Addressing Untreated Hearing Loss with Affordable AI Technology

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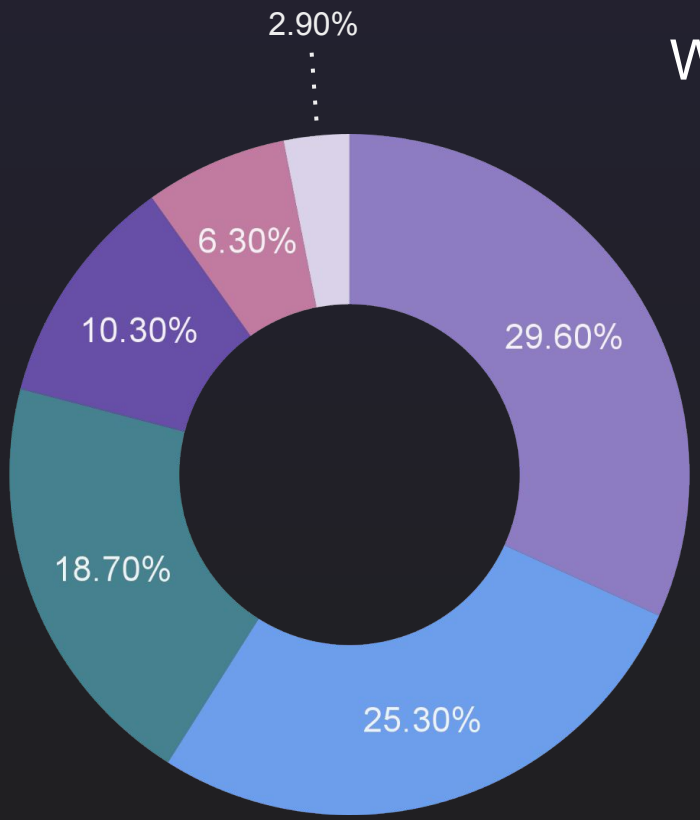
Empowering Intelligence in Everyday Devices

What if less than 10% of people who needed glasses got them…

What if they cost more than a year’s salary…

What if they work poorly when you need them the most…

Why don’t people wear their hearing aids?



- Poor benefit from hearing aids
- Background noise/ noisy situations
- Fit & comfort
- Price & cost of repairs
- Sound quality is poor
- Stigma of wearing hearing aids

Source: MarkeTrak V: "Why my hearing aids are in the drawer": The consumers’ perspective

How can we address these issues?

1.) Improve speech in noise performance

2.) Improve access to high quality hearing aids

Current approaches to noise reduction

Spectral Subtraction:

Noise spectrum is estimated during speech pauses and subtracted from the noisy speech spectrum

Wiener Filtering:

Estimates the optimal filter to minimize the MSE between the enhanced and noisy speech

Beamforming

Utilize delays and frequency differences between multiple microphones to focus microphone direction towards target

Deep Learning-Based Methods:

Learn features of speech and noise during training to estimate and remove noise frequency components

