

UNIVERSITY OF TENNESSEE AT CHATTANOOGA

# CENTER OF EXCELLENCE FOR



# COMPUTER APPLICATIONS



**Adapting to changing technology and application areas requires CECA to change continuously.**

**by Clinton W. Smullen**

**L**ocated near downtown, the University of Tennessee at Chattanooga (UTC) is a metropolitan university whose mission includes a dedication to meeting the general and professional educational needs of area residents, strong community involvement and leadership, and emphases on applied research and public service. UTC seeks to meet its responsibilities as an emerging metropolitan university, actively involved with regional municipalities, schools, business, and industry. Education at UTC goes beyond the traditional classroom and laboratory, as befits an institution where service is also a high priority. UTC faculty members bring their professional expertise to bear on the concerns of the larger community, and the university's metropolitan location provides firsthand learning experiences to students through career-related work experience.

The mission of the Center of Excellence for Computer Applications (CECA) is tied to that of the metropolitan university: to conduct multidisciplinary research in the development and application of computer-based technologies; to encourage and support innovative computing technology research and projects that have significant potential value; and to provide exemplary dissemination, training, and support in advanced technology for the university, region, and state. CECA strives to promote appropriate partnerships between scholars and researchers from education, government, and the private sector for the study of innovative computing technology and to

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**CECA projects range from pure academic research projects through those with primarily educational outcomes to applied research projects applying technology to metropolitan problems.**

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develop a community of resourceful individuals—faculty, students, and outside partners—that advances the role of computer and information technology in the university, metropolitan region, and state.

CECA was established at UTC in 1984 with a broad range of academic and research computing applications in its mission. As technology and the needs of the university and the metropolitan area have changed over the years, so have the organization and goals of CECA, enabling it to concentrate on new and emerging technologies and their impact on education and the community and the exploration of new technologies and implications of their use.

Specific technologies change rapidly. An innovative area of application in the past few years can mature and become a standard set of tools during the next few years. Adapting to changing technology and application areas requires CECA to change continuously. In the mid 1990s CECA moved from a largely centralized research model, where most of the research was accomplished by full-time CECA researchers, to a more entrepreneurial distributed research model, where faculty talent and innovative ideas can be drawn from a wide variety of academic disciplines and CECA can encourage cross-disciplinary approaches to problems. This model works well under continual change. CECA nurtures numerous faculty and partnership research activities, arising from a wide variety of academic disciplines. These researchers work for CECA on a particular project and, along with permanent CECA faculty and staff, develop and apply technology to meet a particular need. Many of these project teams attract external funding to expand their work. If the project activities prove to have lasting value, they acquire ongoing support from external sources to continue. When a worthwhile activity becomes routine rather than innovative, it is internalized by the operations of the organization and dropped by CECA. If an activity cannot prove its worth, then the resources are better applied to a different problem. This flexibility supports the continuous change required of CECA in today's financial and technological environment.

CECA receives approximately \$825,000 per year from the State Centers of Excellence allocation, and CECA projects average \$1.5M in external funding per year. CECA has three full-time faculty members and uses about five full-time faculty members and six graduate assistants on various projects. CECA has about eight full-time staff members.

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research projects through those with primarily educational outcomes to applied research projects applying technology to metropolitan problems. The projects sketched below are meant to indicate the range of CECA activities.

Technology has become embedded in music education, and teachers and students of composition, theory, and performance need training with sophisticated computer equipment. By expanding the use of new technologies in the curriculum, music students are able to create audio CDs, educational CDs, and Web music content; perform notation, sequencing, and midi tasks; electronically compose music; and use ear training, theory drill, and modern notation software. Dr. Jonathan McNair of the UTC Music Department with support from CECA staff has developed and regularly offered a workshop on basic skills in music technology for secondary school in-service teachers. The syllabus and workbook are published by the Technology Institute for Music Educators.

