Source separation

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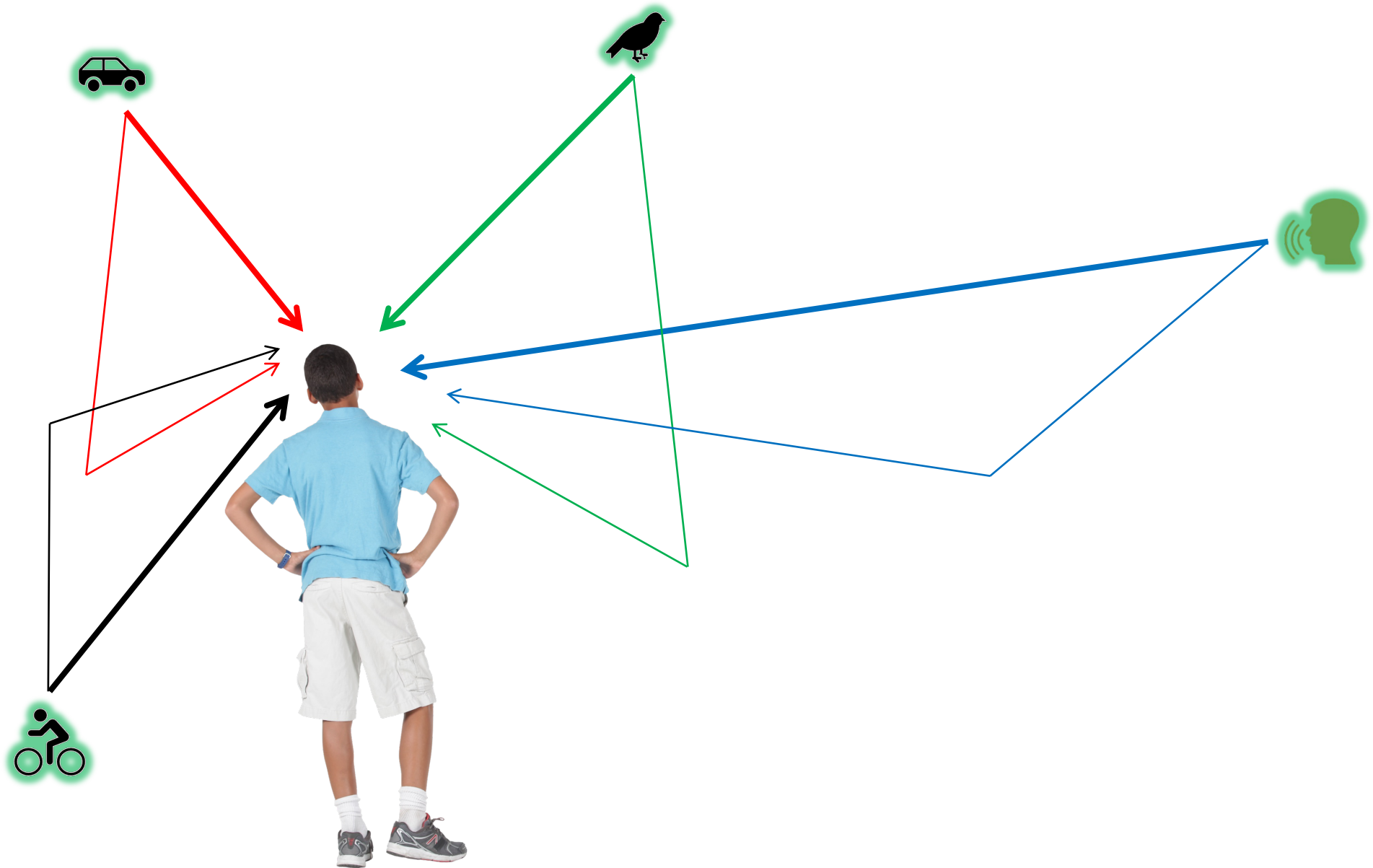
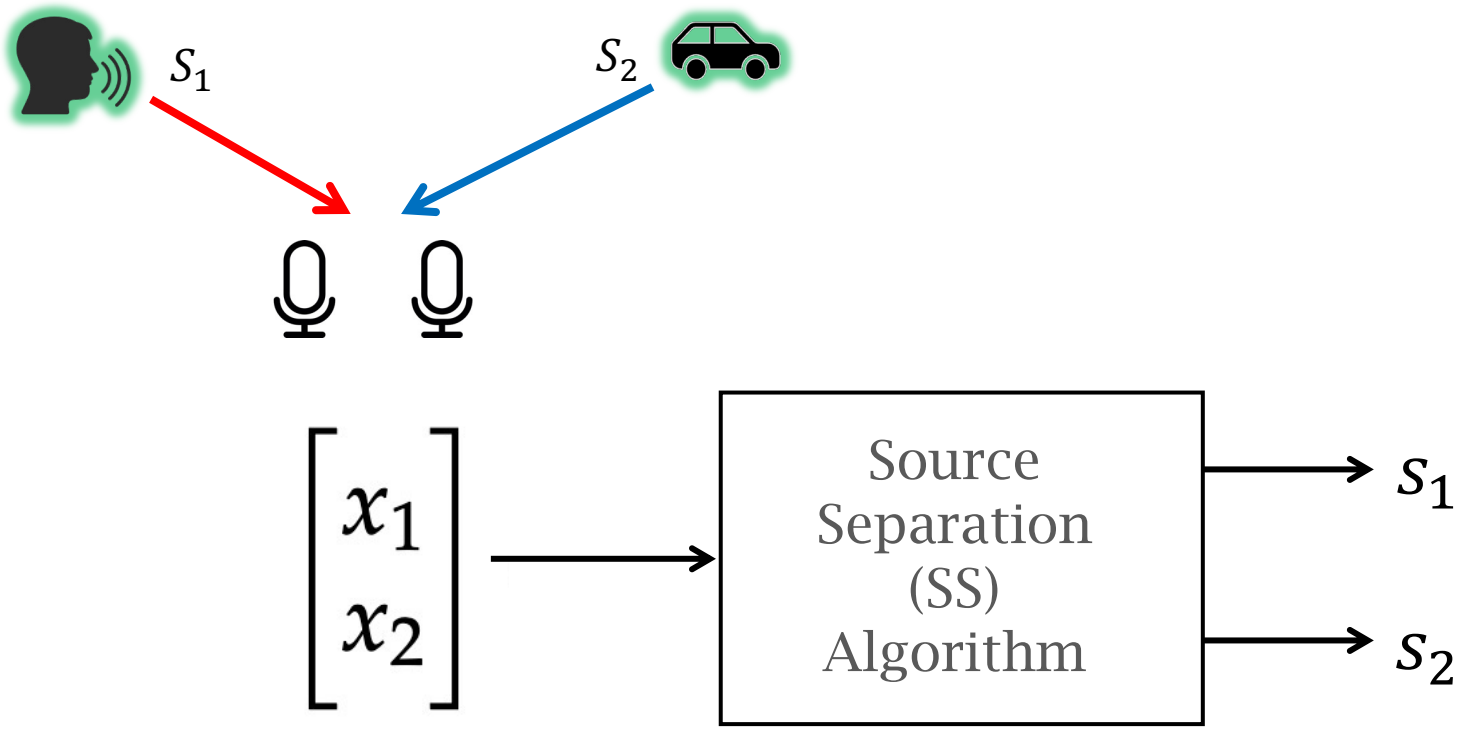


