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原著

ACOUSTIC EVALUATION OF PATHOLOGICAL VOICE AND ITS APPLICATION TO MASS SCREENING FOR LARYNGEAL CANCER

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In recent years acoustic analysis methods for assessing vocal function or laryngeal pathology have attracted increasing attention from head and neck surgeons, laryngologists, phoniatricians, and speech researchers. This is not only because the acoustic method has the advantage of being totally non-invasive,requiring simple recording procedures and being feasible on a small computer, but because the method has promising clinical applications for the early detection and differential diagnosis of laryngeal pathology, as well as for the quantitative assessment of the vocal function of patients undergoing such treatment as surgery, voice therapy or radiotherapy.

In the acoustic study of pathological voice it is of primary importance to choose acoustic measures that provide a good reflection of the vocal function and pathological status of the larynx. Such measures are primarily associated with the following acoustic characteristics of the voice signal :

(1) perturbations in the fundamental period and peak amplitude;

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(2) vocal noise included in the signal;
(3) cycle-to-cycle waveform variations;
(4) average frequency spectral characteristics, and
(5) transitional characteristics of the signal.

We have long been involved in the exploring acoustic measures[1-3], primarily aiming at their application to mass screening for laryngeal cancer by voice[4]. They have included jitter and shimmer measures, laryngeal noise measures, and frequency spectral envelope parameters that have proved effective in differentiating the normal voice from the pathological.

We began with a statistical decision algorithm for detecting pathological voice[4] and now employ an artificial neural network (ANN) to simulate perceptual judgments made by ENT specialists[5]. The basis for our research lies in the fact that ENT specialists can quite often identify laryngeal cancer and certain other common diseases of the larynx, *e.g.*, recurrent laryngeal nerve paralysis and polyp, simply by listening to the patient's voice. This implies that acoustic voice signals convey information on the laryngeal function of a patient. The mechanism of identification in the auditory perception of otorhinolaryngologists appears to be quite complicated and cannot be simulated by a simple discriminant function. This is why we have adopted the ANN technology for the evaluation.

Since careful examination of acoustic measures extracted from voices recorded on the telephone line showed no essential degradation of the measures thorough the line in terms of screening,

we started mass screening for laryngeal cancer by telephone voice. This screening system has been installed at the National Cancer Center East, and we have already processed more than 500 subjects in the Kashiwa City area, where the center is located.

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