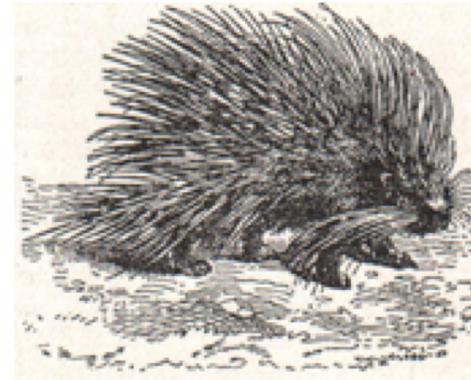


Comparison of Dimensionality Reduction Methods for Hyperspectral imagery

*Hudanyun Sheng
Dylan Stewart*

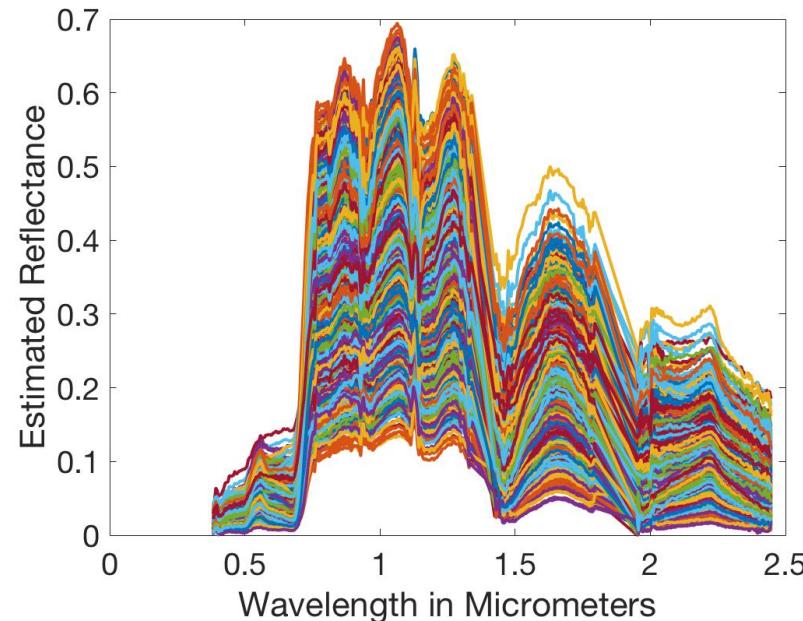
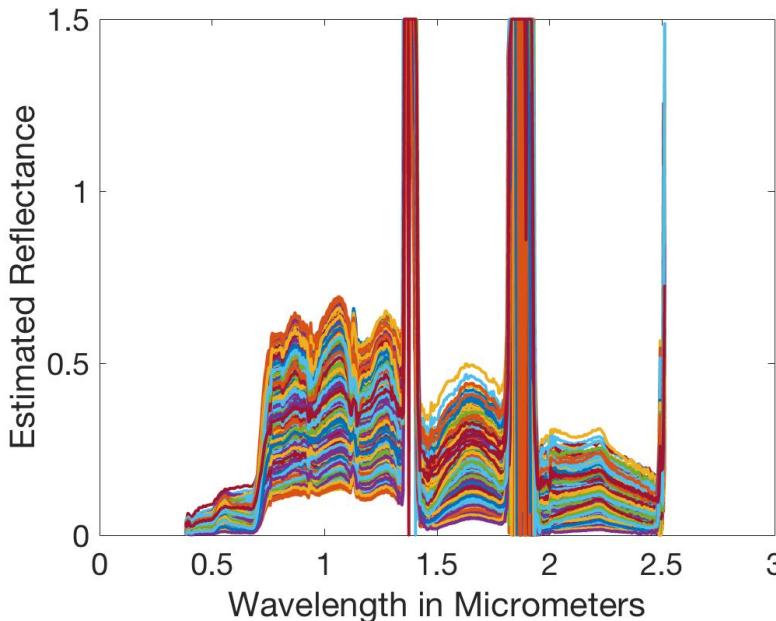