Source separation

Source separation preliminaries

Source separation: The general problem statement



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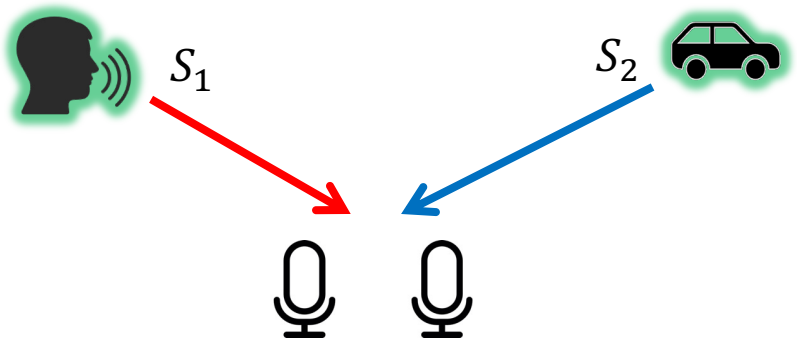

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \underbrace{\begin{bmatrix} a_1 & b_1 \\ a_2 & b_2 \end{bmatrix}}_{\text{Mixing matrix}} \begin{bmatrix} s_1 \\ s_2 \end{bmatrix}$$

Unknown mixing matrix, unknown source signals → heavily under-determined

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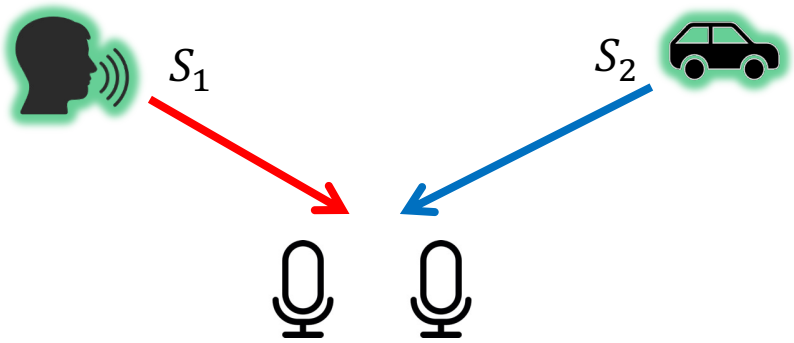

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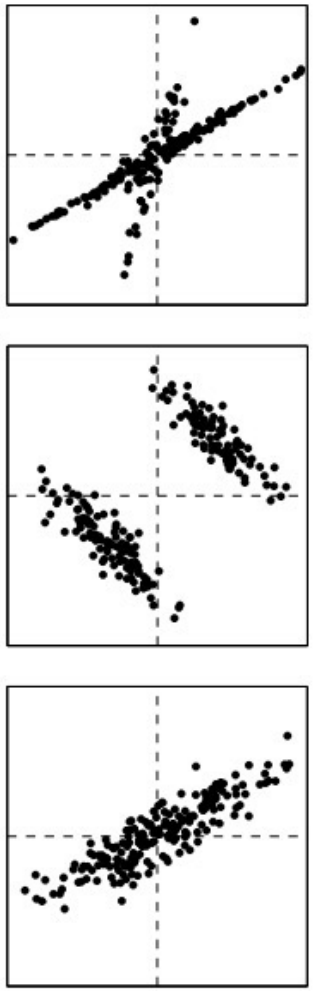

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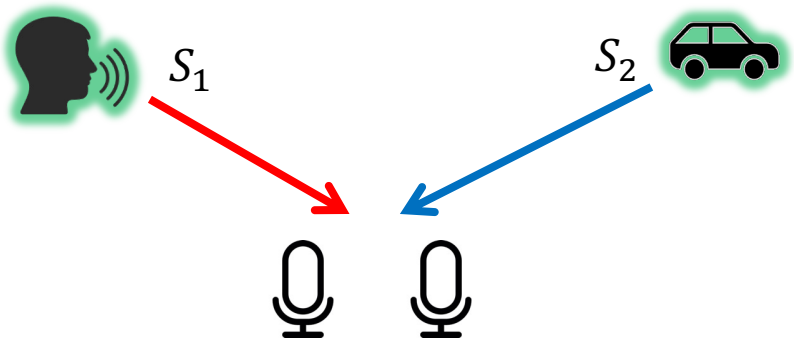

