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Bell Labs Text-to-Speech Synthesis: Then and Now

Bell Labs and "Talking Machines"

Bell Labs first demonstrated an electronic speech synthesis device, the "Voder," developed by H.W. Dudley, at the 1939 World's Fair. The New York Times declared, in describing the machine's operation, "My God, it talks." This early analog system was the forerunner of Bell Labs work in articulatory synthesis, conducted by Cecil Coker in the 1960s, and Joe Olive's work on concatenative synthesis in the 1970s.

Bell Labs: Where "HAL" First Spoke

One of the more famous moments in Bell Labs' synthetic speech research was the sample created by John L. Kelly in 1962, using an IBM 704 computer. Kelly's vocoder synthesizer recreated the song "Bicycle Built for Two," with musical accompaniment from Max Mathews. Arthur C. Clarke, then visiting friend and colleague John Pierce at the Bell Labs Murray Hill facility, saw this remarkable demonstration and later used it in the climactic scene of his novel and screenplay for "2001: A Space Odyssey," where the HAL9000 computer sings this song as he is disassembled by astronaut Dave Bowman.

Joe Olive, recognized as the leading expert in text-to-speech synthesis, recently contributed a chapter, "The Talking Computer: Text to Speech Synthesis," to the book "HAL's Legacy: 2001's Computer as Dream and Reality," (M.I.T. Press, 1996), edited by David Stork.

In 1997 the Bell Labs TTS system was used in the product offerings of several Lucent business units. The Lucent Business Communications Systems' Intuity(Conversant(integrated voice and information processing system uses TTS signal processing cards for applications that include, among others, an e-mail reader. TTS allowed companies to build applications such as voice dialing, voice-activated response systems, or reservations centers using the AYC speech boards.

Here is what the Text to speech webpage looked like in 1997.

fun demo, below!

Introduction

The Bell Labs Text-to-Speech system (TTS) has various applications including reading electronic mail messages, generating spoken prompts in voice response systems, and as an interface to an order-verification system for salespeople in the field.

TTS is implemented entirely in software and only standard audio capability is required. At present, it contains several components, each of which handles a different task. For example, the text analysis capabilities of the system detect the ends of sentences, perform some rudimentary syntactic analysis, expand digit sequences into words, and disambiguate and expand abbreviations into normally spelled words which can then be analyzed by the dictionary-based pronunciation module. The following sentences illustrate the system's text-analysis capabilities.

Lumber will cost $3.95 for 7 ft. on Sat.	.aiff	.wav	.au
That fossil from NM is 165,256,011 yr. old.	.aiff	.wav	.au
Dr. Smith lives on Oak Dr., but St. John lives on 71st St.	.aiff	.wav	.au

The pronunciation module provides pronunciations for most ordinary words, and morphological derivatives thereof, as well as proper names; default strategies exist for pronouncing words not recognized by the dictionary-based methods. Other components handle prosodic phrasing, word accentuation, sentence intonation, and the actual speech synthesis. We believe that the word pronunciation and intelligibility of our American English TTS system are the best available. However, we are continuously working to improve its naturalness. We are also expanding the set of languages that TTS can support, such as German, Chinese (Mandarin and Taiwanese), Russian, French, Romanian, Italian, Spanish (Latin American), Japanese, and Navajo.

Try It Yourself!

You can play with our basic interface or our more advanced interface (which requires a JavaScript capable browser, such as Netscape 3) for our American English TTS system.

We also have a German Text-to-Speech system and a Mandarin Chinese system you can try!

And also look at the following *fun* links:

- NEW TTS projects done by students in our summer programs
- English/Pig Latin "Translator"

More Information:

Who are the members of our group?
How does our system work?

For TTS product information please contact: John Holmgren
For other TTS information contact: Michael Tanenblatt

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