Motivation





Data contains unneeded bands



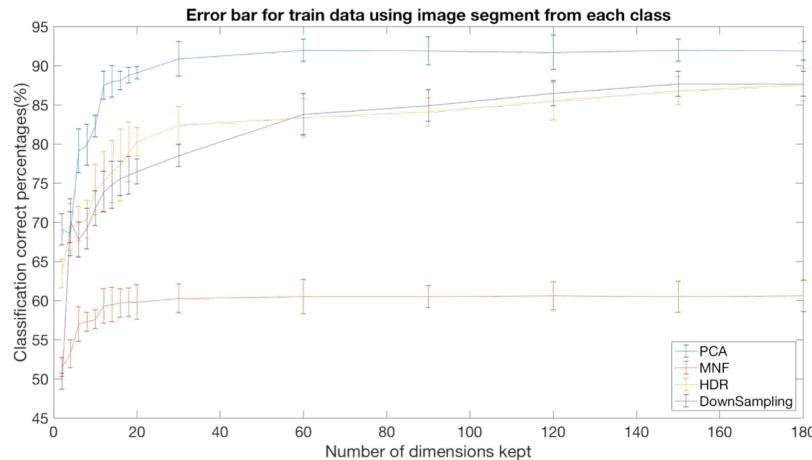
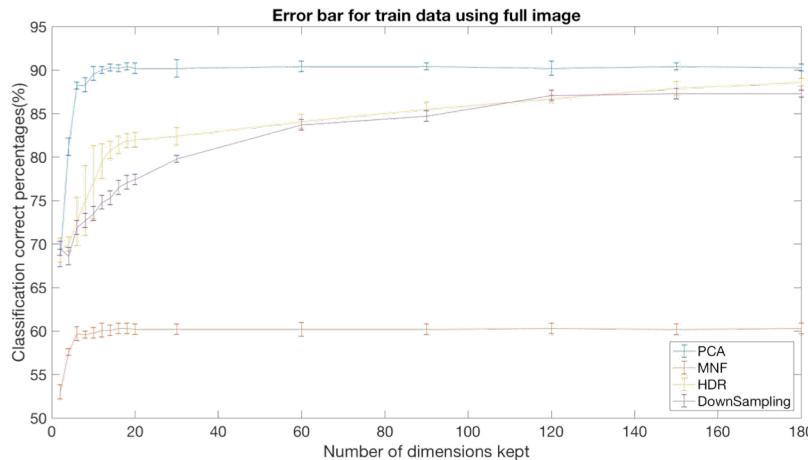


Methods to Compare

- Principal Component Analysis
- Maximum Noise Fraction
- Hierarchical Clustering
- Spectral Down Sampling



Overall baseline results





Comparison of performances

No. experiment	PCA	MNF	HDR	Down sampling
1	90	60	81	78
2	90	60	83	77
3	90	60	82	77
4	90	60	82	77
5	90	60	82	78
6	90	60	82	77
7	90	60	81	77
8	90	60	82	78
9	90	60	82	78
10	90	93	86	87
mean	90.2	60.2	82.0	77.4
std.dev	0.3	0.3	0.4	0.3

TABLE I: Table of training correct percentages when using whole data set to reduce dimensionality

No. experiment	PCA	MNF	HDR	Down sampling
1	89	59	80	77
2	89	60	81	76
3	89	60	81	76
4	89	60	81	77
5	89	60	80	77
6	90	60	81	76
7	89	60	78	76
8	89	60	79	77
9	89	60	80	77
10	89	59	81	77
mean	89.1	59.8	80.3	76.5
std.dev	0.3	0.3	1.2	0.4

TABLE III: Table of training correct percentages when reduce dimensionality for each class

No. experiment	PCA	MNF	HDR	Down sampling
1	91	61	82	76
2	90	60	82	77
3	90	60	81	77
4	90	59	82	77
5	90	61	81	77
6	89	60	81	77
7	91	59	83	78
8	90	61	83	76
9	90	58	81	77
10	90	61	82	77
mean	90.1	60.1	81.7	77.0
std.dev	0.1	1.1	0.6	0.7