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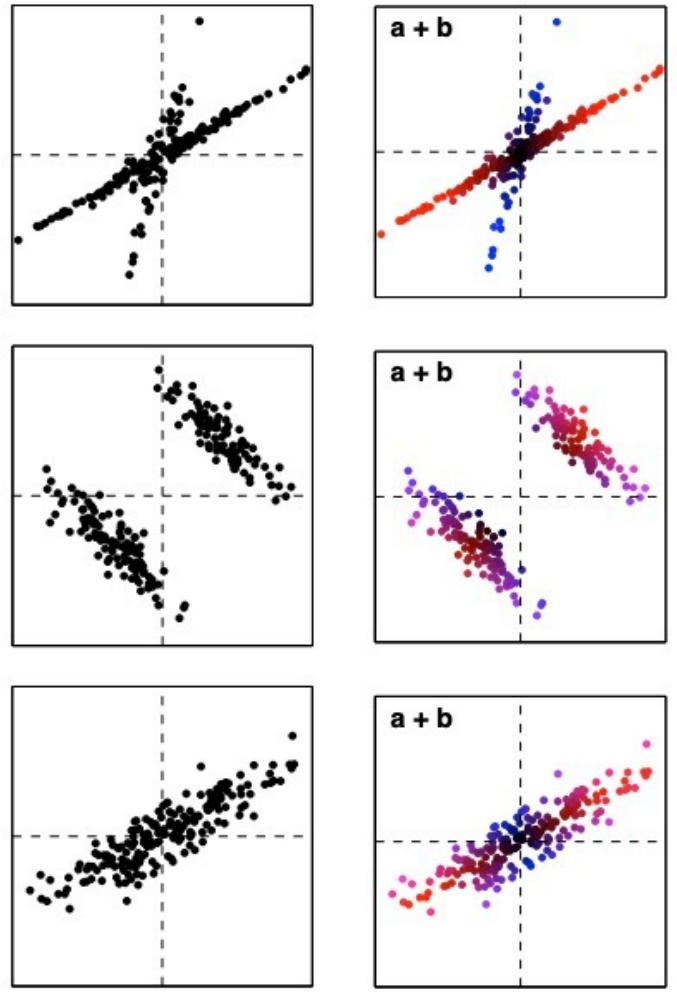
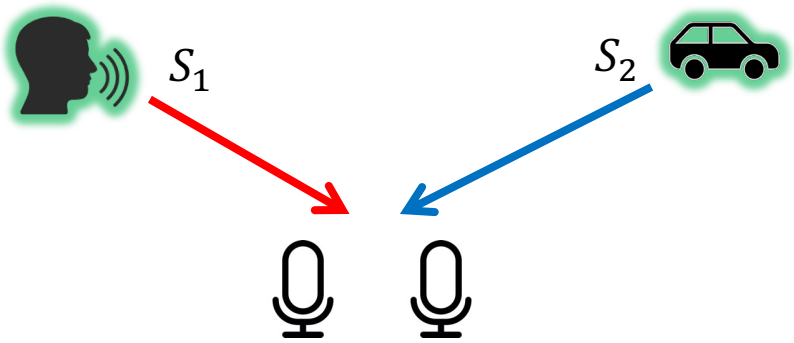


Hard to separate the sources even visually

When can we solve SS?

