

- 1) The core object of the work is to design and develop an adaptive expert system, which could perform audiological investigations of hearing impaired subjects, to identify the hearing loss level and to recommend the most appropriate gain values for different frequency bands of a digital hearing aid. We have tested 353 subjects in the age group of 18 to 72; of these, 289 were males and 64 were females and a hearing aid was recommended for 159 subjects. These subjects were fitted with a digital hearing aid, with a first fit formula selected based on the audiogram of the subject, from any one of the standard linear and non linear prescriptive procedures. The standard procedures are formulas from the National Acoustic Laboratory (NAL), Prescription Of Gain Output (POGO), and the Desired Sensation Level (DSL). The recommendations were verified for satisfaction among the hearing aid users with the value of the Speech Discrimination Score (SDS); only 28 were satisfied with NAL-R, 25 were satisfied with POGO II, 23 were satisfied with NAL-NL2 and 12 were satisfied with DSL I/O. The unsatisfied subjects obtained satisfaction, by changing the gain value with the expertise of audiologists, stored in the expert system. Based on the suggested gain values and additional data from the expert audiologists, the gain formula could be made distinct for different language and living conditions.
- 2) The various gain calculating formulae for digital hearing aids is analyzed for different subjects to find out suitable adaptive gain formula for most successful gain recommendations. The object of the work is to design and develop an adaptive expert system, which could be effectively used to perform screening tests to identify the level of hearing impairment and recommend suitable gain suggestions for frequency bands of digital hearing aid. Initially, the design requirements for a digital hearing aid are being arrived by using the standard gain formulae followed such as National Acoustic Laboratory Revised (NAL-R) and Prescription of Gain Output (POGO II). The test is carried with 272 subjects aging from 25 to 72 and 221 male and 51 female. Of which gain is recommended for 127 subjects with the standard gain formula. When the recommendations are verified for satisfaction among the hearing aid users only 28 received satisfaction with NAL-R and 25 received satisfactions with POGO II. Remaining subjects received satisfaction only after fine tuning the gain value and recommended gains are stored in adaptive expert system. Subsequently, based on the suggested value of gains and additional data from expert audiologists, gain formula could be made distinct for every language.
- 3) The tranquil solution for the hearing impaired subjects to get rid of the impairment is to wear the appropriate hearing aid to increase the hearing level and clarity of the perceived speech. Though the present day hearing aids are inbuilt with a suitable noise removing algorithm to get a clear speech signal, the satisfaction among the users is low. The satisfaction of the hearing aid users will be enhanced only with the fixation of appropriate Real Ear Insertion Gain (REIG) values for different frequency bands of the perceived speech signal. Various prescriptive procedures were developed so far in prescribing these values. But, the strenuous task for the audiologists is in selecting the best procedure and to suggest required modifications. The present work focuses this problem faced by the audiologists by analyzing the various technical snags and arrived with suitable solutions. In the present work, an expert system was developed to predict gain values without the need of the prescriptive procedures and reduced the trial and error time of the audiologists. A gain suggestion database of the satisfied subjects was developed, and later it was used by the correlation algorithm in the gain prediction process. The successful gain suggestions of the most correlated subject for different frequencies in the database are recommended for the new subject. The developed expert system was validated by performing hearing aid trials with 256 hearing impaired subjects and 93.7% of them received satisfaction. The successful gain suggestions made by the expert system are stored continuously to strengthen the database, so as to recommend the most appropriate gain values for the new subject.