Why current noise reduction fails

Directional

Bad with impulses

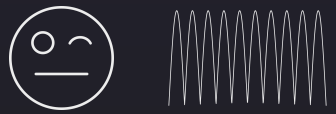
Distorts speech

Poor improvement

AI noise reduction addresses these issues

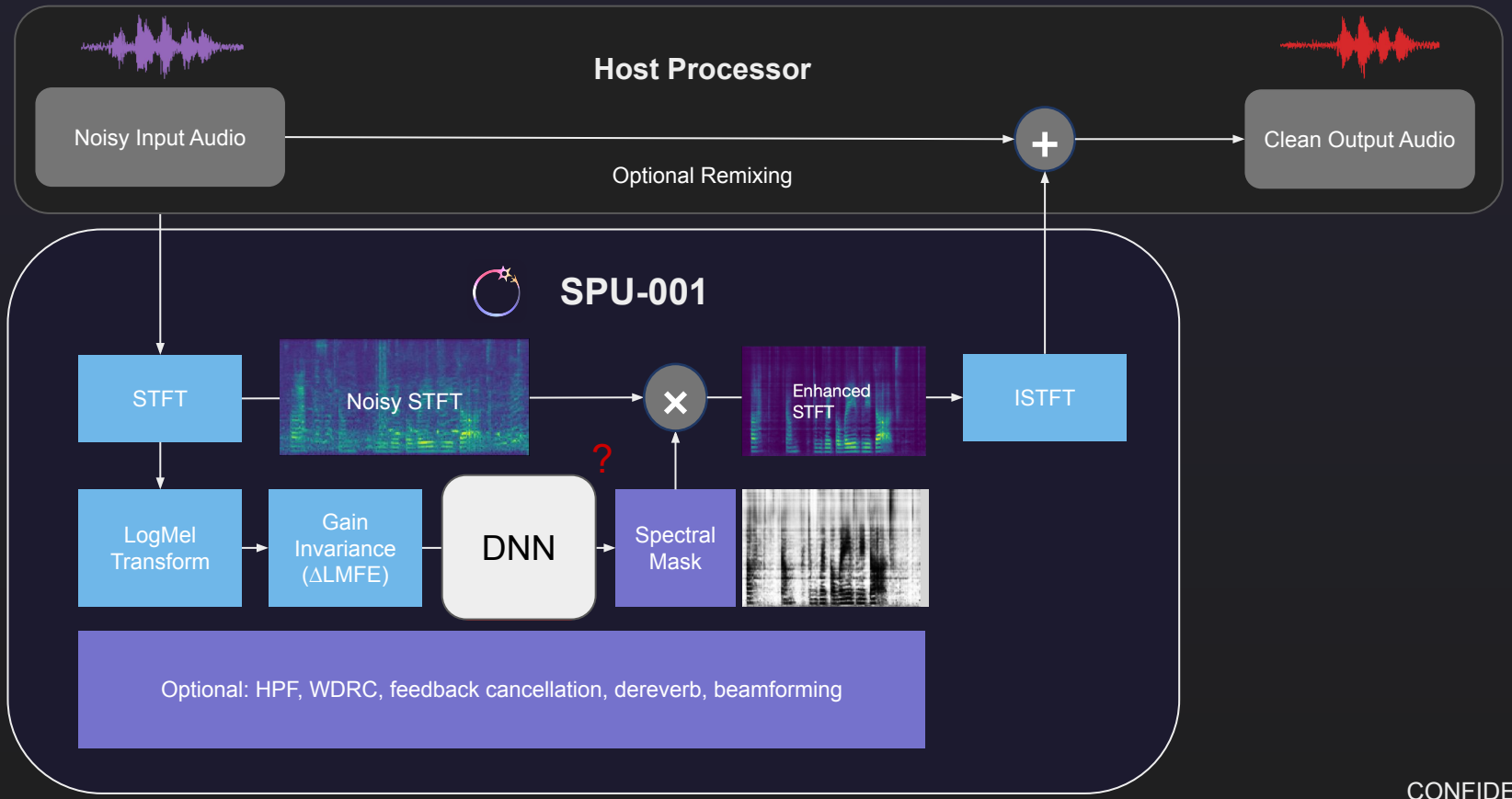
AI noise reduction constraints

Zoom/Teams/Meet	**Hearing Aids**
Latency: 50+ ms	Latency: <10 ms
Power: 1-10 W (CPU) or servers	Power: 1 mW
Throughput: O(1-10) TOPS	Throughput: O(10) GOPS

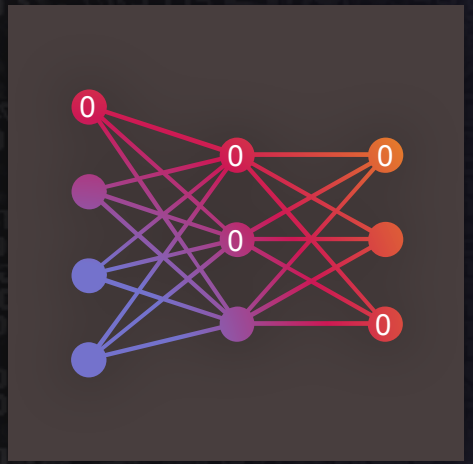


Same performance expectation…

Clara AI Noise Reduction Signal Flow



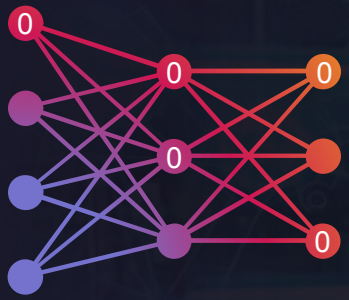
Sparsity enables better tradeoffs



Neural network
Heavy matrix math

High redundancy
Many values can be 0

Conventional



Run the full workload

More Silicon
More Power

femtoAI

Run the sufficient workload

10% Weights
10% Activations

Less Silicon
Less Electricity

10x smaller
100x lower power

femtoAI

Sparse Processing Units (SPUs)

Tiny enough to fit into the smallest devices and **efficient** enough to last all day running **powerful** AI applications on-device in real time

- 3.5mm^2
- 1MB memory (10MB effective)
- µW-scale power consumption
- Native dual-sparsity support

In mass production

Coming Soon

2025: SPU-150
Interface optimizations & lightweight vision support

2026: SPU-2XX Family
Modular architecture with support for vision and NLP

Clara AI noise reduction measurements

Model Name	Algo Latency	Sampling Rate	Total Power	Execution Time (150 mHz clock))
ClaraMono_8ms_v2.0-L	8 ms	16 kHz	980 µW (~23°C)	1.06 ms
ClaraMono_4ms_v2.1-L	4 ms	16 kHz	1.40 mW (~23°C)	1.02 ms
ClaraMono_4ms v2.1-L+WDRC	4ms	16 kHz	1.42mW (~23°C)	1.06 ms

