3/3 MCA First Semester

CA5T3D **SPEECH RECOGNITION** **Credits : 4**

Lecture Hours : 4 periods / week Internal assessment : 30 Marks

Semester and Examination: 70 Marks

Course Description:

Develop an understanding of the relationship of vocal tract shapes and physical acoustics to the acoustic speech signal. Use a spectrum analyzer to relate the acoustic speech signal to acoustical processes. Design and implement digital filters to synthesize speech and code speech at a low bit rate. Implement speech analysis and speech synthesis modules using object-oriented software programs, using techniques such as class derivation, the use of software objects as components in a larger software system.

Course Objective:

- Student will learn the Fundamentals of Speech Recognition
- Student will understand the Speech Signals and its reception
- Student will understand the Analysis Methods for Speech Recognition
- Student able to understand various Pattern Comparison Techniques
- Student able to Process to Recognition System Design and Implementation
- Able to Understand the Hidden Markov Models
- Able to learn various applications of Speech Recognition

Unit I:

Fundamentals Of Speech Recognition: Introduction, The paradigm for speech Recognition, out line, Brief history of speech recognition research.

Unit II:

The Speech Signal: Production, reception, and Acoustic-phonetic characterization: The speech production system, Representing speech in time and frequency domains, Speech Sounds and features, Approaches to automatic speech recognition by machine.

Unit III:

Signal Processing And Analysis Methods For Speech Recognition:

The bank-of-filters front-end processor. Linear predictive model for speech recognition, Vector quantization, Auditory based Spectral analysis model.

Unit IV:

Pattern Comparison Techniques: Speech detection, Distortion Measures-Mathematical Considerations, Distortion Measures-Perceptual Considerations, Spectral-Distortion Measures, Incorporation of spectral dynamic features into distortion measures, Time Alignment and Normalization.

Unit V:

Speech Recognition System Design And Implementation Issues:

Application of source coding techniques to recognition, Template training methods, Performance analysis and recognition enhancements, Template adoption to new talkers, Discriminative methods in speech recognition, Speech recognition in adverse environment.

Unit VI:

Theory And Implementation Of Hidden Markov Models: Discrete time Markov processes, Extensions to hidden Markov Models, The three basic problems for HMMs, Types of HMMs, Implementation issues

for HMMs, HMM system for isolated word recognition

Unit VII:

Speech Recognition Based On Connected Words Models: General notations for the connected Word-Recognition problem, The two level dynamic programming algorithm, The level building algorithm, The one pass algorithm, Multiple candidate strings, Grammar networks for connected digit recognition, Segmental K-Means training procedure, Connected digit recognition implementation.

Unit VIII:

Applications: Task Oriented Applications of Automatic Speech Recognition

Learning Resources

Text Books:

1. L. Rabiner and B. Juang, B. Yagna Narayana, “Fundamentals of Speech Recognition”, Pearson Education. 2007
2. L R Rabiner and RW Schafer, “Digital Processing of Speech Signals”, Pearson Education. 2009.

References:

1. Ben Gold and Nelson Morgan and Dan Ellis, Speech and Audio Signal Processing, John Wiley and Sons Inc., Singapore,2/e, 2004.
2. Thomas F, Quatieri, Discrete-Time Speech Signal Processing, Prentice Hall / Pearson Education, 2006.
3. D. Jurafsky and J.H. Martin, “Speech and Language Processing”, Pearson Education, 2008.
4. J.R. Deller, J.H.L. Hansen and J.G. Proakis, Discrete Time Processing of Speech Signals, John Wiley, IEEE Press, 1999.