

1	<b>LINGUISTICS</b>	236	..Specialized equations or comparisons
2	..Translation machine		
3	..Having particular Input/Output device	237	...Correlation
		238	...Distance
4	..Based on phrase, clause, or idiom	239	...Similarity
		240	...Probability
5	..For partial translation	241	...Dynamic time warping
6	..Punctuation	242	...Viterbi trellis
7	..Storage or retrieval of data	243	..Creating patterns for matching
8	..Multilingual or national language support	244	...Update patterns
		245	...Clustering
9	..Natural language	246	..Voice recognition
10	..Dictionary building, modification, or prioritization	247	...Preliminary matching
		248	...Endpoint detection
		249	...Subportions
200	<b>SPEECH SIGNAL PROCESSING</b>	250	...Specialized models
200.1	..Psychoacoustic	251	..Word recognition
201	..For storage or transmission	252	...Preliminary matching
202	..Neural network	253	...Endpoint detection
203	..Transformation	254	...Subportions
204	...Orthogonal functions	255	...Specialized models
205	..Frequency	256	....Markov
206	...Specialized information	256.1	.....Hidden Markov Model (HMM) (EPO)
207	....Pitch		
208	.....Voiced or unvoiced	256.2	.....Training of HMM (EPO)
209	....Formant	256.3	.....With insufficient amount of training data, e.g., state sharing, tying, deleted interpolation (EPO)
210	....Silence decision		
211	..Time		
212	...Pulse code modulation (PCM)		
213	...Zero crossing	256.4	.....Duration modeling in HMM, e.g., semi HMM, segmental models, transition probabilities (EPO)
214	...Voiced or unvoiced		
215	...Silence decision		
216	...Correlation function		
217	....Autocorrelation	256.5	.....Hidden Markov (HM) network (EPO)
218	....Cross-correlation		
219	..Linear prediction	256.6	.....State emission probability (EPO)
220	..Analysis by synthesis		
221	..Pattern matching vocoders	256.7	.....Continuous density, e.g, Gaussian distribution, Lapalce (EPO)
222	..Vector quantization		
223	...Excitation patterns		
224	..Normalizing	256.8	.....Discrete density, e.g., Vector Quantization preprocessor, look up tables (EPO)
225	..Gain control		
226	..Noise		
227	...Pretransmission	257	....Natural language
228	...Post-transmission	258	..Synthesis
229	..Adaptive bit allocation	259	..Neural network
230	..Quantization	260	..Image to speech
231	..Recognition	261	..Vocal tract model
232	..Neural network	262	..Linear prediction
233	..Detect speech in noise	263	..Correlation
234	..Normalizing	264	..Excitation
235	..Speech to image	265	..Interpolation

266 ..Specialized model  
 267 ..Time element  
 268 ..Frequency element  
 269 ..Transformation  
 270 .Application  
 270.1 ..Speech assisted network  
 271 ..Handicap aid  
 272 ..Novelty item  
 273 ..Security system  
 274 ..Warning/alarm system  
 275 ..Speech controlled system  
 276 ..Pattern display  
 277 ..Translation  
 278 ..Sound editing  
 500 **AUDIO SIGNAL BANDWIDTH  
 COMPRESSION OR EXPANSION**  
 501 .With content reduction encoding  
 502 .Delay line  
 503 **AUDIO SIGNAL TIME COMPRESSION OR  
 EXPANSION (E.G., RUN LENGTH  
 CODING)**  
 504 .With content reduction encoding

**E-SUBCLASSES**

The following subclasses beginning with the letter E are E-subclasses. Each E-subclass corresponds in scope to a classification in a foreign classification system, for example, the European Classification system (ECLA). The foreign classification equivalent to an E-subclass is identified in the subclass definition. In addition to US documents classified in E-subclasses by US examiners, documents are regularly classified in E-subclasses according to the classification practices of any foreign Offices identified in parentheses at the end of the title. For example, "(EPO)" at the end of a title indicates both European and US patent documents, as classified by the EPO, are regularly added to the subclass. E-subclasses may contain subject matter outside the scope of this class. Consult their definitions, or the documents themselves to clarify or interpret titles.