Let's make some simplifications: Mixing matrix is known based on **Angle of Arrival (AOA)**

- What is angle of arrival (AoA)? How do you quantify it?
- Relation between AoA and FFT
- How do you get AoA? From camera or from audio itself?
- How to solve X = A S + N even when A is known



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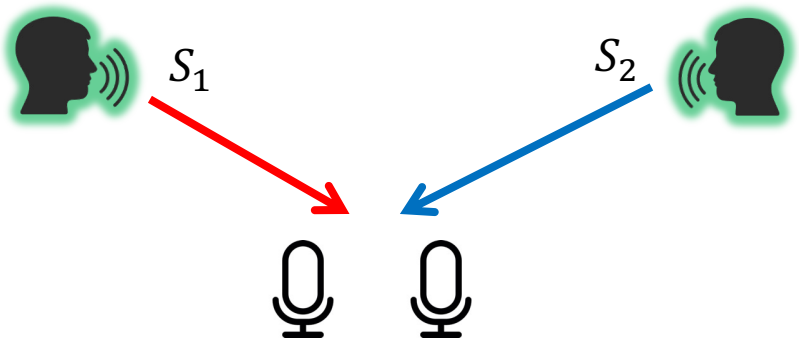
$$X = A.S + N$$

Source = Speech

But what if AoA unknown? **It's hard to solve for S … but what if S is speech signals?**



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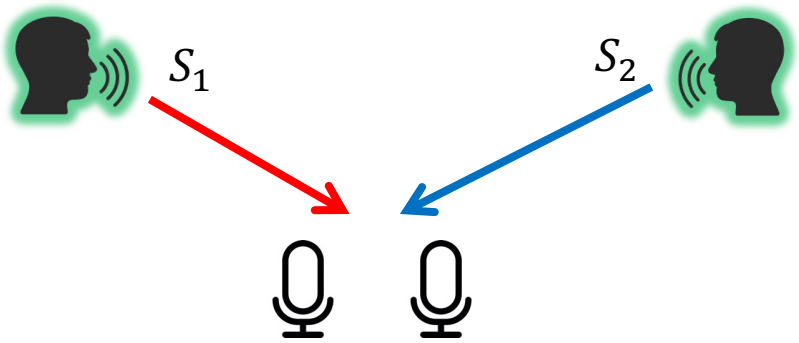
When the source signal is speech, exploit TF-disjointness



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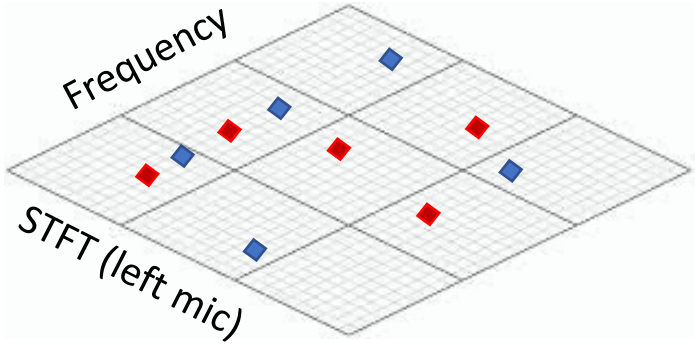

