTC) driver. To find out what you need to do, log on to the Web site of the vendor of your computer hardware and find out what you need to do for your system. Remember that you can run into serious problems every time you modify the BIOS and get to a point where you may not even be able to boot up your machine. So before modifying the BIOS, be sure you understand what you are about to do; it is worth spending some time reading about this or asking a colleague for help.

Now that you have a clear road map, back up both your system and your data and then test your backups to be sure that they actually work. Next, you should upgrade your computer's BIOS, if needed. Although this is the most risky part, there is no point in going forward with upgrading the operating system and the applications if you cannot make the foundation of your computer Y2K ready. After the BIOS is ready, focus on the operating system and then on the various applications.

Links to Web resources featured in this column are available at http://mednav.com/features/Science/.

— RICHARD PETERS AND ROBERT SIKORSKI

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