E17.001 **SPEAKER IDENTIFICATION OR  
 VERIFICATION (EPO)**

E17.002 .Recognition of special voice characteristics, e.g., for use in a lie detector; recognition of animal voices, etc. (EPO)  
 E17.003 .Systems using speaker recognizers (EPO)  
 E17.004 .Details (EPO)  
 E17.005 ..Preprocessing operations, e.g., segment selection, etc., pattern representation or modeling, e.g., based on linear discriminant analysis (LDA), principal components, etc.; feature selection or extraction (EPO)  
 E17.006 ..Training, model building, enrollment (EPO)  
 E17.007 ..Decision making techniques, pattern matching strategies (EPO)  
 E17.008 ...Use of particular distance or distortion metric between probe pattern and reference templates (EPO)  
 E17.009 ...Multimodal systems, i.e., based on the integration of multiple recognition engines or experts fusion (EPO)  
 E17.01 ..Score normalization (EPO)  
 E17.011 ...Use of phonemic categorization or speech recognition prior to speaker recognition or verification (EPO)  
 E17.012 ..Hidden Markov Models (HMMs) (EPO)  
 E17.013 ..Artificial neural networks, connectionist approaches (EPO)  
 E17.014 ..Pattern transformations and operations aimed at increasing system robustness, e.g., against channel noise, different working conditions, etc. (EPO)  
 E17.015 ..Interactive procedures, man-machine interface (EPO)  
 E17.016 ...User prompted to utter a password or predefined text (EPO)  
 E15.001 **SPEECH RECOGNITION (EPO)**  
 E15.002 .Assessment or evaluation of speech recognition systems (EPO)  
 E15.003 .Language recognition (EPO)

- E15.004 .Feature extraction for speech recognition; selection of recognition unit (EPO)
- E15.005 .Segmentation or word limit detection (EPO)
- E15.006 ..Word boundary detection (EPO)
- E15.007 .Creation of reference templates; training of speech recognition systems, e.g., adaption to the characteristics of the speaker's voice, etc. (EPO)
- E15.008 ..Training (EPO)
- E15.009 ..Adaptation (EPO)
- E15.01 ...In the frequency domain (EPO)
- E15.011 ...To speaker (EPO)
- E15.012 ....Supervised, i.e., under machine guidance (EPO)
- E15.013 ....Unsupervised (EPO)
- E15.014 .Speech classification or search (EPO)
- E15.015 ..Using distance or distortion measures between unknown speech and reference templates (EPO)
- E15.016 ..Using dynamic programming techniques, e.g., Dynamic Time Warping (DTW), etc. (EPO)
- E15.017 ..Using artificial neural networks (EPO)
- E15.018 ..Using natural language modeling (EPO)
- E15.019 ...Using context dependencies, e.g., language models, etc. (EPO)
- E15.02 ....Phonemic context, e.g., pronunciation rules, phonotactical constraints, phoneme n-grams, etc. (EPO)
- E15.021 ....Grammatical context, e.g., disambiguation of the recognition hypotheses based on word sequence rules, etc. (EPO)
- E15.022 .....Formal grammars, e.g., finite state automata, context free grammars, word networks, etc. (EPO)
- E15.023 .....Probabilistic grammars, e.g., word n-grams, etc. (EPO)
- E15.024 ....Semantic context, e.g., disambiguation of the recognition hypotheses based on word meaning, etc. (EPO)
- E15.025 ...Using prosody or stress (EPO)
- E15.026 ...Parsing for meaning understanding (EPO)
- E15.027 ..Using statistical models, e.g., Hidden Markov Models (HMMs), etc. (EPO)
- E15.028 ...Hidden Markov Models (HMMs) (EPO)
- E15.029 ...Training of Hidden Markov Models (HMMs) (EPO)
- E15.03 ....With insufficient amount of training data, e.g., state sharing, tying, deleted interpolation, etc. (EPO)
- E15.031 ...Duration modeling in Hidden Markov Models (HMMs), e.g., semi-HMM, segmental models, transition probabilities, etc. (EPO)
- E15.032 ...Hidden Markov Models (HMMs) network (EPO)
- E15.033 ...State emission probabilities (EPO)
- E15.034 ....Continuous densities, e.g., Gaussian distribution, Laplace, etc. (EPO)
- E15.035 ....Discrete densities, e.g., Vector Quantization preprocessor, look-up tables, etc. (EPO)
- E15.036 ....Neural Network (NN) as output probability estimator, e.g., hybrid HMM/NN, etc. (EPO)
- E15.037 ...Non-hidden Markov Model (EPO)
- E15.038 ..Recognition networks (EPO)
- E15.039 .Speech recognition techniques for robustness in adverse environments, e.g., in noise, of stress induced speech, etc. (EPO)
- E15.04 .Procedures used during a speech recognition process, e.g., man-machine dialogue, etc. (EPO)
- E15.041 .Speech recognition using nonacoustical features, e.g., position of the lips, etc. (EPO)
- E15.042 ..Using position of the lips, movement of the lips, or face analysis (EPO)
- E15.043 .Speech to text systems (EPO)
- E15.044 ..Speech recognition depending on application context, e.g., in a computer, etc. (EPO)

