音響信号処理特論

科目番号		履修年度	2014年後期
開設学部等	理工学研究科(後期)　総合知能工学専攻 電子情報工学	期間	後期
曜日時限	火曜日４時限 工1－509	単位数	2
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■授業内容と方法

音響信号処理特論
Advanced Acoustic Signal Processing：In this lecture we are study about Acoustic Speech Signal Processing. First, the mechanism of human speech production and acoustic phonetics such as vowels, the vowel triangle, front, mid, back, diphthongs, semivowels, liquids, glides, consonants, nasals, stops (Voiced, Unvoiced), fricatives (voiced, unvoiced), whisper, afficates are explained. Then, the acoustic theory of speech production, sound propagation Portnoff ？ Sondhi differential equations, uniform lossless tube and formants, effects of losses in the vocal tract, the effect of nasal coupling, excitation of sound in the vocal tract, lossless tube models, wave propagation in concatenated lossless tubes, relationship to digital filter and digital model for speech signals are explained. Next, time-domain methods for speech processing, short-time energy, zero-crossing rate, speech vs. silence discrimination, pitch period estimation, short-time autocorrelation function, short-time average magnitude difference function (AMDF), pitch period estimation using the autocorrelation function, median smoothing are explained. Then, digital representation of the speech waveform, PCM, MPCM, Adaptive quantization, Delta modulation DPCM, ADPCM will be discussed. Next, Homomorphic speech processing, Cepstrum, pitch detection, formal estimation, Homomorphic vocoder are aimed for studies. Also, Linear Predictive Coding (LPC) of speech, LPC analysis, the autocorrelation method, the covariance method, computation of gain for LPC model, Cholesky decomposition solution of LPC equations, Durbin’s recursive solution, lattice formulations, the prediction error signal, relation between the various speech parameters, synthesis of speech from LP parameters, pitch and formant analysis using LPC, LPC vocoder are presented. At last, digital speech processing for Man-Machine Communication by voice and special projects in Acoustic Echo and Noise Cancellation , etc. will be studied.

■達成目標

Digital Processing of Speech Signal：
To know about the mechanism of human speech production and acoustic phonetics.
To know about the acoustic theory of speech production and relationship to digital filter
To know about time-domain methods for speech processing, pitch period estimation.
To know about digital representation of the speech waveform.
To know about Homomorphic speech processing & Linear Predictive Coding, synthesis of speech from LP parameters
To know about Man-Machine Communication by voice, Acoustic Echo and Noise Cancellation by Adaptive Digital Filter Algorithms etc

■評価基準と評価方法

Project & Presentation & Report

■履修条件

■授業計画

1Introduction to speech and signal processing
2The mechanism of human speech production.

3Phonems in American English, Vowel triangle, Diphthongs, Liquids, Glides.
4Consonants, Nasals, Stops, Fricatives, Whisper, Afficates.
5Sound propagation Portnoff？Sondhi equations, Lossless tube, Formants, Losses.
6Nasal coupling, Excitation, Digital model for speech signals.
7Energy, Zero Crossing, Silence, Pitch.
8Autocorrelation, AMDF.
9Pitch period estimation, Median smoothing.
10PCM, Adaptive quantization, Delta modulation.
11Homomorphic Speech Processing, Cepstrum, Pitch detection, Formal estimation, The Homomorphic Vocoder
12LPC of speech, Autocorrelation method
13Covariance method, Computation of gain for LPC model.
14Cholesky, Durbin, Lattice formulations
15The Prediction Error Signal, Synthesis of speech from LP parameters, Pitch and formant by LPC, LPC vocoder.
16Man-Machine Communication by voice, Special Projects in Acoustic Echo and Noise Cancellation, etc.

■事前・事後学習

■教科書

	ISBN
Digital Processing of Speech Signal, L.R. Rabiner/R.W. Schafer, Prentice Hall	0132136031

■参考書

ISBN

■備考(メッセージ)

■オフィスアワー

Tue 3:00-5:00 P.M., Fri 3:00-5:00 P.M.

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