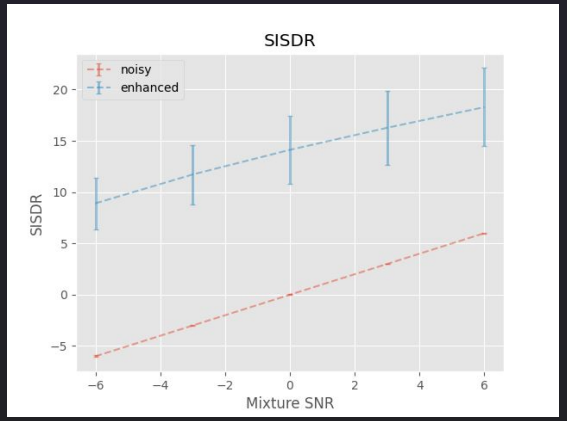
Enables 20 hour battery life 

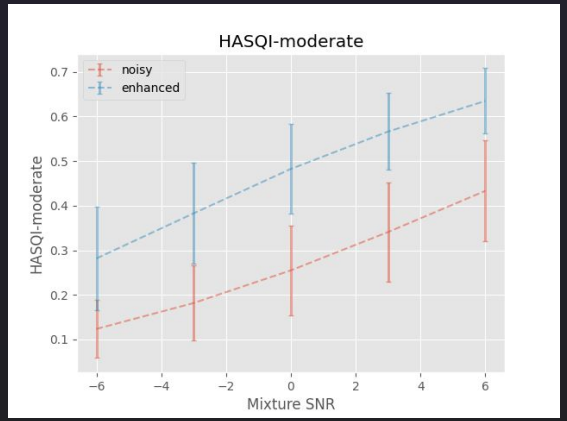
E2E latency under 10ms 

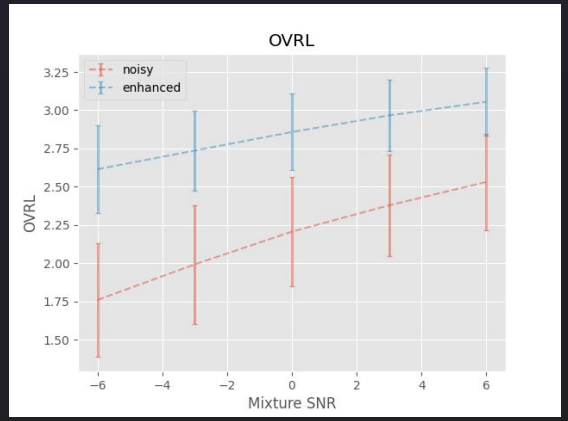
Clara AI Noise Reduction Performance

	Car			Babble					Overall			
Algorithm	**SISDR (dB)**	**PESQ**	**STOI**	**SISDR (dB)**	**PESQ**	**STOI**	**HASQI**	**HASPI[3]**	**OVRL P.835**	**SIG P.835**	**BAK P.835**	**MOS P.808**
noisy	0.0	1.38	0.898	0.0	1.18	0.711	0.267	0.890	1.855	2.601	1.979	2.917
8ms v2.0-L	13.8	2.54	0.932	7.55	1.59	0.784	0.459	0.982	2.507	3.051	3.141	3.241
4ms v2.1-L	12.4	2.27	0.929	6.62	1.51	0.779	0.419	0.964	2.323	3.005	2.715	3.113

Clara AI Noise Reduction Performance







new sound
Help people hear better

AI-Driven OTC hearing aid

Clear Natural Speech
7.5-13.3 dB SNR improvement for clear speech

All-Day Battery
Last a full day of use while AINR feature is on.

Ultra-low latency
Featuring 8ms latency, it delivers instant, natural sound

FEMTOSENSE
Embedded **AI** Platform

OTC hearing aids can improve access

When it’s hard to see an audiologist

When you can’t afford prescription hearing aids

When you don’t think you need hearing aids

When you want to try them quickly and discreetly

Other AI applications for hearing aids

Sensor	Applications	Benefit
Microphone	Voice control, Sound ID	Dexterity, Sickness, Alerts
IMU	Fall detection, tap control	Peace of mind, dexterity
Accelerometer	Own voice rejection, bruxism detection	Better audio, dental health
PPG	HR, BP, O2 tracking, stress detection	AFIB detection, fitness
Optical Temperature Sensor	Health tracking, Ovulation tracking	Sickness detection, wellness

Roadmap

Now

- RIC form factor
- 4 presets covering common fits
- Built in hearing test config
- Custom audiogram import
- AI & classical HA algorithms

Planned

- CIC, ITE, neckband, and earbuds
- AI-assisted fitting software
- Voice ID and sensor intelligence
- Remote audiologist fit and tuning
- E2E AI approaches

Takeaways

1. **Hearing loss is a large untreated issue**

2. **Treating it effectively is hard**

3. **AI is improving the OTC performance and user experience**

4. **If you or someone you know is dealing with hearing loss…**

Don’t just speak up, get help

Thank you

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