- E15.045 ..Systems using speech recognizers (EPO)
- E15.046 .Constructional details of speech recognition systems (EPO)
- E15.047 ..Distributed recognition, e.g., in client-server systems for mobile phones or network applications, etc. (EPO)
- E15.048 ..Memory allocation or algorithm optimization to reduce hardware requirements (EPO)
- E15.049 ..Multiple recognizers used in sequence or in parallel; corresponding voting or score combination systems (EPO)
- E15.05 ..Recognizers for parallel processing (EPO)
- E19.001 **SPEECH OR AUDIO SIGNAL ANALYSIS-SYNTHESIS TECHNIQUES FOR REDUNDANCY REDUCTION, E.G., IN VOCODERS, ETC.; CODING OR DECODING OF SPEECH OR AUDIO SIGNALS; COMPRESSION OR EXPANSION OF SPEECH OR AUDIO SIGNALS, E.G., SOURCE-FILTER MODELS, PSYCHOACOUSTIC ANALYSIS, ETC. (EPO)**
- E19.002 ..Perceptual measures for quality assessment (EPO)
- E19.003 .Correction of errors induced by the transmission channel, if related to the coding (EPO)
- E19.004 .Lossless audio signal coding; perfect reconstruction of coded audio signal by transmission of coding error (EPO)
- E19.005 .Multichannel audio signal coding and decoding, i.e., using interchannel correlation to reduce redundancies, e.g., joint-stereo, intensity-coding, matrixing, etc. (EPO)
- E19.006 .Comfort noise, silence coding (EPO)
- E19.007 .Speech coding using phonetic or linguistical decoding of the source; reconstruction using text-to-speech synthesis (EPO)
- E19.008 .Systems using vocoders (EPO)
- E19.009 .Audio watermarking, i.e., embedding inaudible data in the audio signal (EPO)
- E19.01 .Using spectral analysis, e.g., transform vocoders, subband vocoders, perceptual audio coders, psychoacoustically based lossy encoding, etc., e.g., MPEG audio, Dolby AC-3, etc. (EPO)
- E19.011 ..Blocking, i.e., grouping of samples in time, choice of analysis window, overlap factor (EPO)
- E19.012 ...Detection of transients and attacks for time/frequency resolution switching (EPO)
- E19.013 ..Noise substitution, i.e., substituting nontonal spectral components by noisy source (EPO)
- E19.014 ..Spectral prediction for pre-echo prevention; temporal noise shaping (TNS), e.g., in MPEG2 or MPEG4, etc. (EPO)
- E19.015 ..Quantization or dequantization of spectral components (EPO)
- E19.016 ...Scalar quantization (EPO)
- E19.017 ...Vector quantization, e.g., Twin-VQ audio, etc. (EPO)
- E19.018 ..Using subband decomposition (EPO)
- E19.019 ...Subband vocoders (EPO)
- E19.02 ..Using orthogonal transformation (EPO)
- E19.021 ...Using wavelet decomposition (EPO)
- E19.022 .Dynamic bit allocation (EPO)
- E19.023 .Using predictive techniques; codecs based on source-filter modelization (EPO)
- E19.024 ..Determination or coding of the spectral characteristics, e.g., of the short-term prediction coefficients, etc. (EPO)
- E19.025 ...Line spectrum pair (LSP) vocoders (EPO)
- E19.026 ..Determination or coding of the excitation function; determination or coding of the long-term prediction characteristics (EPO)
- E19.027 ...Determination or coding of an excitation gain (EPO)
- E19.028 ...Using mixed excitation model, e.g., MELP, MBE, Split band LPC, HVXC, etc. (EPO)

