Leading with Intelligence: Driving the AI Revolution in Hearing Aids

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Key takeaways:

- Aris AI embodies the industry's first deep neural network-powered directionality system, marking a significant milestone in Audibel's accelerating trajectory of AI-driven innovation.
- Audibel leverages advanced AI technologies for sophisticated audio processing in hearing aids and intelligent assistive solutions that enhance the experience for both users and hearing care professionals.

Introduction

Audibel has consistently led the hearing health industry, pioneering innovations that improve the quality of life for people with hearing loss. As a recognized leader in hearing healthcare innovation, Audibel has harnessed the power of artificial intelligence (AI), machine learning, deep neural networks (DNN), and is the first in the industry to integrate generative AI (Gen AI) technology to revolutionize the hearing care experience - driving intelligent solutions that elevate both patient outcomes and provider success.

This overview paper provides a summary of the core technologies that power Audibel's intelligent features.

Deep Neural Networks (DNN)

Deep Neural Networks are a class of machine learning models composed of multiple layers of parameterizable units that can learn complex patterns in data. They have demonstrated remarkable success in processing audio and speech, enabling tasks such as voice recognition, noise suppression, and speaker identification.

Traditionally, DNNs required significant computational resources, but recent advancements in model optimization and hardware acceleration have made it feasible to deploy them on small, embedded devices, such as hearing aids.Techniques like model quantization, pruning, and efficient architecture like TinyML *(David et al., 2021)* and MobileNet *(Howard et al., 2019)* have enabled real-time inference with low power consumption. This shift opens new possibilities for always-on voice assistants, sophisticated audio processing methods, and wearable health monitors. By bringing speech and audio intelligence closer to the edge – meaning processing is done directly on the hearing device – DNNs significantly enhance the performance and user experience of hearing aids. This edge-based approach improves privacy by keeping sensitive data local, reduces latency by eliminating the need for constant connectivity, and enables offline functionality. These advantages make DNN-powered hearing aids a transformative tool in delivering faster and smarter hearing support.

At Audibel, this powerful new approach is realized by incorporating an industry-first on-board neuro processor in the hearing aids, starting with Intrigue AI hearing aids. This dedicated hardware supports the implementation of sophisticated DNN-based algorithms in an efficient and compact manner. The Vitality AI line of hearing aids introduced hardware improvements that enabled 100x more DNN processing without impacting battery life or device size. In addition to these hardware innovations, Audibel also adapted leading-edge methods for the development, training and evaluation of algorithms.

DNN training for speech processing involves managing several complexities and tradeoffs. Large datasets are typically required to capture the variability in speech due to accents, noise, and speaking styles, which can increase training time and demand substantial computational resources. Deeper and more complex models often yield higher accuracy but at the cost of increased training and inference time, as well as greater memory and energy consumption.

Overfitting is a common concern, especially when data is limited or not diverse enough, necessitating careful regularization and data augmentation strategies. On-device deployment introduces additional constraints, such as the need to reduce model size through pruning, quantization, or knowledge distillation, often with some loss in accuracy. There is a constant tradeoff between model performance and resource efficiency, particularly for real-time applications on embedded systems. Developers must balance factors like latency, power consumption, model complexity, and robustness to achieve practical, scalable solutions for speech tasks.

In the development of Audibel's DNN algorithms, these tradeoffs are optimized for the best performance possible. One of the recent trends that is considered is the prioritization of high-quality data over large amounts of data.

For example, Li et al. *(2025)* show that data curation in scaling speech enhancement systems has a greater impact on performance than simply scaling up the training dataset. They argue that better performance can be obtained by spending more effort to curate a high-quality training data set rather than just adding (lesser quality) data. In addition to data curation and optimizing the tradeoffs associated with training DNN algorithms, innovative methods were used in other aspects of the DNN development process, including systematic, online, iterative evaluation of algorithm performance. Betlehem et al. *(2022)* showed that an automatic speech recognition system can be used to evaluate DNN-powered speech enhancement algorithms after training, thus saving the time and cost of human subject testing and speeding up the iterative process of algorithm development.

Generative AI

In conjunction with employing DNNs to drive Audibel's AI technologies, we have also developed several features utilizing Generative AI, including Generative AI Assistant in the My Audibel mobile app, AI Assist for professional queries and Gen AI-driven TeleHear AI *(Mehraei et al., 2025)*. Generative AI technology enables machines to understand, generate, and respond with natural-sounding human speech. Using mechanisms like large language models (LLMs) and text-to-speech (TTS) systems, it powers voice assistants and conversational agents that can engage in fluid, context-aware dialogue. These assistants are built for clinicians and patients alike, and provide personalized, lifelike and intelligent human-computer interaction to improve the efficiency and effectiveness of Audibel's tools, technology and processes.

