Progress Report on Automated Speaker-Recognition Systems

L. G. Kersta

Citation: The Journal of the Acoustical Society of America **49**, 139 (1971); doi: 10.1121/1.1975904
View online: https://doi.org/10.1121/1.1975904
View Table of Contents: https://asa.scitation.org/toc/jas/49/1A
Published by the Acoustical Society of America

4:00

NN5. Progress Report on Automated Speaker-Recognition Systems. L. G. KERSTA, *Voiceprint Laboratories (A Division of Farrington Manufacturing Company), Sommerville, New Jersey.*—This paper describes progress in the implementation of an automated speaker-verification system and a technique for codifying information contained within a voiced signal. The technique described is not dependent upon speaker amplitude variations and allows verification of speakers to be accomplished in real time. Subjective experiments of simulated automated systems utilizing spectrographic analysis and an adjustable filter with a decibel readout establishes the feasibility of such a codification process. The manual codification process resulted in a speaker-verification success score in excess of 60% when a single-word utterance was used. By further processing called "serial elimination," several utterances are analyzed serially and result in scores of the order of 95% and greater. A completely automated version of the above-described simulated system employs a bank of narrow-band filters to separate the voiced signals into component spectral parameters. A feature extraction strategy called a "sliding window" is described, which was found to reduce effects of multiple-utterance "jitter." In order to to reduce rejections of the desired speaker, his stored code is derived from the range of variance his utterances exhibit when collected from a succession of time-spaced utterances. With a serial elimination process, speaker-verification scores are comparable to those derived in the simulated system.

4:30

NN6. A Method or Speaker Verification. GEORGE R. DODDINGTON, *Bell Telephone Laboratories, Murray Hill, New Jersey 07974.*—The speaker-verification problem is defined and contrasted with the speaker-identification problem. A speaker-verification experiment is performed using eight known speakers and 32 impostors. Formant frequencies, voicing pitch period, and speech energy—all as functions of time—are used in verification. Proper time normalization is shown to be an important factor in improving verification error performance. Nonlinear time normalization is performed by maximizing the correlation between sample and reference second-formant profiles through a piecewise linear continuous transformation of time. Average error rates after time normalization were: for pitch, 0.05; for formants, 0.04; for energy, 0.04; and over-all, 0.015. This over-all error rate is four times less than that obtained using only utterance endpoint alignment.

FRIDAY, 6 NOVEMBER 1970 — BLUEBONNET ROOM, 2:00 P.M.

Session OO. Underwater Acoustics V: Noise

W. C. MOYER, *Chairman*

Contributed Papers (12 minutes)

2:00

OO1. The Noise of Melting Icebergs. R. J. URICK, G. M. COLVIN, AND T. J. TULKO, *U. S. Naval Ordnance Laboratory, Silver Spring, Maryland 20910.*—Icebergs seem to have escaped serious attention as sources of underwater sound. We have measured the noise of icebergs by using sonobuoys dropped by an aircraft at distances between 200 and 10 000 yd. Two isolated icebergs 130–150 ft high were measured at a location northeast of Newfoundland. Noise apparently originated by the bergs was found to have a spectrum flat to about 8 kHz, with spectrum levels of −37 and −42 dB *re* 1 dyn/1 cm^2 at 200 yd from the two bergs. In the laboratory, we have observed the noise of ice melting in a small pressure vessel containing a hydrophone. Two kinds of noise were heard. One was an impulsive noise apparently due to thermal cracking that disappeared under an applied pressure. The other was a sizzling frying sound that became louder as the pressure increased but occurred only with cloudy milky ice and not with clear ice free of air. We surmise that this noise is caused by the implosion of tiny air bubbles trapped in the ice as their walls become broached during the melting process. Alternatively, the noise of real icebergs may be due to tiny explosions of trapped air bubbles having high internal pressures. Iceberg noise should therefore depend on size, depth, air content, rate of melting, and origin of the berg.

2:15

OO2. Near-Surface Ambient-Noise Correlation Measurements. J. M. THORLEIFSON AND R. J. JORDAN, *Defence Research Establishment Atlantic, Dartmouth, Nova Scotia, Canada.*—Ambient-noise correlation measurements have been made in a deep ocean area with a vertical hydrophone array suspended at a depth of 100 ft. Spatial correlation coefficients were obtained for vertical hydrophone spacings of from 1 to 12.5 ft over the frequency range 100–2000 Hz and for sea states 2 and 4. The measured coefficients are compared to those obtained from theoretical models of ambient noise. The results indicate that below 200 Hz the noise field is mostly horizontal and is attributed to distant sources. Above this frequency, the field can be interpreted as arising from a uniform distribution of directional noise sources at the sea surface.

2:30

OO3. Measurements of the Vertical Directivity of Ambient Sea Noise in the Deep Ocean. T. E. WING, *Bell Telephone Laboratories, Incorporated, Whippany, New Jersey 07981.*—Measurements of the vertical directivity of ambient sea noise in the deep ocean are presented. The measurements were made with a vertical array located near the bottom of the sound channel. The measurements were made with 10% filters at