Improving the view -- a new program for processing Hubble images

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An EPFL student has focused his work on an image of the farthest reaches of the visible universe. An improved image processing program made the photograph clearer, allowing more information to be obtained from it.

Master's student Thibault Kuntzer has focused his efforts on an image taken by the Hubble Space Telescope – the most distant photo of the universe ever taken. As part of a semester project, he tested and increased the efficiency of an image processing program that improves images taken by the telescope – a feat that could be of interest to astronomers, who are on a continual quest for higher resolution images of the outer reaches of the universe. As he wraps up the processing of the final image, which he claims could well be better than NASA's, he explains how to extract the maximum amount of information from the photons detected by the telescope.

NASA experts

"Astronomy is a mélange of every aspect of physics. The images are beautiful, but to understand them, you have to be multidisciplinary," says the Neuchâtel-born student. "To interpret an astronomical image, it's necessary to clean it up and make it clearer; astrophysicists call this "deconvolution." To do this, you have to understand the characteristics of the sensors, such as their sensitivity to each color. Then, by applying mathematical and numerical processing methods, you can reduce blurriness while still conserving as much of the raw data as possible."

Frédéric Courbin, senior scientist in EPFL's Laboratory of Astrophysics, has developed a custom-made technique for processing each image. The trick with this approach is to find the right calibration, for example as a function of the sensor used. Kuntzer took on this painstaking job – more than 200 hours in all – in order to come up with the right algorithm. "It takes nearly 60 hours on a laptop computer to process a very high resolution 100 megapixel image! You quickly realize that improving an image in a few seconds, like they do on CSI is impossible," he says.

A promising technique

This personalized processing program improves the image resolution, revealing twice as much detail. Applying the technique to the image of the farthest galaxies in the universe would enable it to be validated more easily, given that this image has already been analyzed numerous times. This would also reveal whether the technique was able to unveil new information. The method could then be used for research requiring very high resolution images. For example, astronomers need to see every detail in order to study deformations known as gravitational mirages, which appear on far-off objects when a massive body is in front of them.

"After several tests, I observed the initial results and it got easier and more intuitive," Kuntzer explains. With the help of intuition, this custom-made approach would also permit other images to be processed more easily, as well. In the end, what started out as an exercise in comparing image processing methods has allowed the student to make a real contribution to research.

More information: lastro.epfl.ch/
hubblesite.org/newscenter/arch … ve/releases/2004/07/

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