Course offering: ECE-537 Fall 2007

Speech Processing Fundamentals
The theory, principles and practice of Speech and Hearing, as a communication science

Goal: Provide an intuitive understanding of *speech production* and *signal processing by the auditory system*
The course is divided into three parts:

I: The theory and application of acoustics of speech production, anatomy of the vocal tract, introductory acoustic phonetics, including inhomogeneous transmission line theory, reflectance, 1 and 3 dimensional wave equation, Bernoulli oscillators, room acoustics, plus a solid review of Fourier and Laplace transforms and all derivatives, including the short-time Fourier Transform (and inverse), and DSP of speech, such as compression and coding (e.g., LPC/CELP/VQ), homomorphic processing, Hilbert transforms, etc.

II: Psychoacoustics of speech perception, critical bands, JNDs, masking and the physiology of the auditory pathway; middle and inner (cochlear) ear modeling, and auditory neural signal processing.

III: The articulation index, STI, SII, information theory, entropy, channel capacity, the confusion matrix, state models, EM algorithms, and Bayesian networks, summarized with a review of select classic papers on speech processing, speech perception and speech recognition.

Many practical applications will be emphasized, including hearing aids, speech (and music) coding, cochlear implants, ASR, and others. In the past guest lectures by world-class speech scientists have been the norm.

ECE-410 + Matlab (or equivalent) programming is required for many of the home works, as well as an interest in understanding how speech is produce, processed by the human auditory system, and recognized.

Learn everything we know about speech signal processing, from the point of view of the ear, brain and auditory system.

Questions to: Prof. Jont Allen (jontalle@uiuc.edu)