Crossroads
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Introduction

by ***Michael A. Grasso***

Interdisciplinary Computer Scientists represent a bridge between computer systems and their potential users. They are professionals with the ability to not only develop new applications, but who also have the knowledge to transfer this technology to various fields. Their domain expertise enables them to appreciate the needs of their users, while their technical expertise helps them to recognize the most efficient ways to implement these requirements. This dual responsibility helps them to be effective communicators, serving as liaisons between software engineers and the user community.

Computer science has a role in nearly every discipline, from business and industry to healthcare and education. [**3**, **1**] An abundance of technical opportunities are available that include informatics, intelligent systems, visualization, simulation, robotics, networking, and human factors. For example, computational chemists use quantitative models for rational drug design. Physicians rely on handheld computers for clinical decision support. Social scientists employ simulation techniques to model complex data. Manufacturing efficiency and quality are enhanced by robotic applications. Disabilities are overcome by natural language processing and novel interface techniques. Education is enriched by virtual communities. The growing influence of computers was summed up in a recent New York Times article with the statement that

"All Science is Computer Science [2]."

This issue of *Crossroads* explores some of the ways computer technology is being applied to other disciplines. We begin with Ricardo Hoar and Joanne Penner who address the growing problem of traffic congestion. They discuss a novel method for traffic simulation that uses a holistic approach, taking into account all modes of transportation. They then use an evolutionary strategy to optimize traffic light timings for various transportation scenarios.

Our next article by Thomas Royce and Rance Necaise discusses the problem of DNA sequence alignment. All of our genetic information is encoded on molecules of DNA. An important step in identifying the exact sequence of these molecules is to fragment them into manageable pieces, identify the composition of each fragment, and then align the sequences back together. Standard methods use an M x N matrix to determine the best way to align these sequences. This paper introduces an improved algorithm that uses less memory and relies on parallel techniques.

Sadaf Alam, Roland Ibbett, and Frederic Mallet present a computer architecture for the study of Quantum Chromodynamics (QCD), a branch of Particle Physics. This discipline views the entire universe as a collection of particles such as quarks and gluons. Research in this area is attempting to find out what the tiniest particles are and how they interact with each other. This article outlines the design steps of a QCD computer on a chip that performs space-time calculations, and presents an overview of the simulation model used to prototype and validate its operation.

The last article by Craig Thomas includes an overview of a speech generation system for the French language. Traditional text-to-speech systems can only support phonemes (the speech sounds used in a language) and duration. This limitation results in computer-generated speech that is monotone and sounds non-human. To address this problem, the author introduces a new approach that also encodes prosodic information, which gives it the ability to vary pitch and stress. The result is computer-generated speech that sounds more realistic.

These articles represent just a sample of the interdisciplinary work being done in Computer Science. We hope they provide a glimpse into the many ways that computers have improved our quality of life and helped humankind.

References

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Biography

Michael Grasso (**grasso@gwu.edu**) is a medical student at the George Washington University School of Medicine in Washington, DC. He also holds a Ph.D. in Computer Science from the University of Maryland Baltimore County. His areas of expertise include medical informatics, software engineering, and human factors. The focus of his research is to develop new modalities that enable computers to be tightly coupled to the essential processes of patient care.