Exploiting Chaos for Speech Coding and Artificial Speech Production

AzTE Case # M11-161

Background

As the world becomes increasingly connected through technology, more and more of our daily lives are conducted via communication devices. As we spend more time doing so, delayed transmission, warbled voice effects, and miscommunications cost us time and money. Typically in speech transmission, the speech itself is not transmitted as-is, rather a compressed form is sent and then reconstructed. The compression basically parameterizes the speech, sends the smaller parameter set across the transmission medium, where reconstruction takes place. A common method is the code-excited linear predictive (CELP) coding method that relies on a codebook of Gaussian waveforms and selects from these the signal to transmit. But this method introduces a bottleneck in improving the CELP method since the code book can only be so large or it takes up too much memory. It also slows down the CELP algorithm because it requires a memory fetch to read the long excitation sequences from memory.

Invention Description

Researchers at Arizona State University have created an efficient method for speech coding and synthesis, which uses less memory and avoids a bottleneck in transmitting speech, making it faster. The current speech coding platform uses code to excite speech which is limited by memory constraints and results in slow transmission. The new process utilizes nonlinearity and chaos in human speech pattern in order to produce a more biologically correct synthesized speech with less error at a faster rate. By implementing a chaos-based approach, the efficiency of communications (e.g. cell phones) can increase, as there is no need to provide look-up tables in order to parameterize and recreate a signal. Furthermore, by mimicking natural speech production, improved accuracy of the reproduced signal is possible (as evidenced through mean square error statistics on a number of signals).

Potential Applications

- Telephony
- Internet streaming
- Phone companies
- VOIP
- Internet telephony

Benefits and Advantages

- Streamlined - Prevents bottlenecking for increased speed
- Increased Clarity - The more biological method provides a more natural sound
- Speed - Eliminates need for codebook which increases speed