Interactive Quality Enhancement in Acoustic Echo Cancellation

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intelligent signal processing and multimedia lab

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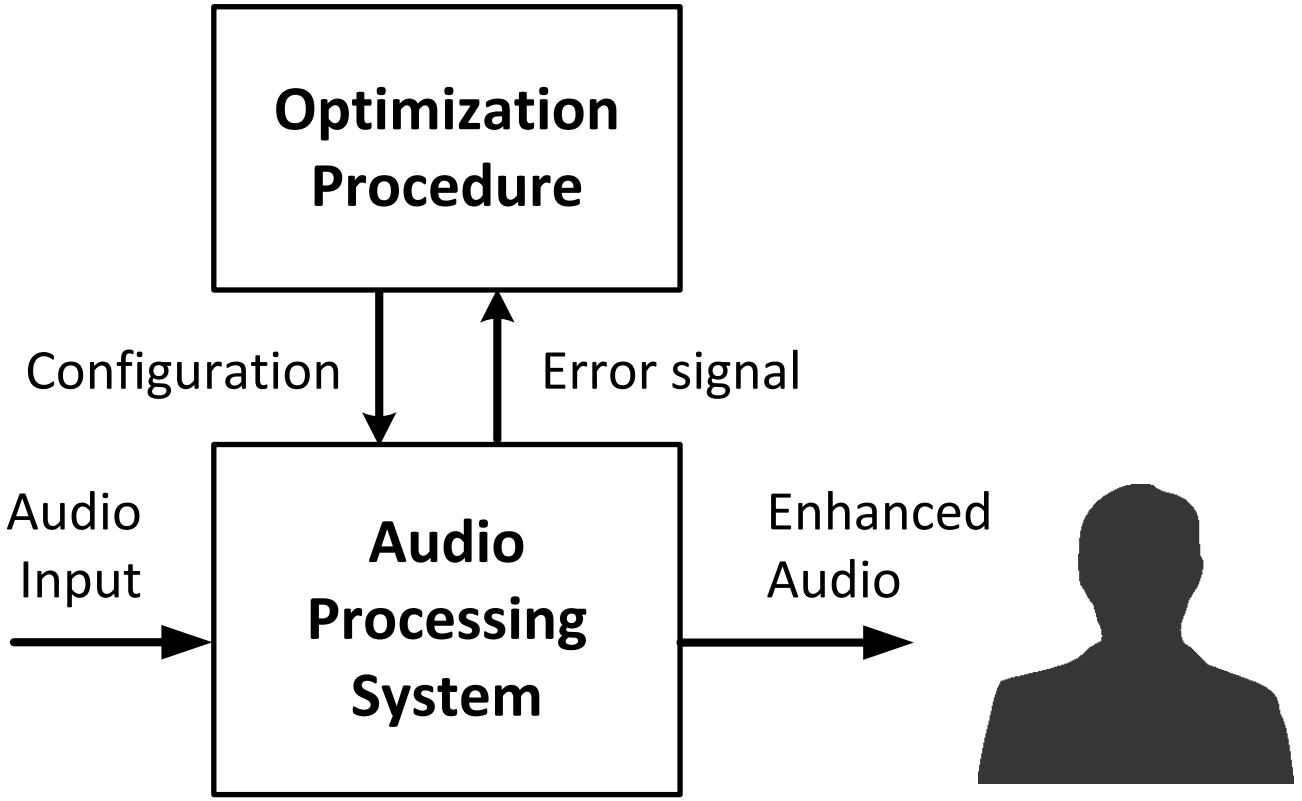
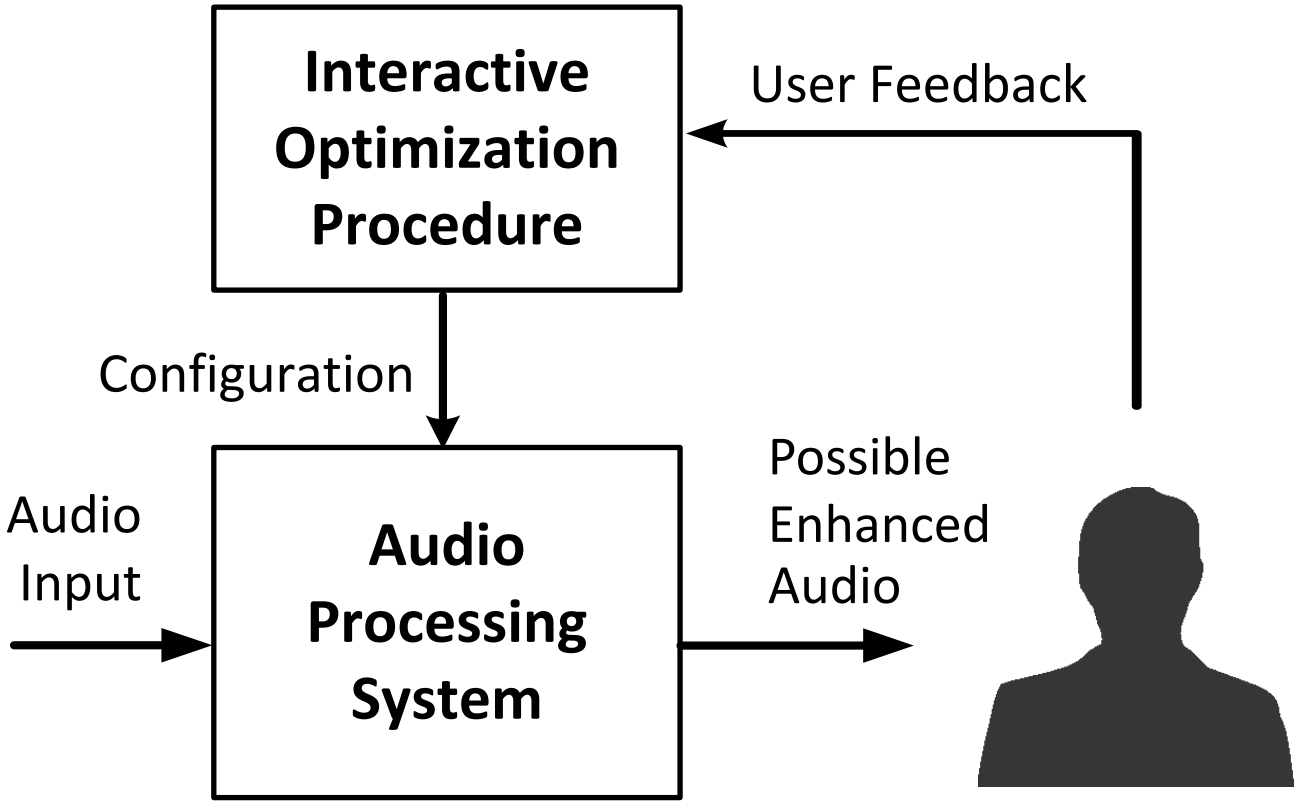
Contents