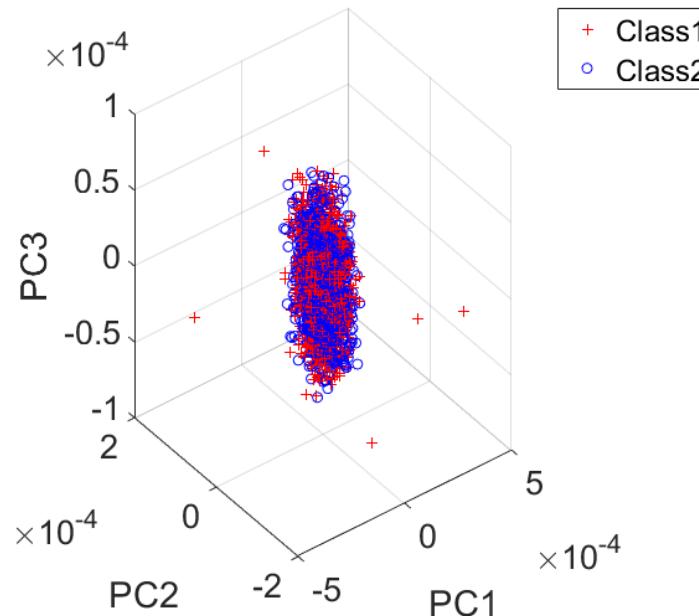
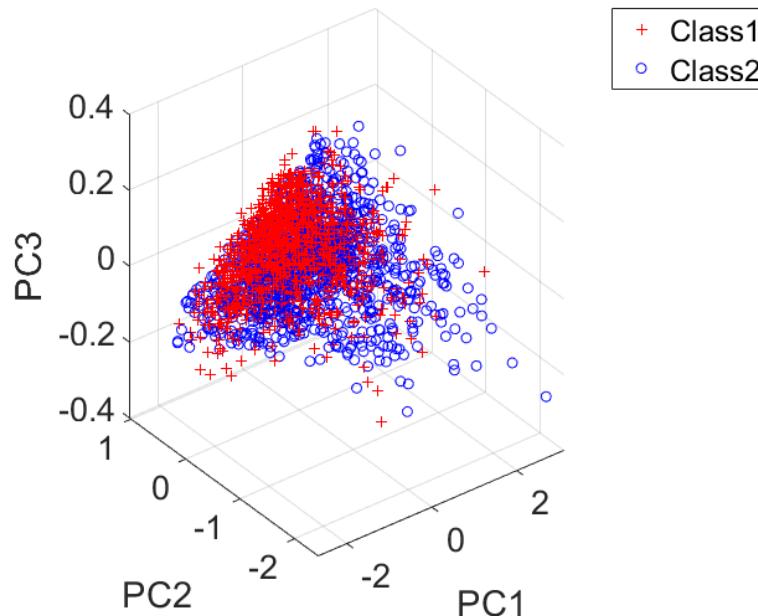
TABLE II: Table of test correct percentages when using whole data set to reduce dimensionality

No. experiment	PCA	MNF	HDR	Down sampling
1	89	61	79	76
2	89	60	82	76
3	89	60	80	77
4	89	59	81	76
5	89	60	79	76
6	89	60	81	76
7	89	59	79	78
8	90	60	79	75
9	89	57	79	76
10	88	61	81	76
mean	89.0	59.6	80.0	76.3
std.dev	0.4	1.1	0.9	0.8

TABLE IV: Table of test correct percentages when reduce dimensionality for each class