CECA faculty member Dr. Henry, of Chemical Engineering, has developed an extensive collection of chemical and environmental laboratory experiments that can be accessed remotely through a Web interface. This system allows students with class conflict or those located in a remote site to conduct the experiments on their own schedule and for other interested individuals from around the world to use the Internet control laboratory. More than six thousand remote experiments were performed this year. This project, called WebLab, continues to explore the limits of remotely controlled engineering equipment. The work has been presented to more than seven professional engineering organizations at six international meetings and has been the subject of several newspaper and radio reports. It is sponsored in part by the National Science Foundation (NSF), National Instruments, and Microsoft. Numerous classes from across the United States and around the world have used the laboratory experiments over the Internet as an integral part of their curricula.

CECA is partnered with the Center for Applied Social Research (CASR) to provide students with hands-on experiences in applied social science research. CASR provides social science research services to the community at large. Student researchers are used for the research projects. These experiences train the students in applied research skills and how to apply them to problems in society. Through the center, the students participate as team members and design and conduct applied research projects for the campus and the community. CASR uses modern computer-based data collection and analysis systems in partnership with CECA.



CASR has attracted more than \$160,000 in funded research projects so far. These projects were accomplished using student workers.

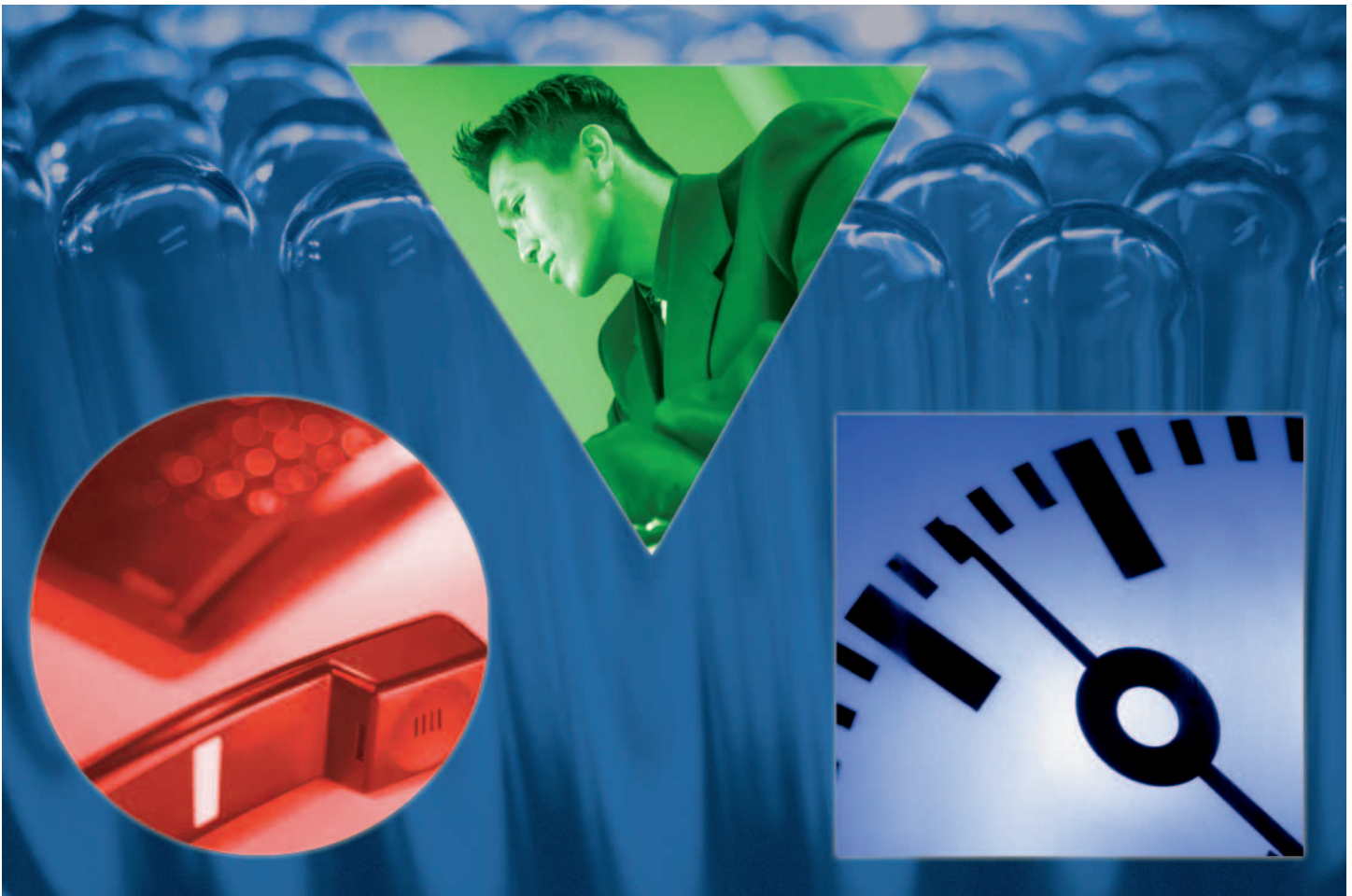
CECA faculty member Dr. Xu, of Mathematics, works in the area of applied mathematics and physics dealing with the identification and imaging of objects. His current research deals with the development of a so-called time-reversal method for detecting and imaging an inhomogeneity below the surface of another object, including anomalies in human bodies. The techniques needed to solve this problem are drawn from the application of computers to solving numerically systems of nonlinear differential equations and the application of nonlinear optimization techniques. The time-reversal method studies the reverse scattering of acoustic wave propagation in the time domain. The time-reversal methodology is related to several fundamental problems in classical mechanics and computational physics. A practical solution to this problem has important commercial, environmental, governmental, and health applications, such as the remote identification of underwater natural resources, seamount mineral deposits, submerged wreckage and navigational obstacle identification, and the determination of osteoporosis in