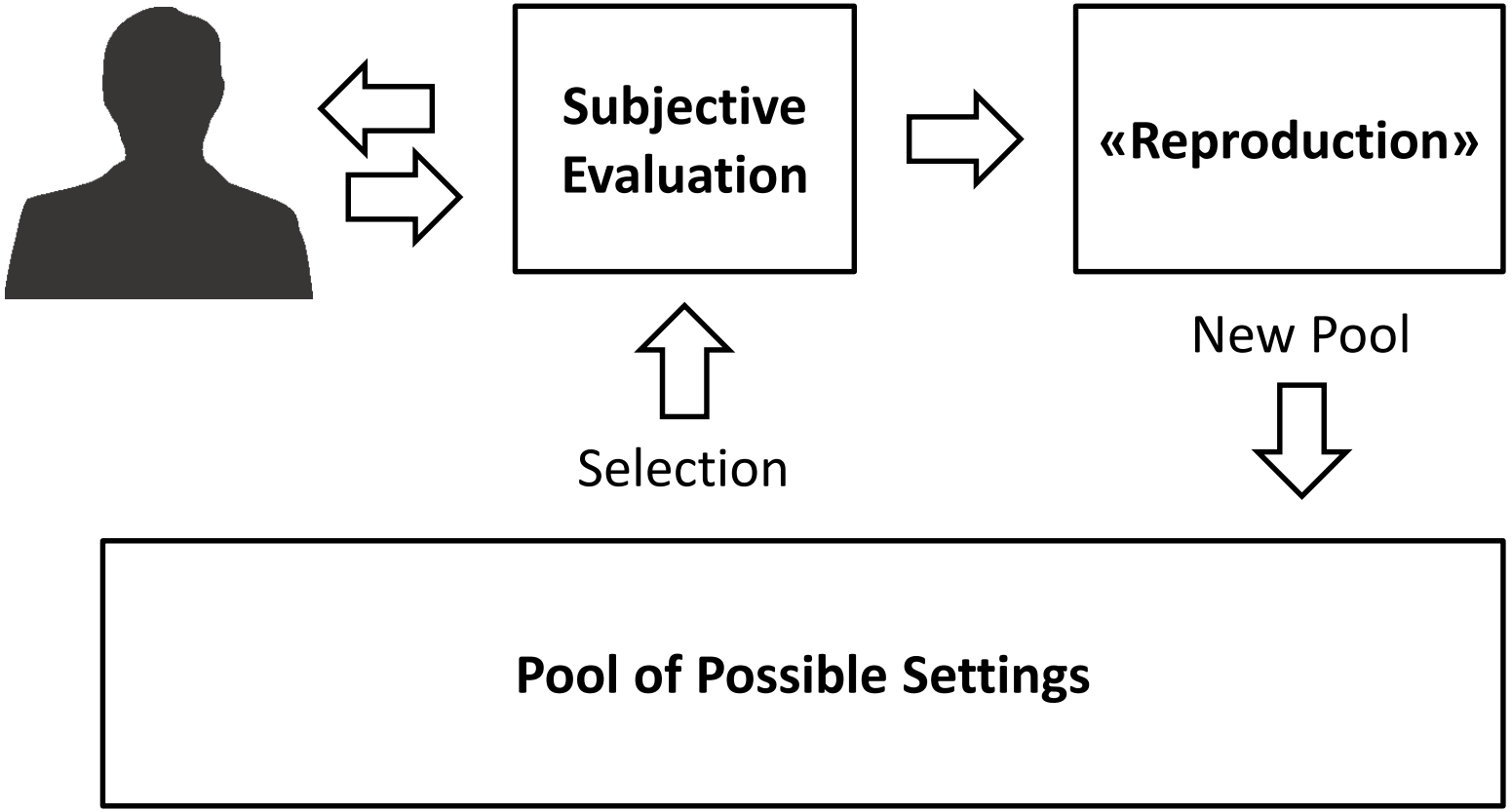
Standard Approach



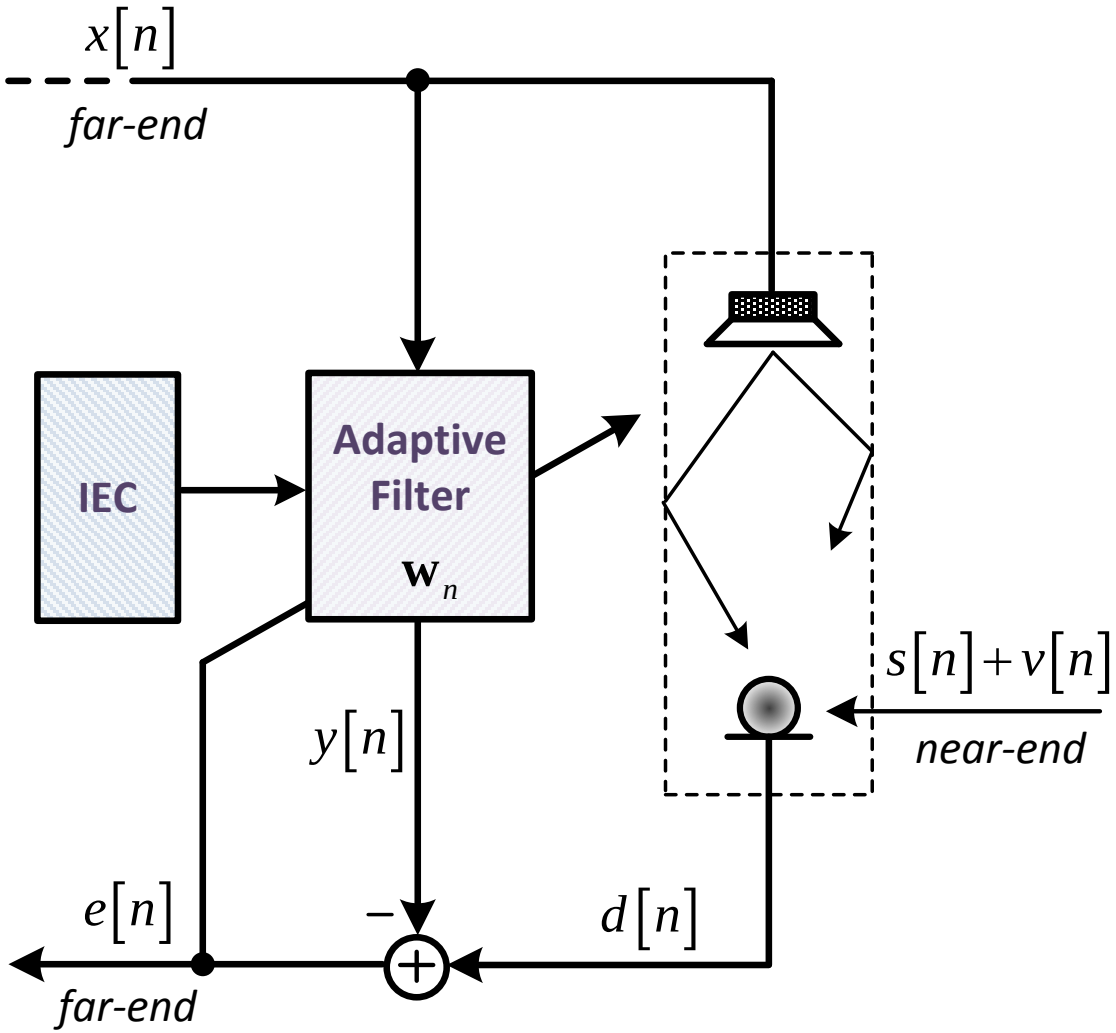
Our Approach



Interactive Evolutionary Computation



Interactive AEC



Review of APA

1. *Input matrix:*

$$\boldsymbol{X}_n = \begin{bmatrix} x[n] & \cdots & x[n-M+1] \\ \vdots & \ddots & \vdots \\ x[n-K-1] & \cdots & x[n-M-K-2] \end{bmatrix}$$

2. *Filtering stage:*

$$\boldsymbol{y}_n = \boldsymbol{w}_{n-1}\boldsymbol{x}_n$$

3. *Update stage:*

$$\boldsymbol{w}_n = \boldsymbol{w}_{n-1} + \mu \boldsymbol{X}_n^T (\delta \boldsymbol{I} + \boldsymbol{X}_n \boldsymbol{X}_n^T)^{-1} (\boldsymbol{d}_n - \boldsymbol{y}_n)$$

Setup

1. Five signals distorted by female voice.

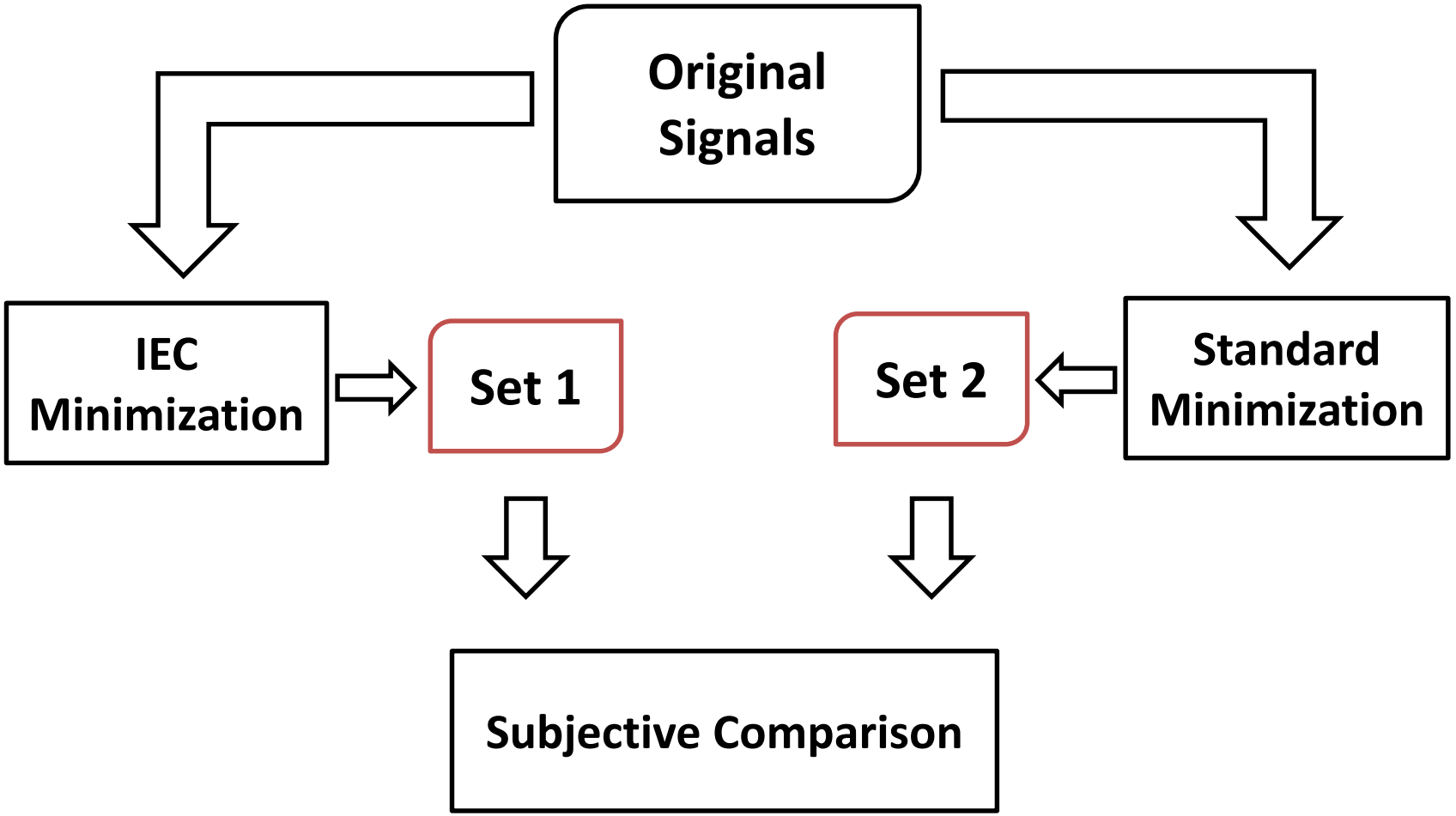
2. Echo cancellation through *affine projection algorithm* (APA).