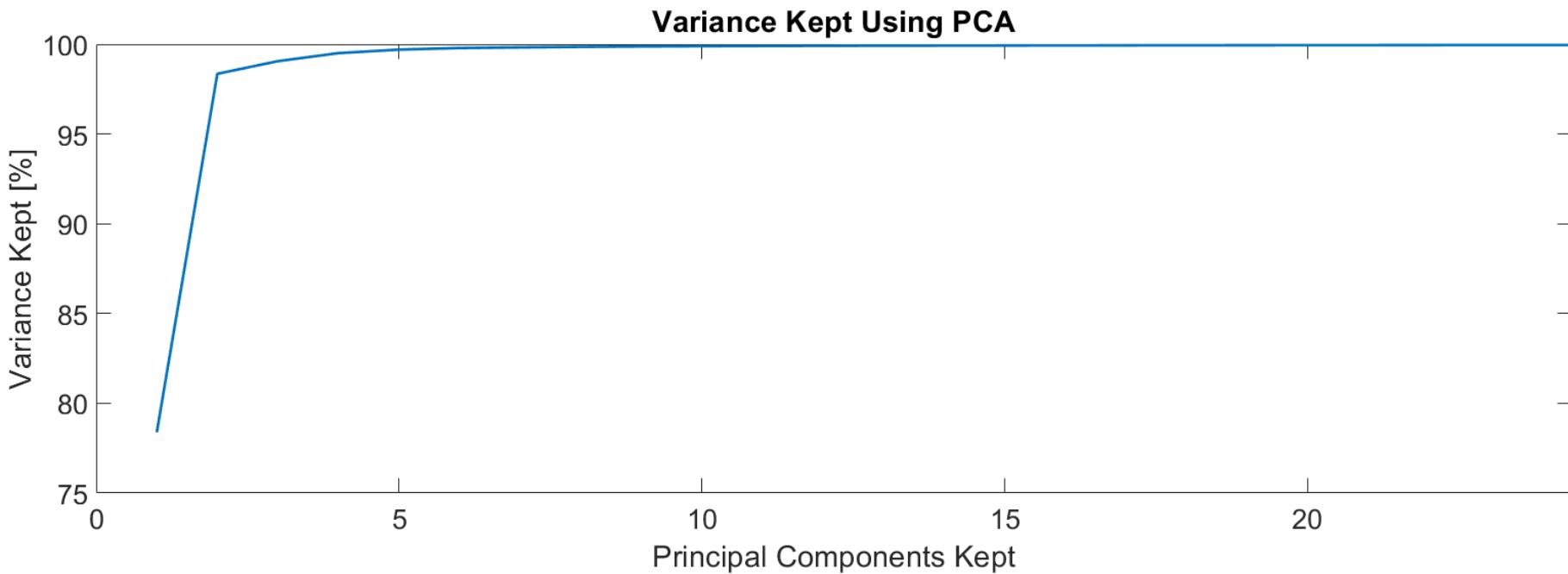


PCA 3D Visualization



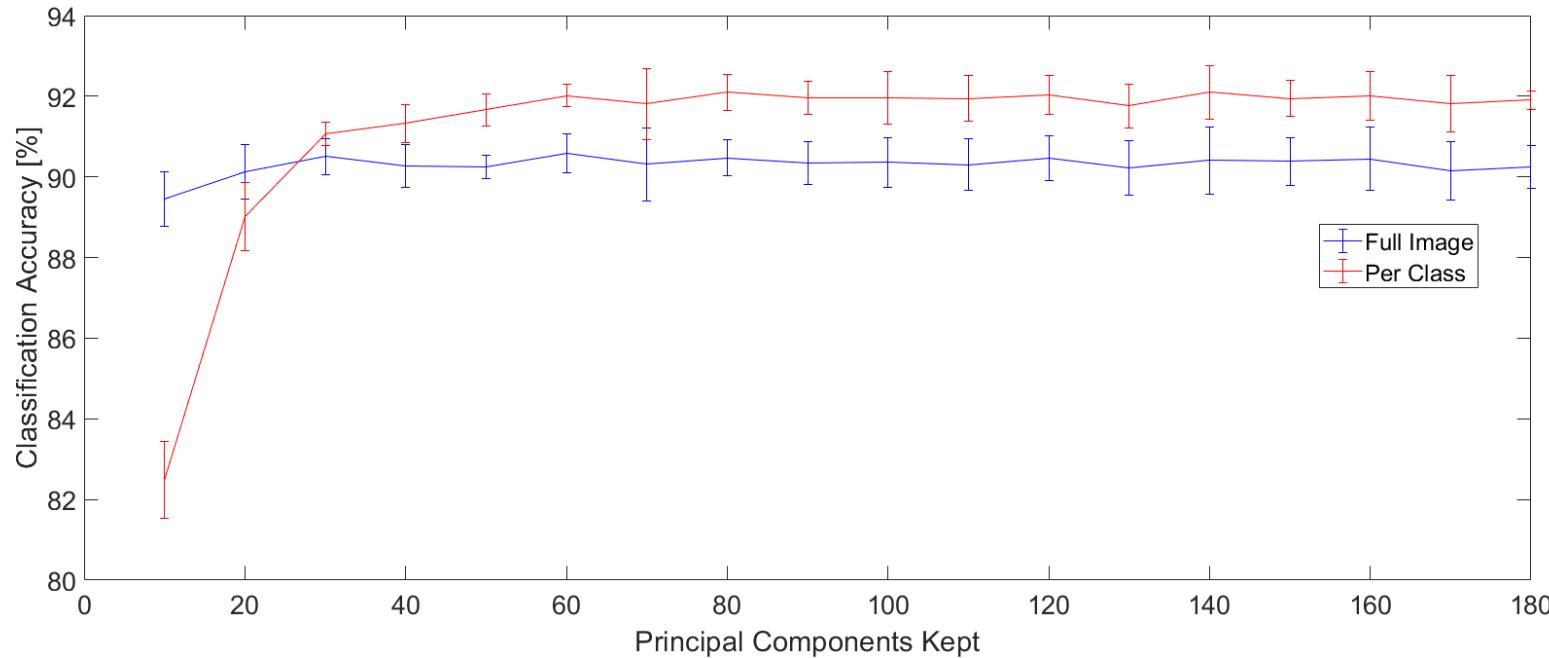


PCA Variance vs Components Kept





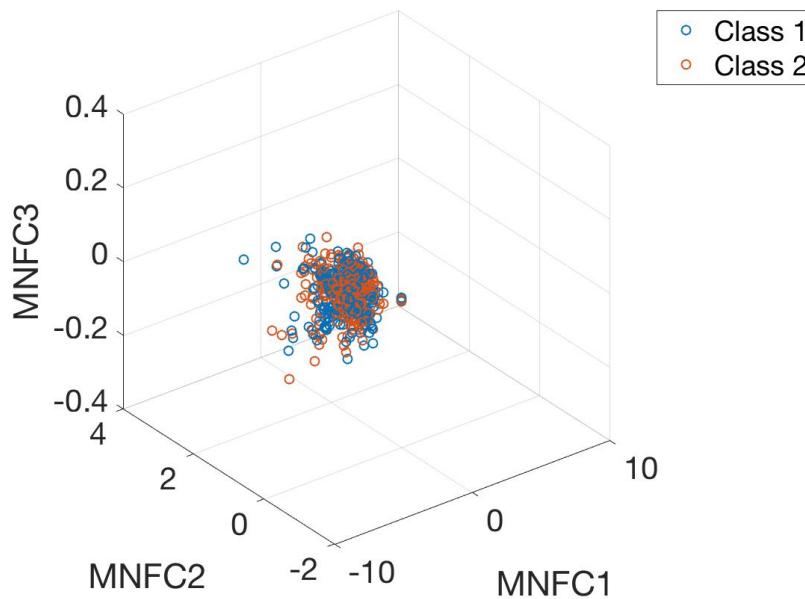
