

# EE 513 HW5

Matt Ruffner

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## 1 Problem 5.1

In this homework, we investigate the effect of microphone array spacing on the SNR values of a Steered Response Power (SRP) based sound source location algorithm.

Two microphone arrays were setup on adjacent walls, the target was set to the center of the room for consistency throughout the variation of the microphone spacing. The peak Steered Coherent Response Power (SCRCP) at this target was calculated as the ratio of peak lobe power to sidelobe power, where the sidelobe's peak is atleast 12 points (0.75m) away from any higher point. The exponent parameter of the Phase Only Transform (PHAT) was also modified to be 0.75.

The resulting SNR values are plotted with error bars corresponding to the standard deviation and variance is shown in Fig. 3 . In Table 1, the resulting SNR values are shown for 5 iterations of the program.

As the microphones are placed closer together, both the standard deviation and variance decrease. The SNR is generally higher for the denser microphone placements, more than two standard deviations away from the average lowest spacing value.

As an example, the resulting SCRCP images for a .75 meter microphone spacing are shown in Figures 1 and 2.

Mic Spacing (m)	0.75	0.50	0.20
SNR Values (dB)	6.27	7.06	6.57
	7.19	7.55	7.00
	5.14	6.97	7.06
	6.80	6.83	7.25
	6.20	7.43	7.17
SNR Standard Deviation (dB)	0.77	0.31	0.26
SNR Variance	0.60	0.10	0.07
Average SNR	6.32	7.17	7.01

Table 1: SNR of mainlobe to sidelobe power in dB across multiple microphone spacing distances.

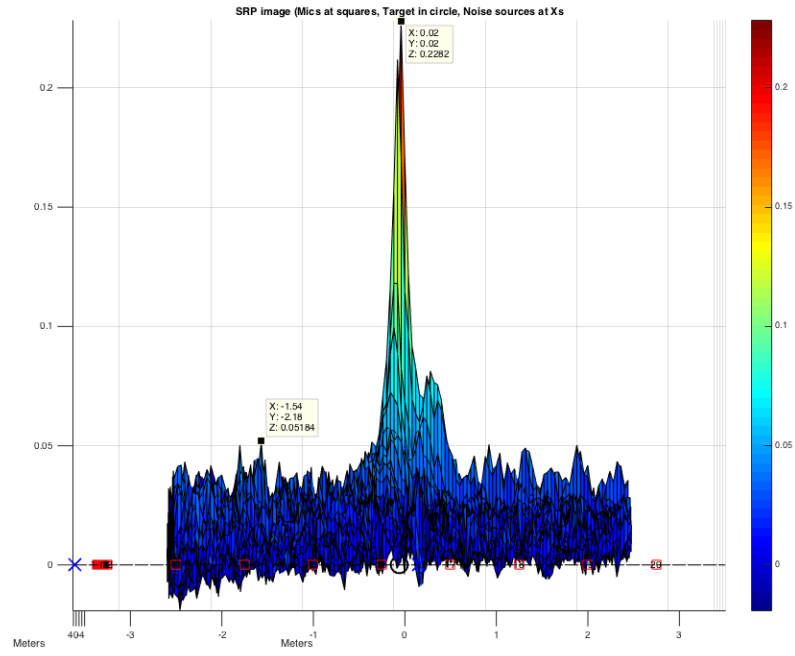


Figure 1: Orthogonal view of the plot, showing the highest relative maxima.

