

## Editorial

# Artificial Intelligence in Digital Hearing Aids: A New Mentality

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## ARTIFICIAL INTELLIGENCE: GENERAL UNDERSTANDING

Artificial intelligence (AI) has a wider scope of its applications in every domain nowadays. Artificial intelligence in general, refers to the field of computer science which generates, uses computer programs to solve complex problems and provides intelligent solutions.<sup>1</sup> For this procedure, several different rules, algorithms, and software can be used.

## ARTIFICIAL INTELLIGENCE: ROLE IN THE HEALTHCARE INDUSTRY

When the healthcare industry is considered, AI has been used extensively. Techniques of AI assists physicians in clinical decision making i.e., radiology<sup>2</sup> and tackling various diseases<sup>2</sup> such as cancer<sup>2,3</sup> neurology<sup>2,4,5</sup> and cardiology.<sup>2,6,7</sup> Analysis of big data can be easily obtained by the clinician into a required clinical chunk of data by techniques used in AI.<sup>2</sup> Additionally, the big success of AI in medical literature<sup>2</sup> has been in segregating larger chunks of relevant clinical data from large medical records of patients *via* the use of sophisticated algorithms which may help in achieving efficient clinical decision-making.<sup>2,8,9</sup> AI helps further to physicians to render quality patient care by chunking larger updated information from various sources such as textbooks, clinical practices, and journals.<sup>2,10</sup> In addition, AI technology helps in better medical results with fewer errors in — diagnostic and therapeutic as evidenced more with humans clinical practice.<sup>2,6,11</sup>

## ARTIFICIAL INTELLIGENCE — ROLE IN HEARING HEALTHCARE INDUSTRY (AMPLIFICATION DEVICES)

In a similar trend in the hearing healthcare industry, artificial intel-

ligence has been found to be widely in use.<sup>2</sup> Artificial intelligence with reference to amplification devices — digital hearing aids can be understood as a vehicle or platform which facilitates audibility and assists in communication *via* the use of advanced algorithm and software. With the advancement in technology from analog to digital, listening performance has been enhanced for hearing impaired users. But the standard term “digital” doesn’t imply all digital hearing aids are the same.<sup>1</sup> They differ in terms of the technology used and hence fall into essential, advanced and premium series. Premium quality in every brand of hearing aids refers to enhanced performance series with multiple advanced features. It incorporates that feature which makes the hearing aid smart, intelligent for its users and here comes in the AI. This new platform assists in the superior performance of hearing aids with respect to real-time acoustic demands. Hearing-impaired patient’s experiences various listening situations which may be at times predictable, repeated and or real-time varying or combination of all. In such different situations, signal and noise may not be same all the time. The level of sound and competing signals fluctuates from time to time. Traditional amplification devices were limited to meet such challenging and varying acoustic needs. With the development of technology with digital hearing aids, hearing impaired patients become handy with AI technology.<sup>1,12</sup> These techniques may facilitate the use of features and programs to users and enable them to perform better in noisy conditions with the added performance of directionality cues. For communication to be an effective significant signal to noise ratio (S/N Ratio) has to be maintained. According to previous research<sup>1,13</sup> S/N ratio has been reported to be a major challenge for effectiveness of communication, especially by sensorineural hearing-impaired patients. The overall sound level over noise is crucial for the understanding of the message. It has been reported in the literature that hearing-impaired individuals may perceive appropriately with S/N ratios of +14 to +30 dB for

communication.<sup>1</sup> Louder the background noise, sound signal less effective and reception deteriorates.

Does the major question arise now as to how does digital hearing aids incorporating AI techniques perform so intelligently? AI incorporates two significant approaches<sup>1,14</sup> termed as classical approach and statistical approaches. Classical approaches work based on a predetermined rule structure to analyze input signals to derive output. On the contrary a Statistical approach incorporates analysis of larger sets of data to find patterns and make conclusions for its general applicability. The classical approach has been majorly used in hearing aids programming considering practical aspects of hearing aid users.<sup>1</sup> The rules of this approach are explicit. For deriving the output from a varying situation it has set rules which can easily compare the inputs and gives an output. On the contrary statistical approaches are not explicit which requires the user to hear parallel different potential solutions in the acoustic environment to decide upon the desired output. This may not be feasible for patients in real time-varying acoustic environments that they may thousands of trials in a given setting and decide upon a solution or an output. Hence this approach limits its application for hearing aid programming.<sup>1</sup>

## CONCLUSION

Artificial intelligence has more benefits over its limitations, as it assists the users to handle complex situations in real-time *via* the rule-based system and not prediction in isolation. AI technology opens a gateway to allow the usage of complex algorithms and software for problem-solving. AI technology is good, relevant and meant to help hearing-impaired people and it's not just technology of bits and bytes. These computer-assisted applications make routines work very easier and save lots of time. Hearing aid users can be benefited to communicate more effectively *via* the use of different advanced features and programs which work actively in a real-time acoustic environment. The key component of communication i.e., S/N ratio is taken care of effectively thus helping hearing aid users to hear better and understand speech. Professionals can confidently recommend the amplification devices to their patients. The limitations of AI are that though these computer-assisted technologies can effectively fasten daily routine works but cannot mimic human bestowed property of cognition,<sup>1</sup> thinking,<sup>1,15</sup> language processing<sup>1</sup> and social interaction.<sup>16</sup> Owing to its many advantages AI through its applications are accepted world-wide.

## CONFLICTS OF INTEREST

The author declares there is NO conflict of interest

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