PCA Classification vs Principal Components



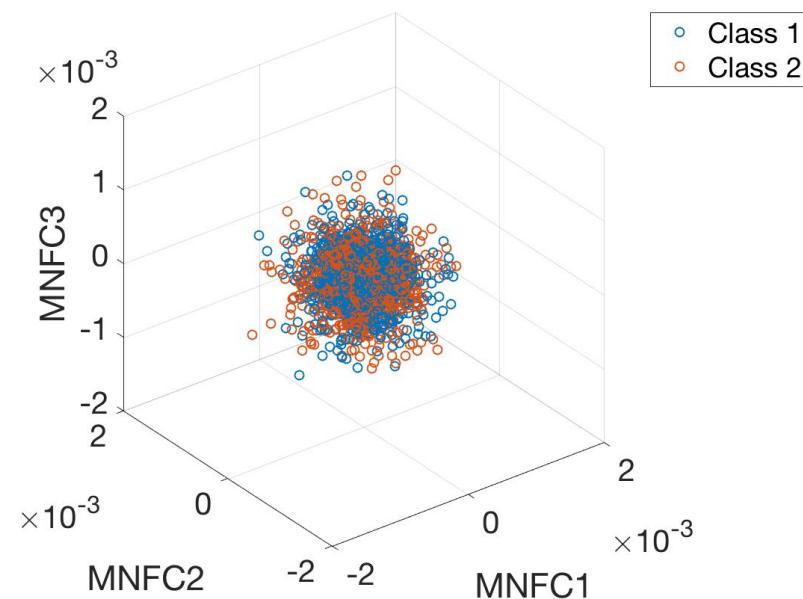


MNF 3D Visualization

Top 3

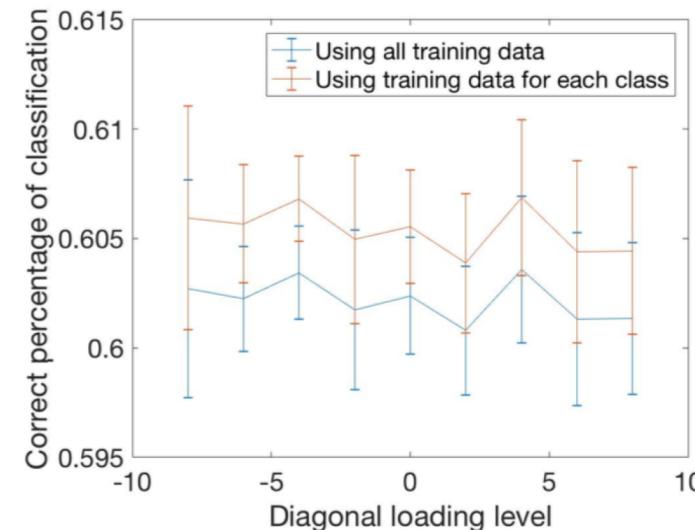
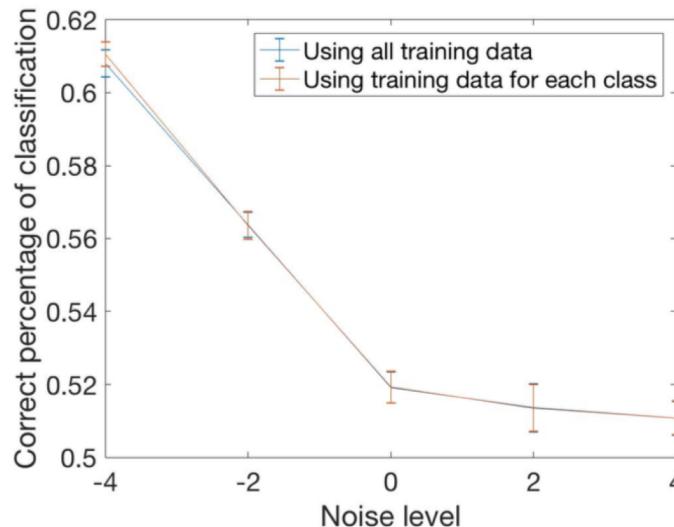


