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# United States Patent [19]

Luginbuhl et al.

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[54] TRAINING OF HOMOSCEDASTIC HIDDEN  
MARKOV MODELS FOR AUTOMATIC  
SPEECH RECOGNITION

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395/2.52-2.54, 2.64-2.66; 381/41-43

## [56] References Cited

### U.S. PATENT DOCUMENTS

4,819,271 4/1989 Bahl et al. .... 395/2.65  
4,827,521 5/1989 Bahl et al. .... 395/2.65  
5,193,142 3/1993 Zhao ..... 395/2

### OTHER PUBLICATIONS

K. K. Paliwal, "A Study of LSF Representation For  
Speaker-Dependent and Speaker-Independent  
HMM-Based Speech Recognition Systems", ICASSP '90,

1990, pp. 801-804.

J. S. Bridle et al., "An Alphanet Approach to Optimising  
Input Transformations For Continuous Speech Recognition", ICASSP '91 1991 pp. 277-280.

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[57]

## ABSTRACT

A method for training a speech recognizer in a speech recognition system is described. The method of the present invention comprises the steps of providing a data base containing acoustic speech units, generating a homoscedastic hidden Markov model from the acoustic speech units in the data base, and loading the homoscedastic hidden Markov model into the speech recognizer. The hidden Markov model loaded into the speech recognizer has a single covariance matrix which represents the tied covariance matrix of every Gaussian probability density function PDF for every state of every hidden Markov model structure in the homoscedastic hidden Markov model.

10 Claims, 1 Drawing Sheet

