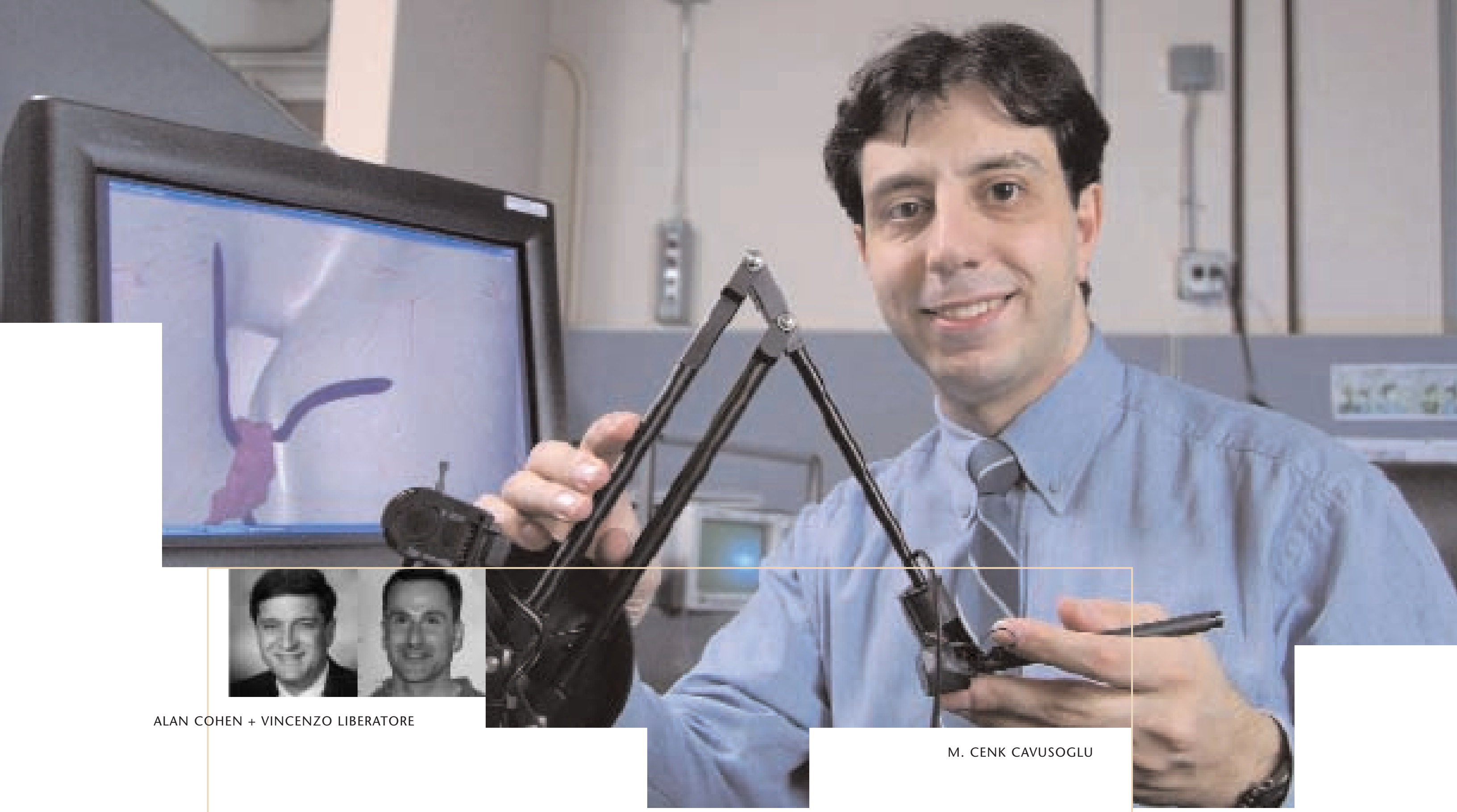

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M. CENK CAVUSOGLU

Engineering + Medicine

Revolutionizing Medical Education through Virtual Reality

Despite the recent widespread popularity of minimally invasive surgical interventions, the steep learning curve of this technique has posed a major problem in the training of resident and attending surgeons. Minimally invasive surgery requires unique spatial perception and motor skills that are difficult to master. Traditional methods of surgical training that were previously adequate are not as effective in training these substantially new techniques.

Virtual environments present a complement to the contemporary apprenticeship-based training scheme of surgery. The idea, similar to using a flight simulator to train pilots, will lead to a quantum leap in surgical training. Virtual environments make it possible to create an interactive three-dimensional simulation environment, where surgeons, using haptic interfaces, can manipulate, cut, or suture dynamically and geometrically correct models of organs simulated on a computer. Providing a milieu in which there is no risk to patients, virtual environments are interactive and three-dimensional in contrast to text materials, and relatively inexpensive compared to training in the operating room or in animal laboratories. A unique advantage of this virtual training is that it is possible to generate arbitrary anatomies and pathologies, thus allowing surgeons to be trained for cases that they will encounter only infrequently in their entire careers.

An interdisciplinary research team led by **M. Cenk Cavusoglu, Ph.D.,** assistant professor at the Case School of Engineering, Department of Electrical Engineering and Computer Science, in collaboration with **Alan Cohen, M.D.,** professor at the Case School of Medicine, Department of Neurosurgery, and **Vincenzo Liberatore, Ph.D.,** associate professor at the Case School of Engineering, Department of Electrical Engineering and Computer Science, is developing the enabling technologies for the next generation of surgical training simulators that will revolutionize surgical training. The research focuses on several key enabling technologies ranging from human interfaces and computer networks, to an open source software development framework for medical simulation.

The research is driven by a clinical application of the technology for the development of a training simulator for endoscopic neurosurgery. Three-dimensional geometric models of the anatomical structure are constructed from segmentation of magnetic resonance images. They are then augmented with realistic computer graphics and simulation of the dynamic behavior of the manipulated tissue, and embedded into a virtual environment-based simulation. While the initial prototype is being developed for endoscopic third ventriculostomy, it will be followed by simulations of more complex procedures. Magnetic resonance images acquired from actual patients will be used to construct a library of patient-specific models of various pathologies and anatomical variations to provide a rich set of training cases.

http://robotics.case.edu/
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