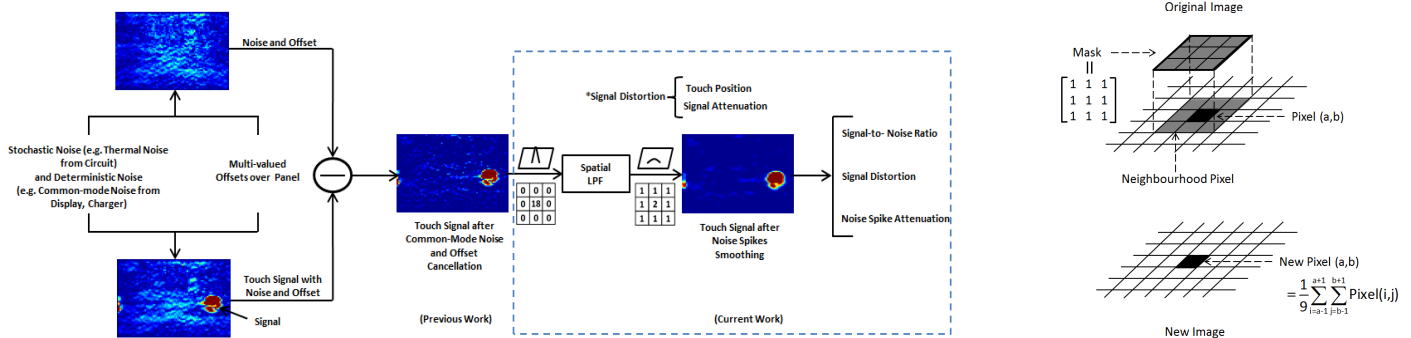


# Reduction of Noise Spikes in Touch Screen Systems by Low Pass Filtering

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## Introduction

- Noise spikes generated after correlated double sampling (CDS) lead to potential touch mis-registration.
- Spatial low pass filtering based technique is employed to smooth noise spikes.

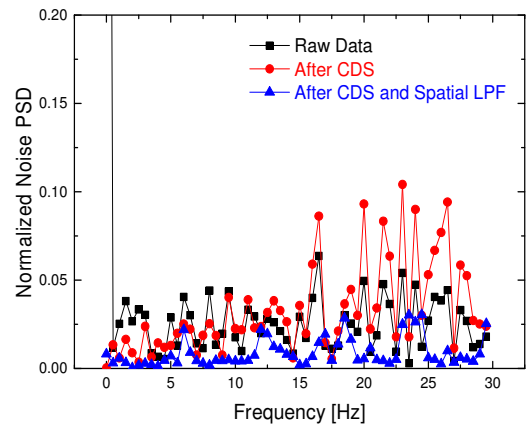
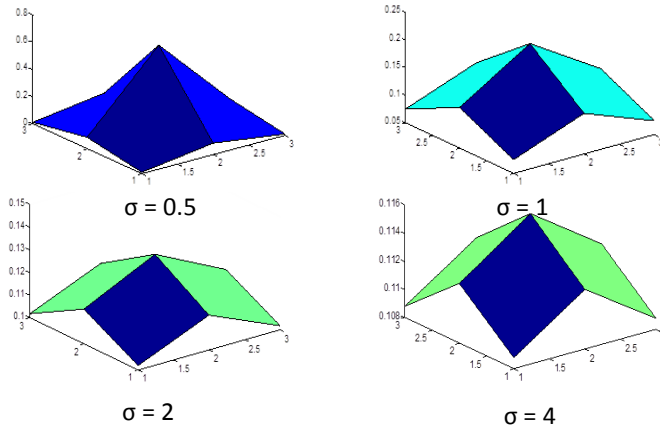


## Results and Discussions

$$F_{LPSF}(n, m, k) = \sum_{i=0}^{L-1} \sum_{j=0}^{W-1} C_{i,j} \times F_{CDS} \left( n + i - \frac{L-1}{2}, m + j - \frac{W-1}{2} \right)$$

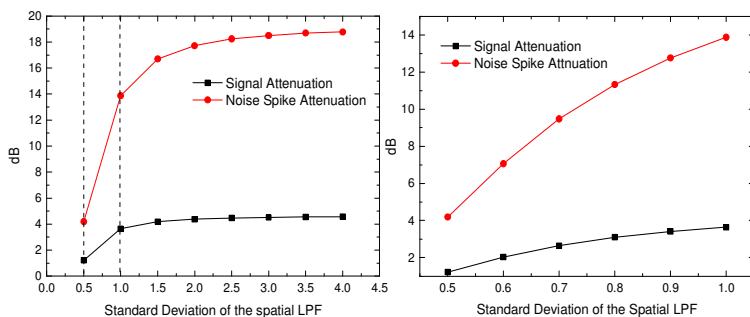
- Spatial Gaussian filters with various bandwidths:

- PSD of raw data, CDS and LPF processed data:



- Signal and noise spikes attenuation:

$$F_{LPSF}(n, m) = \sum_{i=0}^{L-1} \sum_{j=0}^{W-1} C_{i,j} \times F_{CDS} \left( n + i - \frac{L-1}{2}, m + j - \frac{W-1}{2} \right)$$



## Conclusion

- Noise spikes after CDS are smoothed. SNR is boosted by 15.6dB and noise spikes are attenuated by 19.25 dB.
- The spatial LPF based technique together with CDS based technique provide a fully packaged solution for noise reduction in touch screen panels.