- E19.029 ...Long-term prediction, i.e., removing periodical redundancies, e.g., adaptive codebook, pitch predictor, etc. (EPO)
- E19.03 ...Using sinusoidal excitation model (EPO)
- E19.031 ...Using prototype waveform decomposition or waveform interpolative coders (PWI) (EPO)
- E19.032 ...Determination or coding of a multipulse excitation (EPO)
- E19.033 ...Algebraic codebook; sparse pulse excitation (EPO)
- E19.034 ...Regular pulse excitation (EPO)
- E19.035 ...Determination or coding of a code excitation; code excited linear prediction (CELP) vocoders (EPO)
- E19.036 ...Pitch excitation, e.g., PSI-CELP (pitch synchronous innovation CELP), etc. (EPO)
- E19.037 ...Residual excited linear prediction (RELPE) (EPO)
- E19.038 ...Vector sum excited linear prediction (VSELPE) (EPO)
- E19.039 ..Details of speech and audio coders (EPO)
- E19.04 ...Vocoder architecture (EPO)
- E19.041 ...Vocoders using multiple modes (EPO)
- E19.042 ....Using sound class specific coding, hybrid encoders, object-based coding (EPO)
- E19.043 ....Mode decision, i.e., based on audio signal content versus external parameter (EPO)
- E19.044 ....Variable rate or variable quality codecs, e.g., scalable representation encoding, etc. (EPO)
- E19.045 ...Pre- or post-filtering (EPO)
- E19.046 ...Pre-filtering, e.g., high frequency emphasis prior to encoding, etc. (EPO)
- E19.047 ...Post-filtering, e.g., pitch enhancement, formant emphasis for decoder, etc. (EPO)
- E19.048 ...Audio streaming, i.e., formatting and decoding of an encoded audio signal (EPO)
- E19.049 ...Transcoding, i.e., converting between two coded representations avoiding cascaded coding-decoding (EPO)
- E21.001 **MODIFICATION OF AT LEAST ONE CHARACTERISTIC OF SPEECH WAVES (EPO)**
- E21.002 ..Speech enhancement, e.g., noise reduction, echo cancellation, etc. (EPO)
- E21.003 ..Applications (EPO)
- E21.004 ...Speech corrupted by noise (EPO)
- E21.005 ....Periodic noise (EPO)
- E21.006 ....The noise being separate speech (EPO)
- E21.007 ...Speech corrupted by echo-reverberation (EPO)
- E21.008 ...Speech corrupted by stress-Lombard effect (EPO)
- E21.009 ...Enhancement of intelligibility of clean or coded speech (EPO)
- E21.01 ...Enhancement of diverse speech (EPO)
- E21.011 ...Bandwidth extension taking place at the receiving side, e.g., generation of low- or high-frequency components, regeneration of spectral holes, etc. (EPO)
- E21.012 ...Separate reconstruction of interference and of speech signal (EPO)
- E21.013 ....The interference being a separate speaker (EPO)
- E21.014 ...Active noise canceling (EPO)
- E21.015 ...Public address system (EPO)
- E21.016 ..Suppression or repetition of time signal segments (EPO)
- E21.017 ..Time compression or expansion (EPO)
- E21.018 ..Suppression or repetition of time signal segments (EPO)
- E21.019 ..Transformation of speech into a nonaudible representation, e.g., speech visualization, speech processing for tactile aids, etc. (EPO)
- E21.02 ..Synchronization of speech with image or synthesis of the lips movement from speech, e.g., for "talking heads," etc.(EPO)
- E11.001 **MISCELLANEOUS ANALYSIS OR DETECTION OF SPEECH CHARACTERISTICS (EPO)**

- E11.002 .General speech analysis without  
concrete application (EPO)
- E11.003 .Detection of presence or absence  
of speech signals (EPO)
- E11.004 ..Voice/data decision (EPO)
- E11.005 ..End point detection (EPO)
- E11.006 .Pitch determination of speech  
signals (EPO)
- E11.007 .Voiced-unvoiced decision (EPO)
- E13.001 **SPEECH SYNTHESIS; TEXT TO SPEECH  
SYSTEMS (EPO)**
- E13.002 .Methods for producing synthetic  
speech; speech synthesizers  
(EPO)
- E13.003 ..Concept-to-speech synthesizers;  
generation of natural phrases  
not from text but from  
machine-based concepts (EPO)
- E13.004 ..Sound editing, manipulating  
voice of the synthesizer (EPO)
- E13.005 .Details of speech synthesis  
systems, e.g., synthesizer  
architecture, memory  
management, etc. (EPO)
- E13.006 ..Architecture of speech  
synthesizers (EPO)
- E13.007 ..Excitation (EPO)
- E13.008 ..Systems using speech  
synthesizers (EPO)
- E13.009 .Elementary speech units used in  
speech synthesizers;  
concatenation rules (EPO)
- E13.01 ..Concatenation (EPO)
- E13.011 .Text analysis, generation of  
parameters for speech  
synthesis out of text, e.g.,  
grapheme to phoneme  
translation, prosody  
generation, stress, or  
intonation determination, etc.  
(EPO)
- E13.012 ..Grapheme to phoneme, detection  
of language (EPO)
- E13.013 ..Prosody rules derived from text  
(EPO)
- E13.014 ..Stress or intonation (EPO)

**FOREIGN ART COLLECTIONS**FOR 000 **CLASS-RELATED FOREIGN DOCUMENTS**