Focusing and frequency smoothing for arbitrary arrays with application to speaker localization

Hanan Beit-On, Vladimir Tourbabin, Boaz Rafaely

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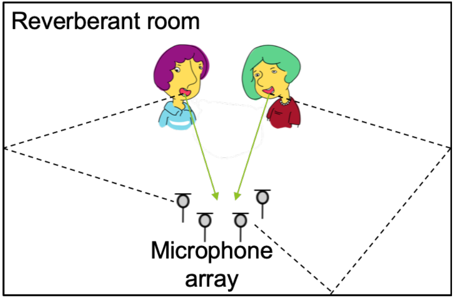
Ben-Gurion University of the Negev

facebook Reality Labs

H. Beit-On and B. Rafaely, "Focusing and frequency smoothing for arbitrary arrays with application to speaker localization," IEEE/ACM TASLP, 2020.

Microphone arrays in reverberant environments



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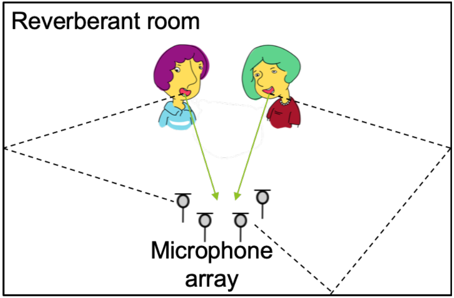

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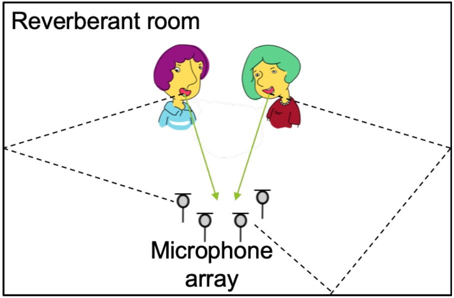

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- We want to enable their application to arbitrary arrays

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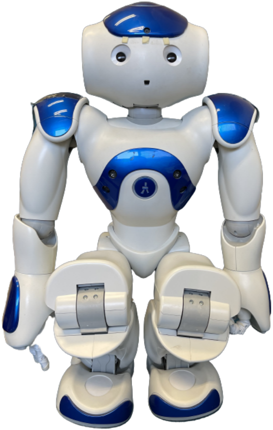
3. **Spatial aliasing:** insufficient samples to compute $\mathbf{H_{nm}}(f)$, $L < (N+1)^2$

Focusing analysis for robot head

- $I = 12$ mics. mounted on Nao robot head



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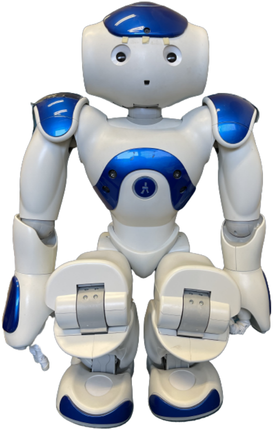

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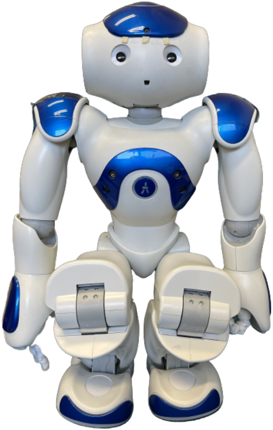

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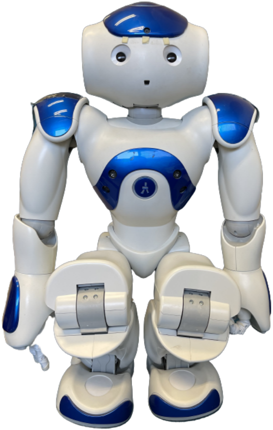

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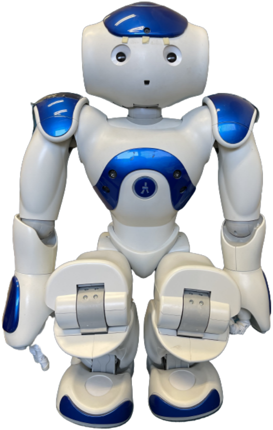

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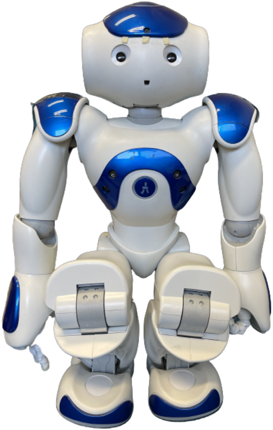

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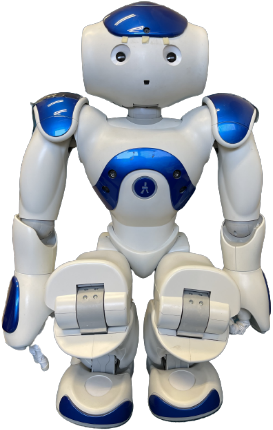

