

# EE367 Final Project: BM3D Implementation for video denoising

Caelia Thomas

Department of Electrical Engineering, Stanford University

## Motivation

- Denoising is not only important for image processing, but for video processing as well
- Each denoising technique and algorithm has tradeoffs that must be evaluated based on context
- This project seeks to compare a popular method, BM3D, to others discussed throughout the course

## Background & Related Work

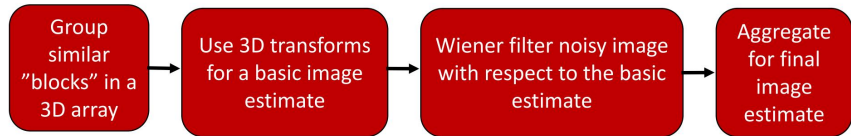
- Classical techniques involve spatial filtering
- Non-local means methods are more precise, and are a transform-based technique
- BM3D, specifically, involves collaborative filtering and block matching of 3D image arrays

## References



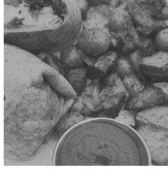


- [1] Fan, L., Zhang, F., Fan, H. *et al.* Brief review of image denoising techniques. *Vis. Comput. Ind. Biomed. Art* 2, 7 (2019).
- [2] K. Dabov, A. Foi, V. Katkovnik and K. Egiazarian, "Image Denoising by Sparse 3-D Transform-Domain Collaborative Filtering," in *IEEE Transactions on Image Processing*, vol. 16, no. 8, pp. 2080-2095, Aug. 2007.
- [3] Dabov, Kostadin, et al. "BM3D image denoising with shape-adaptive principal component analysis." *SPARS'09-Signal Processing with Adaptive Sparse Structured Representations*. 2009.

## BM3D Method

- Distinguishing characteristic is stacking similar "blocks" of noisy pixels into a 3D stack (array)



## Experimental Results

<i>Clean</i>	<i>Noisy</i>	<i>Gaussian.</i>	<i>Bilateral</i>	<i>BM3D</i>
				
	PSNR:	9.09	13.73	13.47
	Avg 15 frames:	6.41	8.94	8.81
				<u>9.09</u>
				<u>6.41</u>