Bottom 3





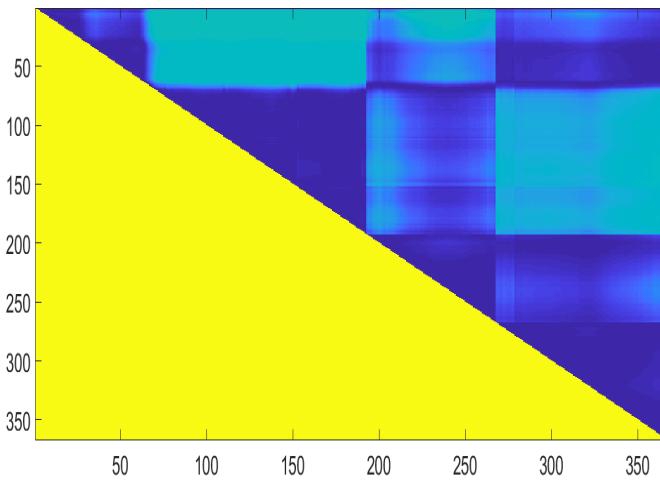
MNF noise level & diagonal loading factor



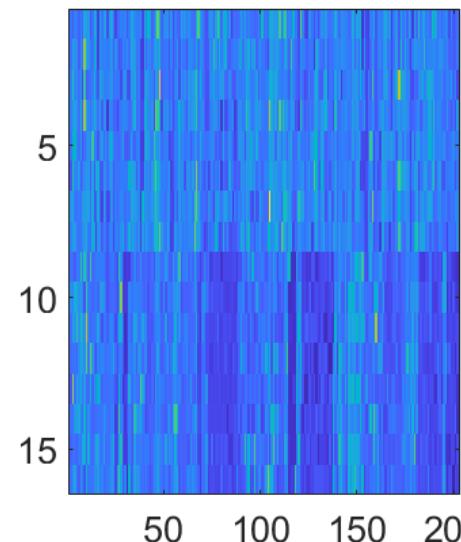


HDR Verification

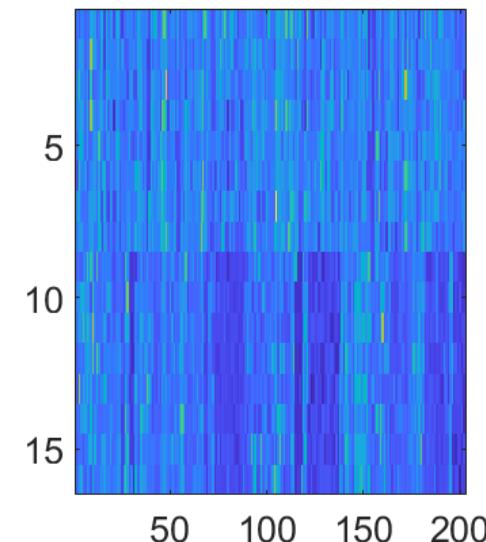
KL-Divergence Similarity Matrix



483nm