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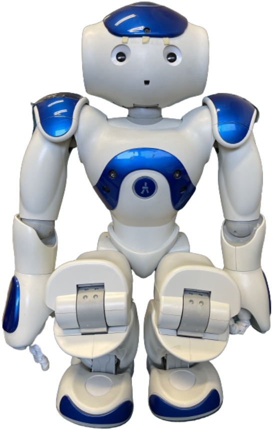

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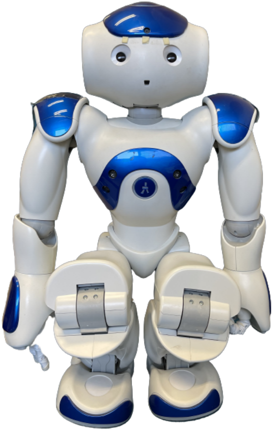

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Focusing performance for robot head

- Focusing error: $$\epsilon\left(f'\right) = \frac{1}{J_f}\sum_{f}\frac{\|\mathbf{T}(f,f')\mathbf{H_{nm}}(f) - \mathbf{H_{nm}}(f')\|_F}{\|\mathbf{H_{nm}}(f)\|_F}$$

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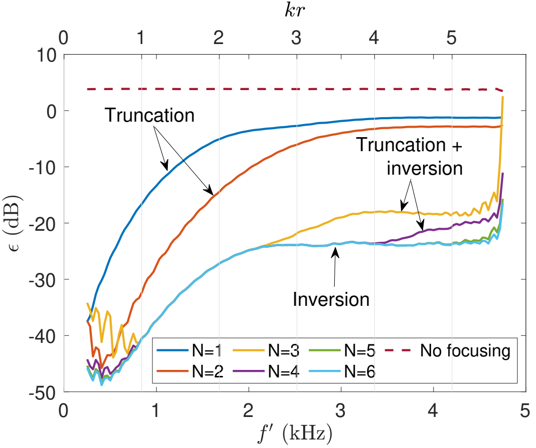

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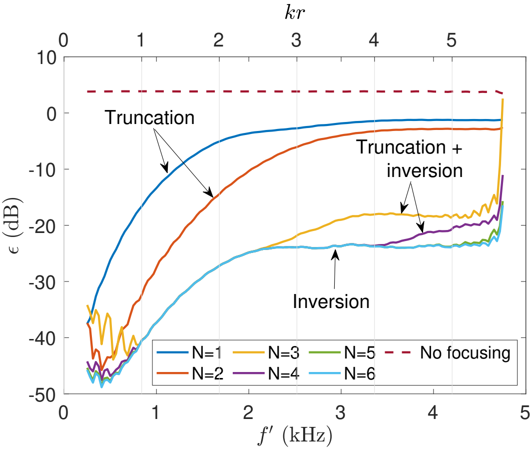

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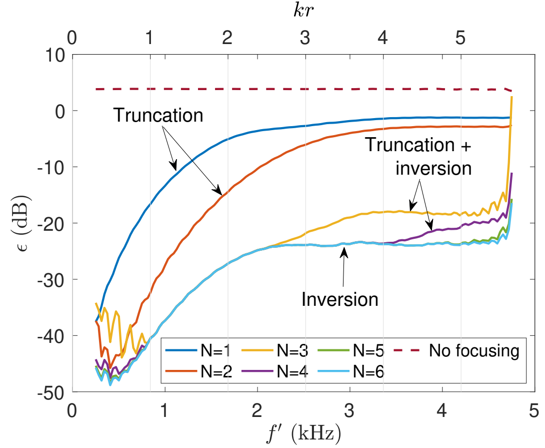

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- For $N = 6$ truncation error is negligible

Speaker localization using LOCATA challenge data

- Real world recordings of speakers in a room using Nao head array

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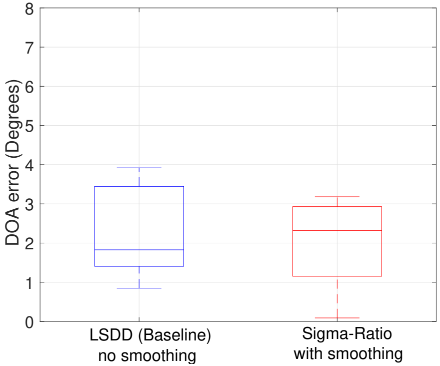

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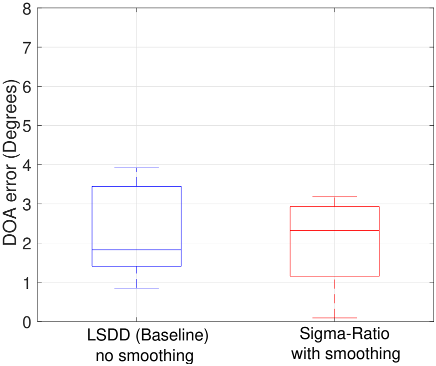

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- This implies that focusing and frequency smoothing can be applied for other applications as well