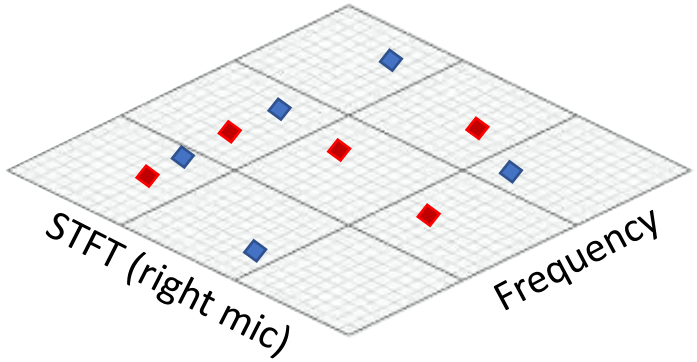

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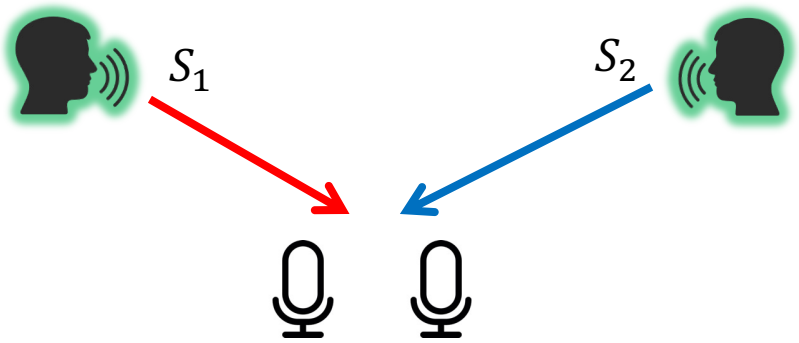

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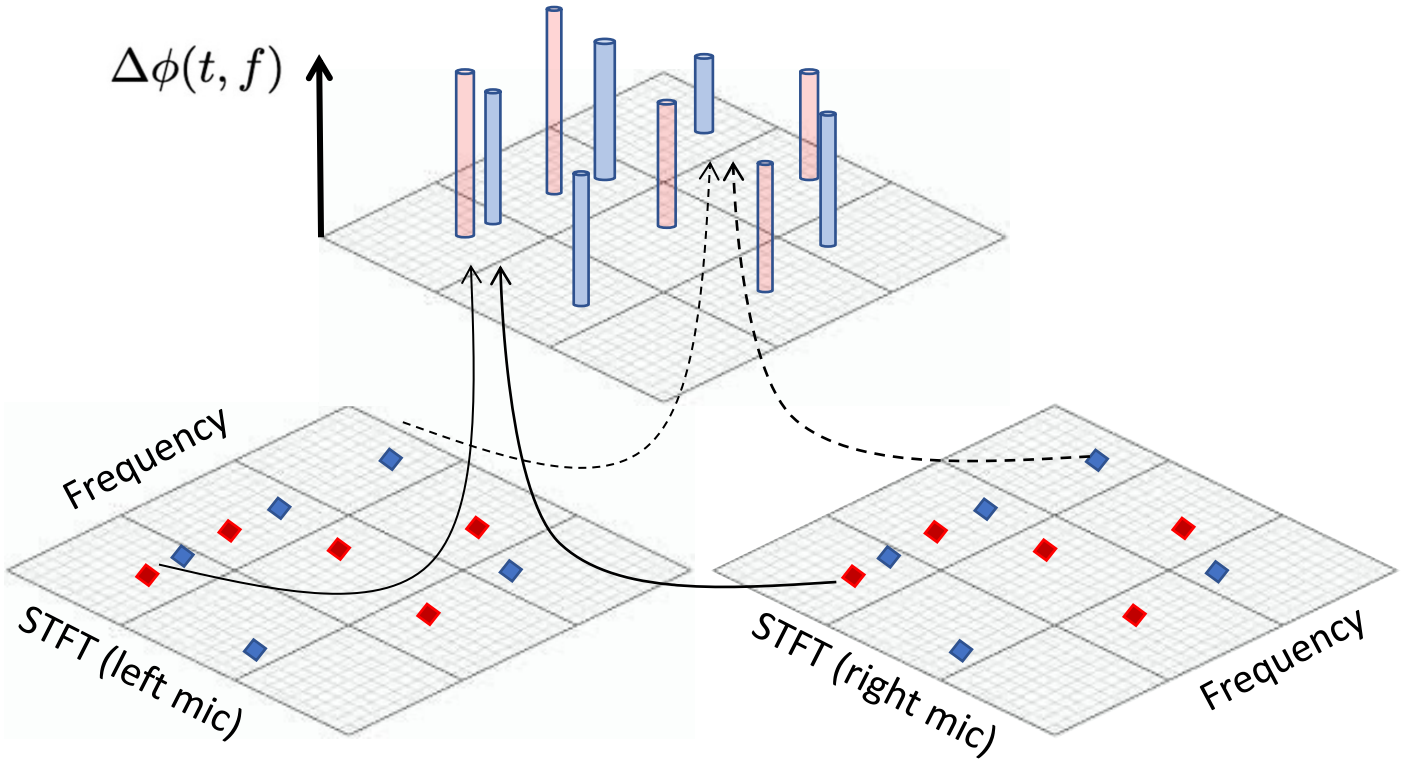

