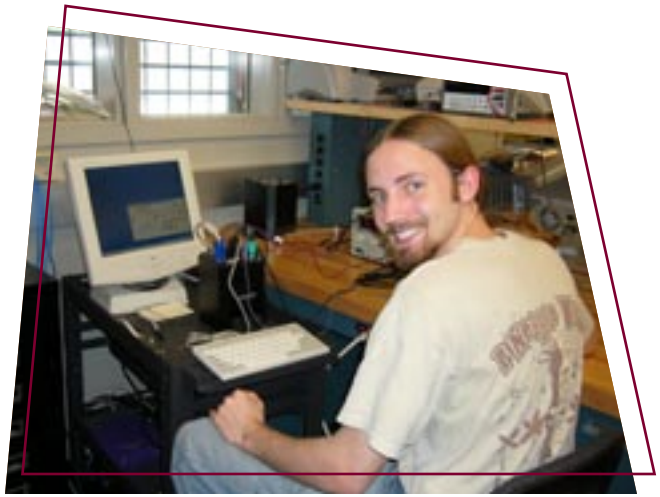
OUR VISION

The Intelligent Electronic Systems (IES) program is an integral component of the Human and Systems Engineering (HSE) thrust at the Center for Advanced Vehicular Systems (CAVS). IES is developing next generation smart networking technology for collaborative decision-making and information retrieval. Applications include security, transportation, data mining and virtually any activities requiring human computer collaboration. Our research expertise spans communication, signal processing, human computer interaction, and intelligent systems.

The IES program represents a convergence of research conducted at our university over the past decade in several areas: communications, signal processing, speech recognition, and human-computer interface design.



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We continually seek bright, energetic students (graduate and undergraduate) to participate in our research activities. We offer a highly focused team environment for students which fosters the acquisition of the technical and communication skills critical for careers in technological research and development.

http://www.cavs.msstate.edu/hse/ies/

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ERC

CAVS

Human & Systems Engineering

Intelligent Electronic Systems

Center for Advanced Vehicular Systems

CAMPUS BUS NETWORK

The Intelligent Transportation System (ITS) is now globally viewed as a way to revolutionize the transportation system. Networked vehicles that perform collaborative problem-solving will be a cornerstone of the next generation ITS. The U.S. Department of Transportation's ITS program has launched a new generation of initiatives aimed at improving transportation safety, relieving congestion and enhancing productivity. Automotive companies are creating a new generation of vehicles that integrate personal computing, the Internet, and wireless communications. Together the automotive companies are interfacing in-vehicle data acquisition and telematics systems with global telecommunications infrastructures to provide a portfolio of diagnostic services for the transportation/automotive market.

The main objective of this project is the development of the hardware and software necessary to perform two-way communications with a vehicle and to collect critical vehicle performance and sensing data. Our Web-based real-time vehicle tracking and performance monitoring system will combine the latest developments in automotive telematics with GPS technology to create a next generation, intelligent transportation network. This will be accomplished by integrating existing on-board measurement information available in most current vehicles through industry-standard interfaces, to new cellular modem technology that allows high-speed wireless data connections. For more information visit our project web site at: http://www.cavs.msstate.edu/hse/ies/projects/cbn/

IN-VEHICLE DIALOG SYSTEMS

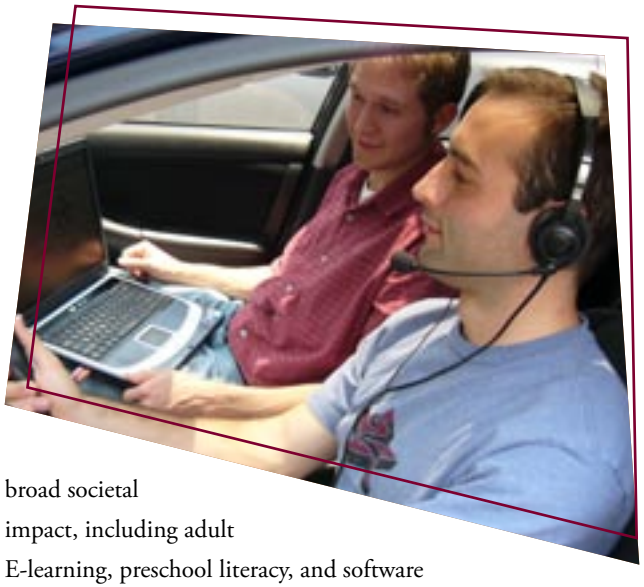
Spoken language dialog systems enable a user to interact with a computer in a natural conversational style. Achieving this goal for the in-vehicle navigation task requires providing accurate, real-time responses to complex queries in a noisy environment. We have developed a demonstration system that allows users to navigate the Starkville/MSU area through spoken dialog. Users can query the system for many categories of information, such as obtaining directions to get from one location in town or on campus to another:

> "How can I get from the gas station on the corner of 82 and South Montgomery to the MSU Engineering Research Center?"

or finding restaurants, hotels, stores, and other local businesses:

> "Where is a supermarket closest to the Hotel Chester?"

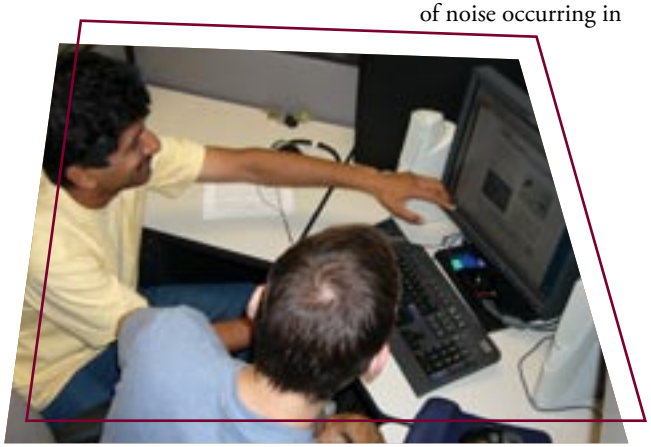
We have developed and tested our system on a variety of speakers and dialects. It is based upon our public domain speech recognition system and the DARPA Communicator client/server architecture. This framework provides the flexibility and power to investigate a wide range of experimental conditions for many other types of tasks and applications. This has enabled using our prototype as a testbed to study other application areas with



broad societal impact, including adult E-learning, preschool literacy, and software development environments for visually impaired programmers.

NONLINEAR STATISTICAL MODELING OF SPEECH

Current speech recognition statistical modeling techniques typically employ linear methods. Indeed, Hidden Markov models (HMMs) have been the primary approach to speech recognition for almost 25 years. However, a fundamental change is needed to provide speech systems that are more robust to the vast amounts of noise occurring in



real world usage. Although first proposed in the early 1980's, progress in the field of nonlinear statistical modeling of speech has been slow due to past limitations on computing power. Nonetheless, advances in this area have accelerated to a point where nonlinear approaches are more realistic options for speech recognition. The goal of this project is to develop a new approach to statistical modeling of speech based on nonlinear statistics using principles of chaos.

To date, we have developed speech recognition tracking methods employing various algorithms, all linearly based. Again, as noted, speech recognition research has not generally considered the nonlinear nature of speech and background noise, resulting in systems that are less robust to real world conditions. In this project, we will address this gap by exploring the application of nonlinear methods for tracking speech patterns. Our first step will be to implement a speaker recognition system using a nonlinear time series approach to modeling the signal. This approach will be compared to our previous attempts to advance HMMs based on Support Vector Machines (SVMs) and Relevance Vector Machines (RVMs).