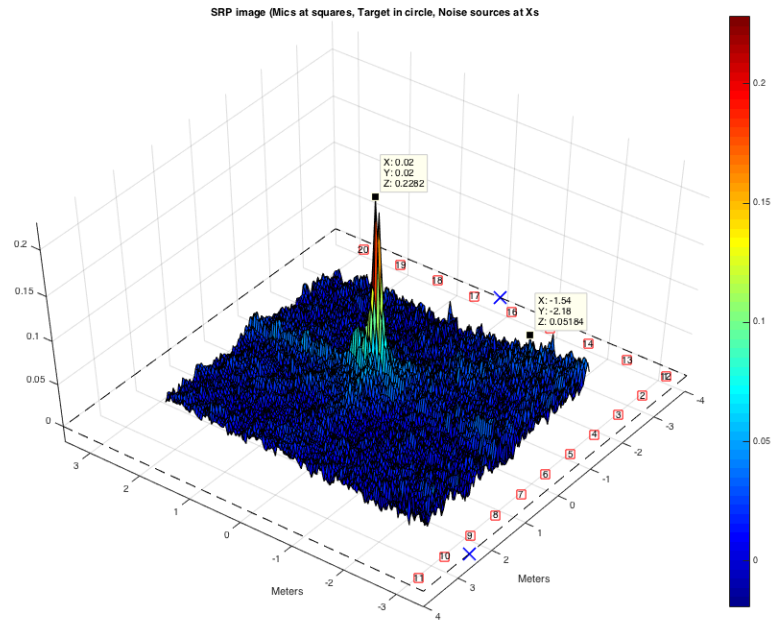


Figure 2: Showing the microphone placement on adjacent walls.

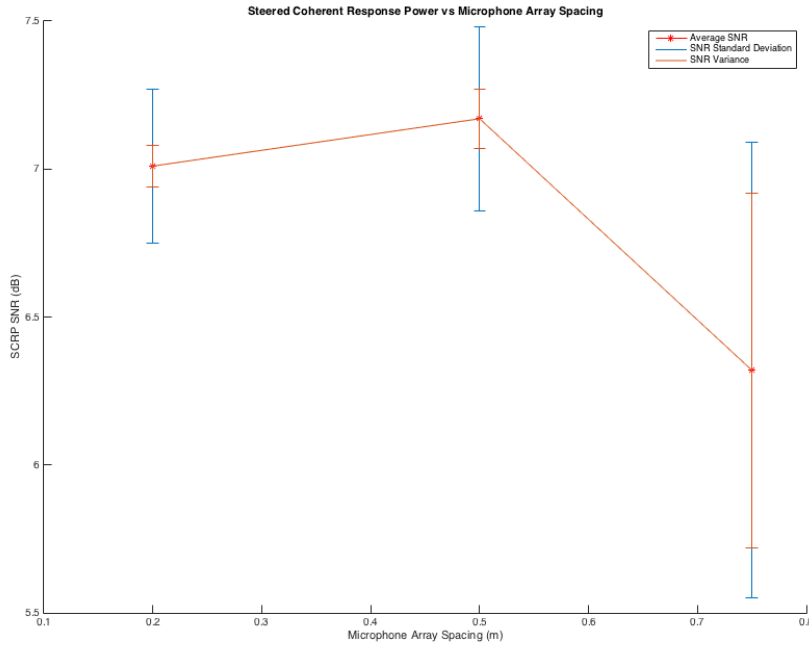


Figure 3: Average SCRCP SNR values with standard deviation and variance.

## 2 MATLAB Changes

The microphone placements were generated in the following way.

```
% matt ruffner 2/28/17
% added simple loop with pause to inspect plot
% moved the mic placement up here in the algorithm for accurate mic counts
mints=[0.75 0.5 0.2];
for mint=mints
    mposperim = [regmicsline([v(:,1) v(:,2)], mint) regmicsline([v(:,1) v(:,4)
    ], mint)];
    micnum = size(mposperim,2);%micnum = 8; % Number of mics in array to be
    tested
```

The signal source was modified to be in the center.

```
% matt ruffner 2/28/17 - place target in center to test mic spacing
% sigpos = ((fov(:,2)-fov(:,1))*ones(1,sigtot)).*rand(3,sigtot) + fov(:,1)*
    ones(1,sigtot);
sigpos = [0;0;v(3,1)];
```

The processing window was also changed to 60ms.

```
% Time window for frequency domain block processing
trez = 60e-3; % In seconds
```