

Denoising of Fluorescence Microscopy Images using ML Methods

Refresher:

- Image segmentation using clustering algorithms
- Regional denoising using learning methods

Dataset: [A Poisson-Gaussian Denoising Dataset with Real Fluorescence Microscopy Images](#)

Baseline Algorithms Implemented:

- K -Means
- DBSCAN
- HDBSCAN
- CNNs

Traditional Denoising



Figure 1: NLM Denoised, PSNR score = 5.693

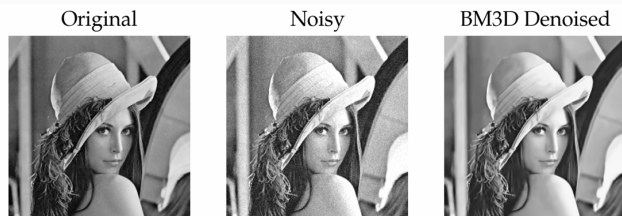


Figure 2: BM3D Denoised, PSNR score = 13.838

Clustering

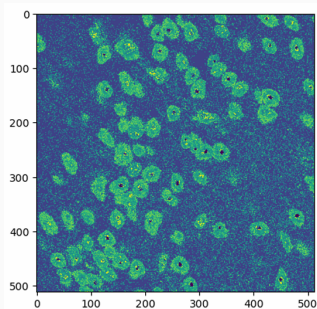


Figure 3: KMeans

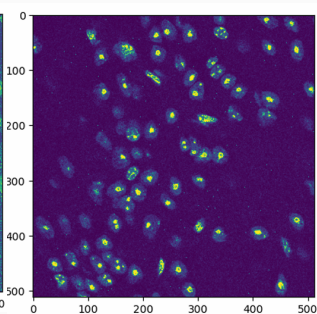


Figure 4: DBSCAN

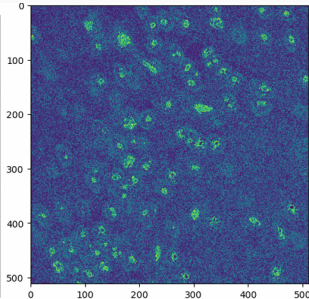


Figure 5: HDBSCAN

Metric	K-means	DBSCAN	HDBSCAN
Silhouette Score	0.590	0.972	0.975
Davies-Bouldin Index	0.540	0.381	0.408
Calinski-Harabasz Index	18391.967	910.775	1159.744
WSS Score	3.747	0.771	0.962

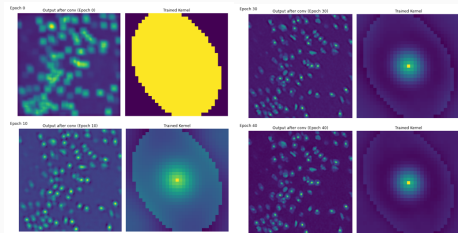


Figure 6: At different Epochs

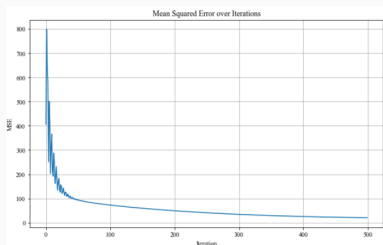


Figure 8: Training Loss vs Iterations

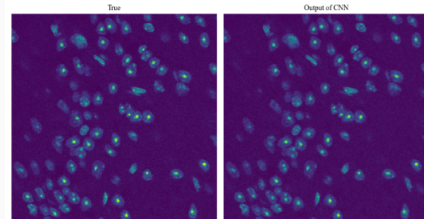


Figure 7: True and Output

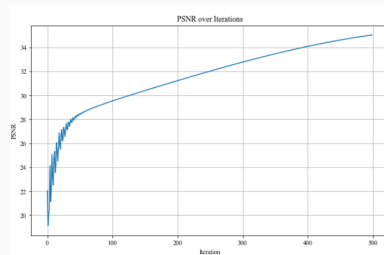


Figure 9: PSNR vs Iterations

CNN Results

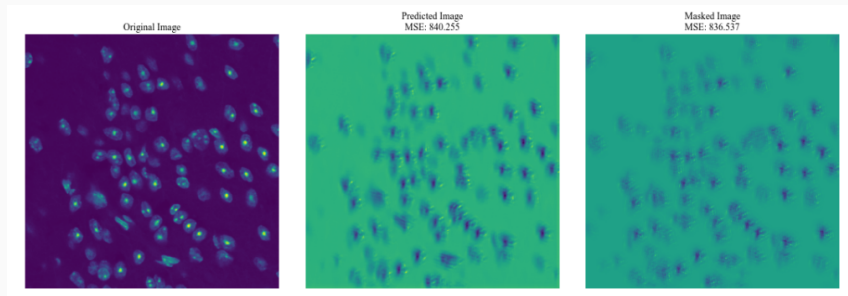


Figure 10: CNN over unmasked and masked image

Relevant Papers

- C. Yang, L. Liang, Z. Su. (2023). Real-World Denoising via Diffusion Model. <https://arxiv.org/abs/2305.04457>
- K. Zhang, W. Zuo, and L. Zhang. (2018). FFDNet: Toward a fast and flexible solution for CNN based image denoising. *IEEE Transactions on Image Processing*