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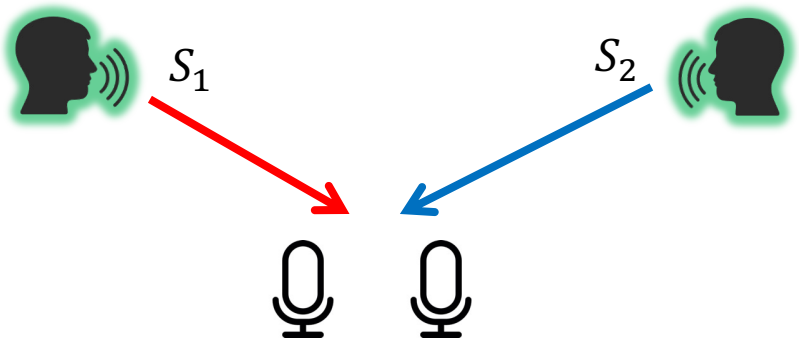

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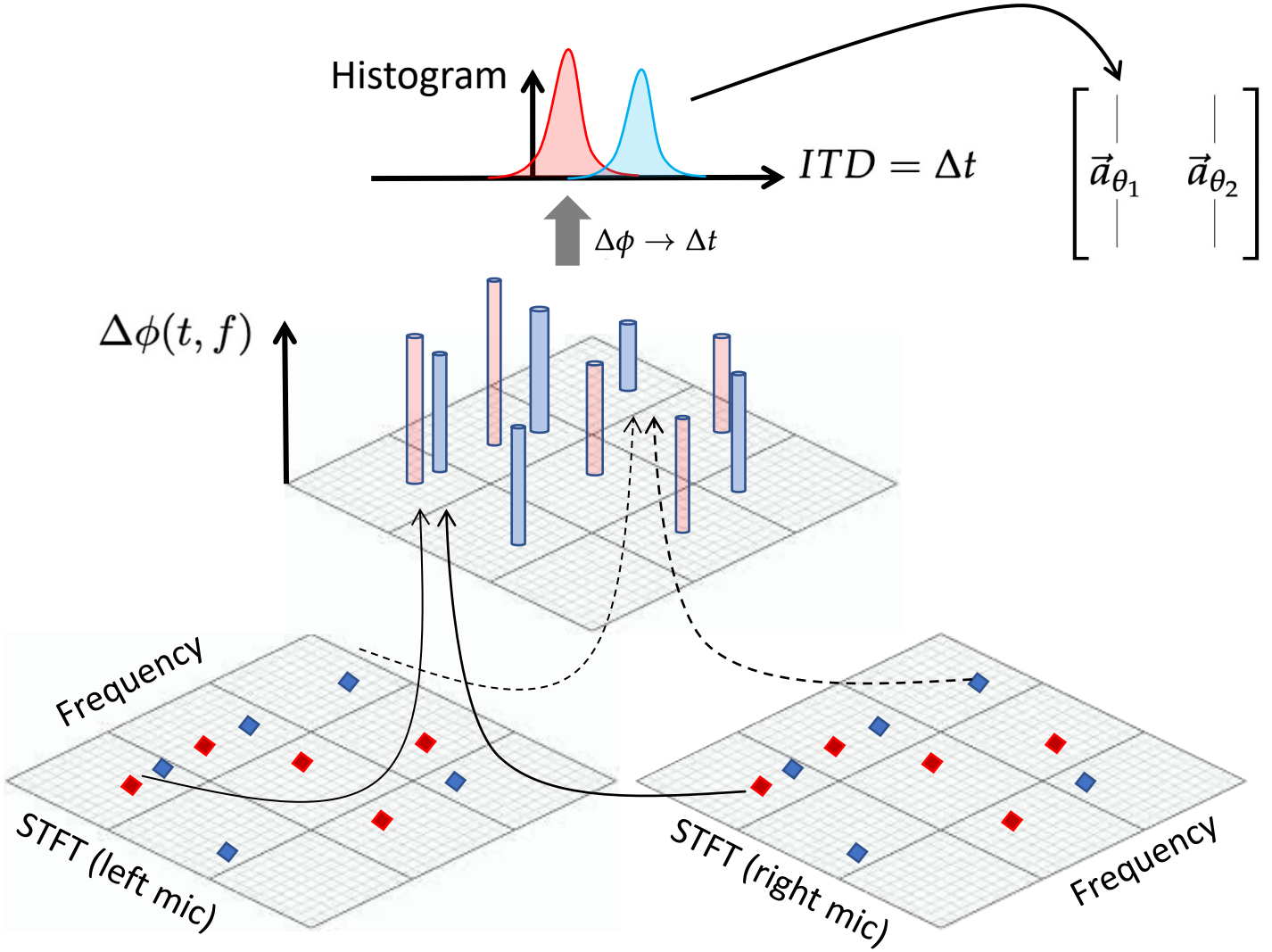