humans using ultrasound. Dr. Xu has received support for his work from the NSF research fund, the China-Cornell Fellowship fund, and the Sea Grant Fellowship fund. CECA is a member of a community-based partnership establishing a community information service for Chattanooga and Hamilton County, the Southeast Tennessee Information Service (SETNIS). SETNIS collects and organizes data from a range of sources and makes it available to various information consumers throughout the city and county. SETNIS is a comprehensive electronic database of mapped and tabular data about Chattanooga and Hamilton County. SETNIS collects, organizes, and presents information on community assets such as schools, libraries, churches, hospitals, and community centers and includes social demographic information in areas such as census, health, education, criminal justice, and welfare that can assist with decisions that improve the quality of life for all citizens. The creation of this capacity, which did not exist in any U.S. city a decade ago, represents an important technical and institutional breakthrough. To succeed, SETNIS exploits major cost reductions made possible

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**CECA is a member  
of a partnership  
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through new information technologies to operate on an ongoing basis at a level that can be locally self-sustaining. With SETNIS, a user can easily produce indicators covering topics such as births, deaths, crime, health status, educational performance, public assistance, and property conditions. Human-service agencies, governments, community organizations, neighborhood associations, and individuals can use SETNIS to enhance their abilities to plan, conduct research, and evaluate programs and proposals. After initial implementation, SETNIS will expand to encompass more information and provide access to more citizens over the coming years, becoming an integral component of the community's infrastructure.

SETNIS is affiliated with the National Neighborhood Indicators Partnership, a professional group of 12 such information services in the United States including Atlanta, Boston, Denver, Oakland, Baltimore, Miami, Milwaukee, Philadelphia, Indianapolis, Washington, D.C., Providence, R.I., and Cleveland, Ohio. It is unique for a city the size of Chattanooga to have such a resource. The development of SETNIS will require three years. SETNIS is sup-

ported by private and governmental sources.

As befits a center of excellence at a metropolitan university, CECA research projects provide the applied research efforts in technology at UTC a focus and allow the faculty to bring their professional expertise to bear on the problems and concerns of the larger community. CECA works with the community to apply technology to meet the emerging needs of the metropolitan region and extend the benefits of quality education, excellent research, and dedicated service to all. CECA faculty members are productive in obtaining significant external funding for technology-related projects, and several CECA projects have been developed into local startup companies. CECA works to build a community of resourceful individuals, including faculty, students, and outside partners, that advances the role of computer and information technology in the university and surrounding region. As the role technology plays in every Tennessean's working life expands, so do the benefits returned to the people of Tennessee from the CECA. ■

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