Enhancing Your Image

Inpainting is the age-old practice of restoring visual works—a process that until recently was only performed manually by experts. Many people now use computers to retouch digital photographs, yet the work can still be painstaking. A promising new field of mathematical research is the development of algorithms that solve partial differential equations to digitally inpaint with little input or effort from the user. The technique can also be used, as in the example below, to recover missing portions of transmitted images without requiring retransmission of the data.

The apparent ease with which these new algorithms restore pictures masks the difficulty of creating software to imitate the trained eye and hand of a professional. Digital inpainting methods must incorporate information not only about colors near the incomplete area, but also about the direction of change in the boundaries between existing lines and missing ones. Some inpainting procedures rely on techniques from computational fluid dynamics, ensuring that known information "flows" continuously into needed areas. Thus, results from the well-established field of computational fluid dynamics are applied to the new field of digital inpainting so that everyone can get the complete picture.

For more information: "Filling in Blanks," Ivars Peterson, *Science News*, 11 May 2002.

Photographs courtesy of S. Rane and G. Sapiro

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