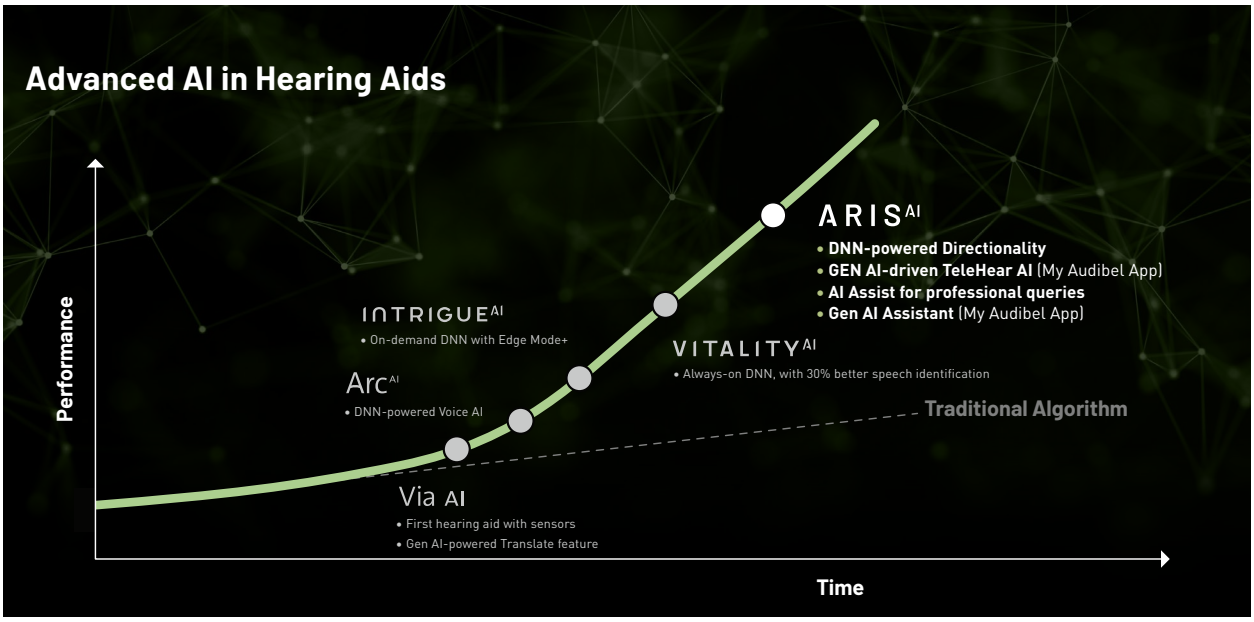

Figure 1: Audibel's technological progression over time

Audibel Leads in AI and DNN Technology

Audibel is an industry leader in the application of DNN technology. In a very short time, a multitude of DNN applications were implemented, spanning speech enhancement, noise reduction, and directionality features. This entry into the cutting-edge technology stream stemmed from decades of experience and application of traditional machine learning techniques and artificial intelligence. The figure above shows a timeline of Audibel's more recent DNN-driven features, starting with DNN-powered Voice AI in 2021 – Audibel's first DNN application for hearing assistance. Shortly thereafter, in 2023, Audibel introduced an on-demand DNN-powered speech enhancement through Edge Mode+ running on the industry-first dedicated on-board neural processor.

In 2024, Vitality AI hearing aids were introduced that included an always-on DNN for speech enhancement, resulting in 30% better speech recognition, and accomplished this huge performance boost without impacting battery life.

The latest advancements in DNN and AI are redefining the future of hearing technology, particularly in the areas of directionality and assistive features. At the forefront is Aris AI, featuring Audibel's all-new DNN-powered intelligent directionality system, which dynamically adapts to complex listening environments to deliver up to 70% better speech intelligibility compared to other leading hearing aid brands *(Marquardt & Taylor, 2025)*. This breakthrough underscores Audibel's leadership in applying DNN technology to real-world challenges.

This new directionality system optimally balances the need for speech understanding and spatial awareness *(Marquardt et al., 2025)*. Utilizing a DNN-based speech detector, the system switches between a focused directionality mode when speech is present and a spatial adaptation mode when spatial awareness is needed. The result is a highly adaptive and context-aware hearing device that optimizes the listening experience across a broad range of real-world scenarios.

Complementing this advancement is a suite of generative AI-driven assistive technologies – TeleHear AI, AI Assist, and an enhanced Smart Assistant – that provides users with more intuitive, personalized and responsive support. These tools leverage the power of AI to anticipate user needs, simplify communication, and enhance accessibility, whether users are at home, in a crowd, or on the go. Together, these innovations reflect Audibel's commitment to pushing the boundaries of what hearing aids can do, elevating them into intelligent, multifunctional systems that empower both patients and the hearing care professionals who support them.

Summary

Audibel has strong leadership in pioneering industry-leading technologies rooted in machine learning, deep-neural networks and generative AI. With Aris AI, Audibel continues to push the bounds of innovation with the industry's first DNN-powered multi-channel intelligent directional system, and smart assistive technologies that help patients hear better and live better lives.

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Martin McKinney, Ph.D., holds a B.S. degree in Electrical Engineering from Tufts University, an A.M. degree in Electroacoustic Music from Dartmouth College and a Ph.D. in Speech and Hearing Sciences from Massachusetts Institute of Technology. He currently works as Director of Algorithms and Data Technology at Starkey.