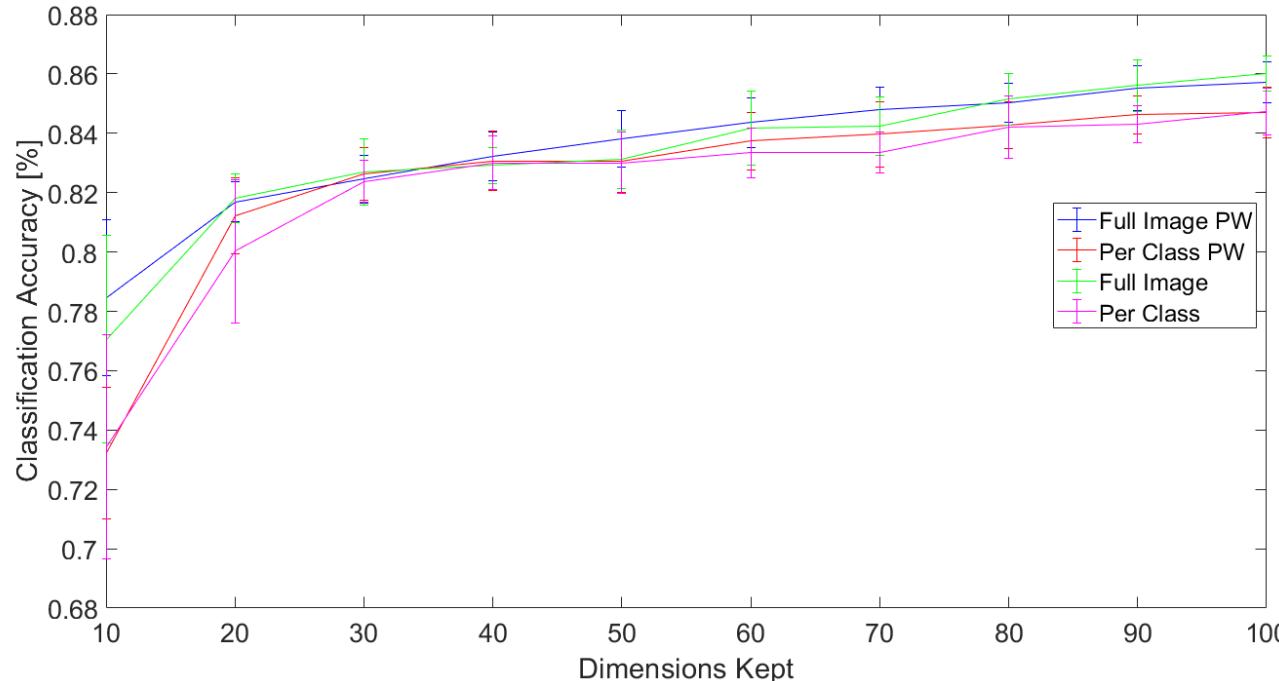


488nm





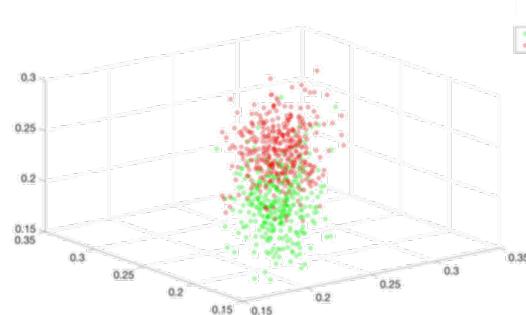
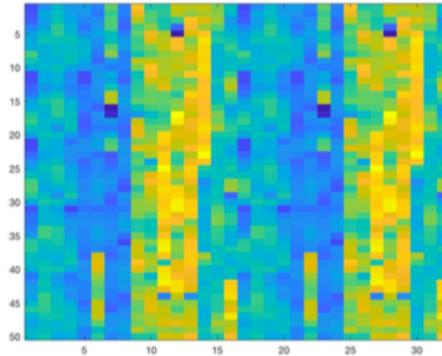
HDR KL vs KL with Parzen Window



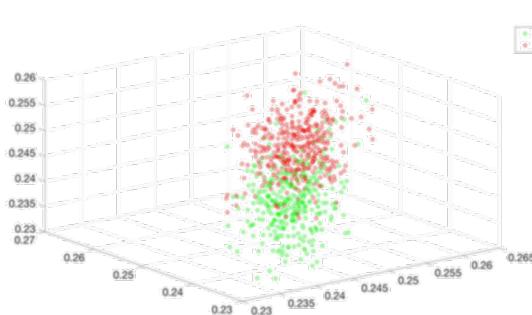
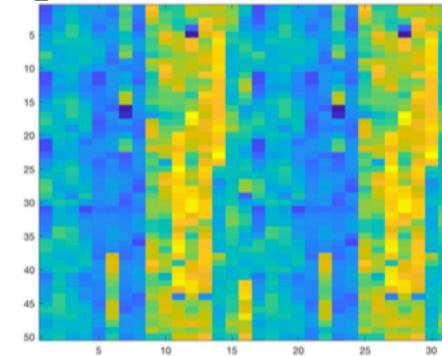


