Department of Computer Science
Texas Southern University
COMPUTER SCIENCE RESEARCH SEMINAR

Predicting the future –
An inverse dynamical systems view of time series

by

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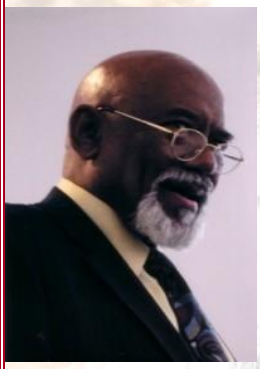
Biography



Oscar H. Criner is Professor of Computer Science and Interim Associate Dean of the College of Science and Technology at Texas Southern University. He received his early education in the public schools of Texas and graduated from Phillis Wheatley Senior High School in Houston. He attended Howard University in Washington, DC, graduating with a B.S. in mathematics and a minor in physics. After graduation, he spent a year teaching physics at Grambling College and then returned to the graduate school at Howard. He received the Ph.D. degree in applied mathematics from the University of California at Berkeley. His study and dissertation research areas were nonlinear partial differential equations and the multidimensional calculus of variations.

In his early career, he was a data analyst for Lockheed Missiles and Space Company working on guidance systems for the Polaris Missile; later, an applied mathematician for United Research Services (URS) in Burlingame California, where he became an expert on the effects of nuclear weapons and began working on computational simulations of complex phenomena. He constructed simulations of finite amplitude stress waves in real soil media and their interaction with buried structures. At URS, he constructed computational solutions for dynamic boundary value problems of surface water waves and computational simulations of the propagation of forest fires in mountainous terrain. He studied explosion generated water waves in the ocean. He constructed "high speed" data collection and analysis systems for simulations of missile failures at launch time. Going on to work for the U.S. Naval Radiological Defense Laboratory in San Francisco, he devised measures for the control of mass fires in a post nuclear weapons attack urban environment and constructed computational models of data from cyclotron experiments for neutron cross-section spectroscopy. He also worked for Sandia Corporation (now Sandia National Laboratory) in Livermore California, where he used the first true supercomputer, the Control Data 6600, to solve initial-boundary value problems in the vibrations of thin shells experiencing shock excitations. By 1970, Dr. Criner was a principal in Mathematical Services Corporation, a company that constructed and marketed specialized software and services in the printing, finance, survey research, and health care industries.

Dr. Criner's company designed and implemented the first computerized remote surveying system and operated the system to survey 5,000 families quarterly in the Seattle Income Maintenance Experiment. The system used radio-telephones and portable computer terminals to connect with a mainframe in Cupertino, California from remote sites in Seattle, Washington. This technology is in your pocket, today, but was cutting edge in 1971.

Social issues had begun to dominate his thinking and activity and he was invited to join the Westside Community Mental Health Center, Inc. in San Francisco as an Assistant Director. At Westside, he constructed management information systems for the 40 social service agencies that comprised the center. The construction of the system for

Westside led to his entry into the medical and health care information systems business. He constructed two additional cutting edge information systems for two of the first Medicaid health maintenance organizations. In Houston, his businesses constructed and marketed medical information systems up until the UNIX wars of 1982.

The Westside position and Dr. Criner's advocacy for health care in the community led to his being appointed to several health care organizations including the Board of Directors, Bay Area Comprehensive Health Planning Council, San Francisco; the Committee on Admissions of the University of California Medical School, San Francisco, California; and the Board of Directors, Alameda County Unit, American Cancer Society, Oakland, California.

Finally, this activity led to his being invited to join the faculty of the Department of Black Studies at San Francisco State University. There, his research in economics and the scientific workforce led to a deeper understanding of the barriers that prevent African Americans from entering scientific professions and motivated his decision become an advocate for science education and to teach at a historically black college.

After a search of computer science programs in colleges around the country, Dr. Criner found a perfect match. Texas Southern University, in his hometown, needed a person to head the computer science program. He became the first head of the Department of Computer Science at Texas Southern University in September 1976. He built a student body from 50 in 1976 to over 700 in 1984 when he left the position to become the Founding Dean of the College of Science and Technology, where he currently serves as associate dean.

He left the Deanship in 1986 and returned to industry on a faculty development leave. From 1986 to 1993 he was a consultant on software quality and productivity for large software manufacturers, AT&T Bell Laboratories and Motorola. From 1989 to 1992, he also served as an information systems consultant for the Governor's Capital Improvement Program in St. Thomas, U.S.V.I. Dr. Criner teaches computer science, computational modeling, and environmental science. His current research interests are complex systems modeling in the environment, the economy, the financial markets and STEM education.

Abstract

Time series are datasets where the abscissa or horizontal axis is time and the ordinate or vertical axis is the value of a measured quantity. The measured quantity is usually a number, but it may be an object of some kind, like a movie, a medical record, or a complex state of the economy.

In this talk, I present some history and the evolution of my mathematical theory of inverse dynamical systems analysis, the techniques I developed, and the design and implementation in software. I present some of the results for applications to finance and economics; which are the "proof-of-the-pudding". There are nearly 100,000 time series describing the global economy in the Federal Reserve Bank's database and the databases produced by the financial markets. The tools used for analyzing these time series are mostly statistical are usually ineffective in predicting events for policy. This has given a new emphasis to computational analysis of data, which has been given a new name, "data analytics."

While the actual differential equations of the dynamical systems producing the data are unknown, there is a great deal if information that can be concluded from treating the data as the output of some dynamical system. This means that we assume that the principals of dynamics are applicable to economics and finance. This shows the need for scientists to analyze this mountain of socio-economic data. We show some of the results of this point of view.