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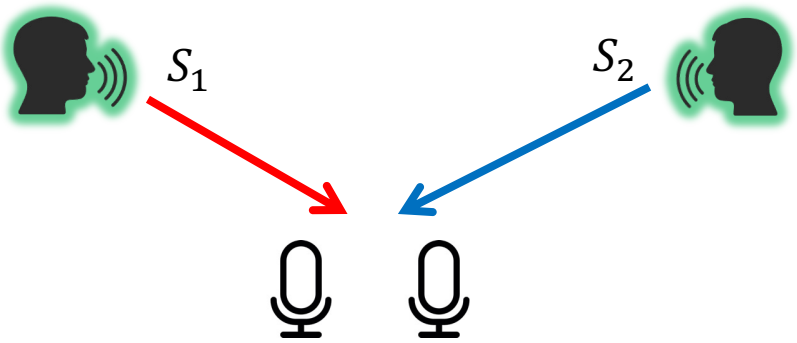

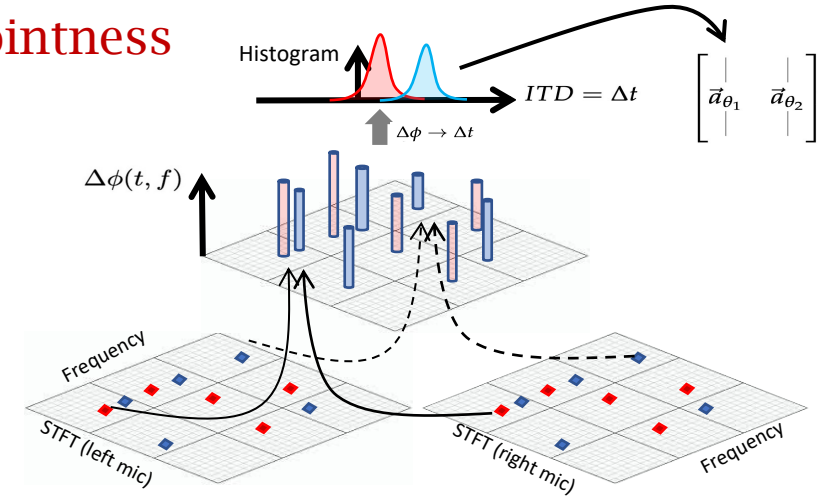

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DUET Algorithm Steps:

1.

2.

3.

4.

5.