Pavia Dataset

Fake Pavia

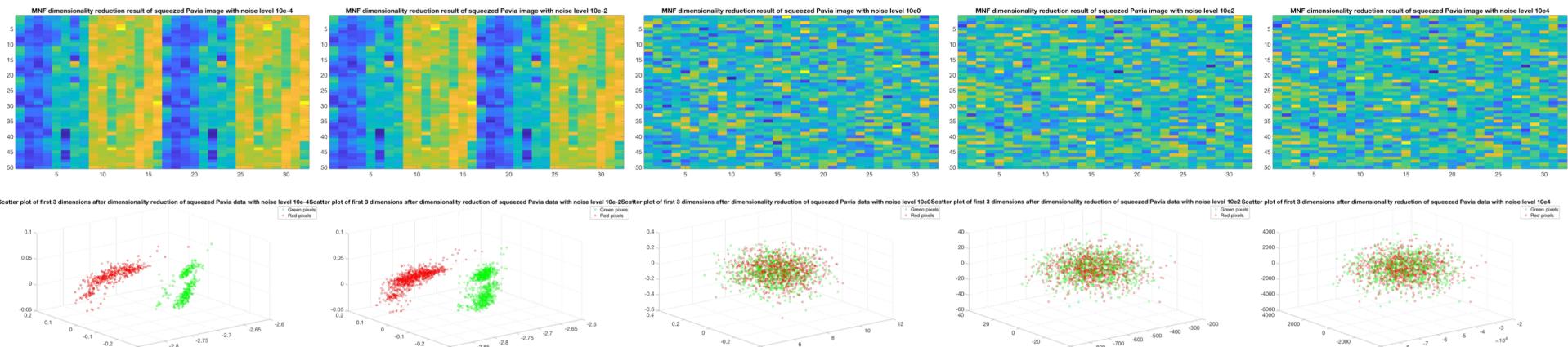


Squeezed Fake Pavia



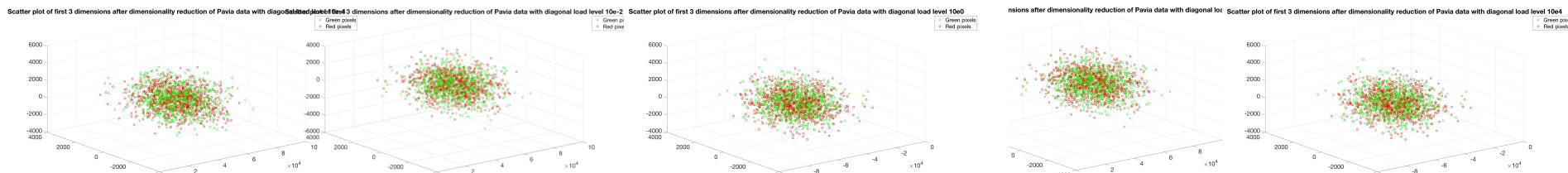
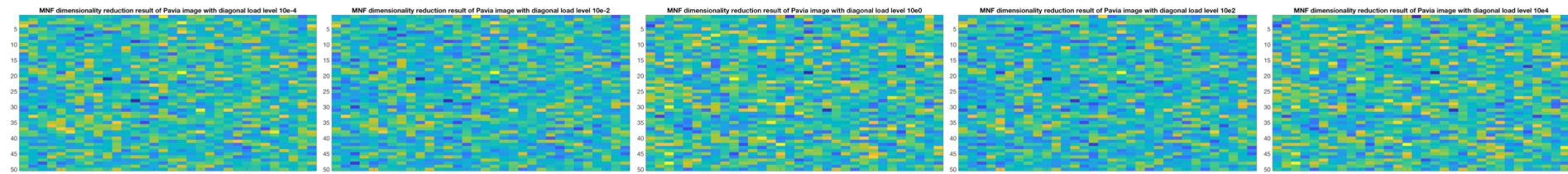


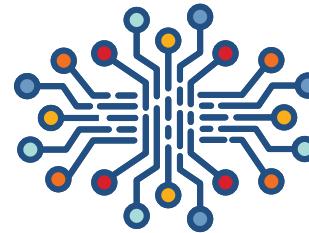
Pavia: Noise Level





Pavia: Diagonal loading factor



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