3. A standard GA minimizes *normalized misalignment*:

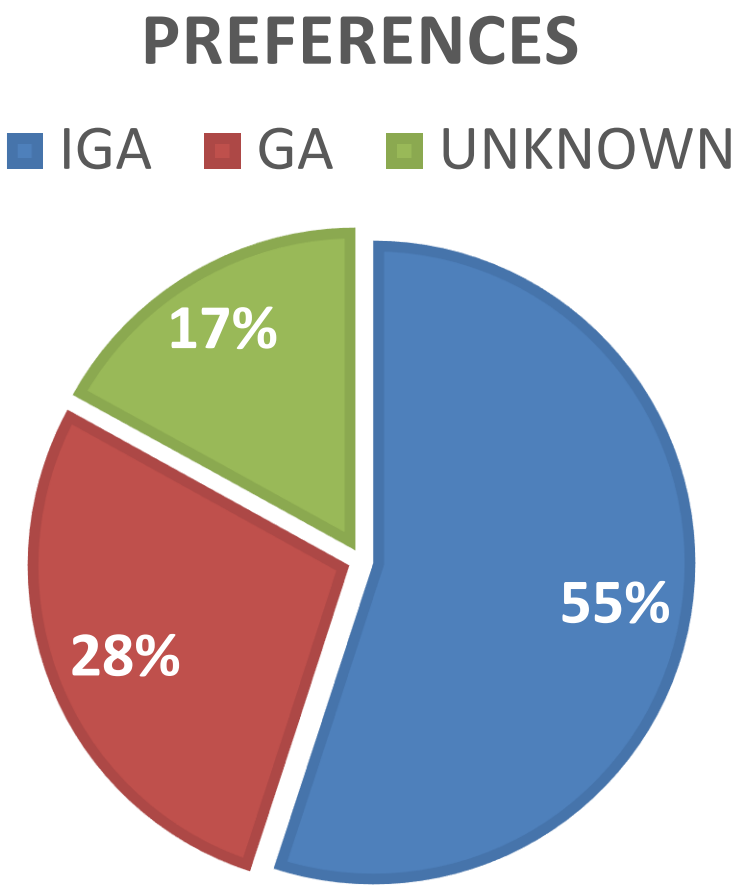
$$M = 20 \log \frac{\|\boldsymbol{w}_0 - \boldsymbol{w}_n\|}{\boldsymbol{w}_0}$$

4. An IGA should minimize user's preferences.

Workflow


Original Signals
IEC Minimization
Set 1
Set 2
Standard Minimization
Subjective Comparison

Results



Conclusions

1. Good results of interactive quality enhancement on AEC.

2. User fatigue is the main drawback to be confronted.

3. Possible combination of objective and subjective measurements.

Thanks for your attention!

Any Questions?