PDM Example

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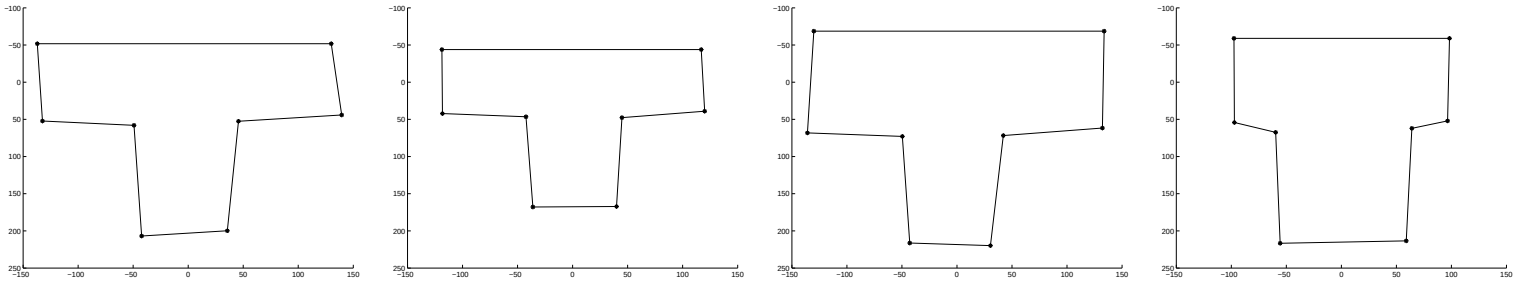
Representing the TEEs using PDMs

Have 8 2D points for each TEE in standard position



Have $N = 31$ instances with variations

Can we make a model of the TEEs? **YES!**

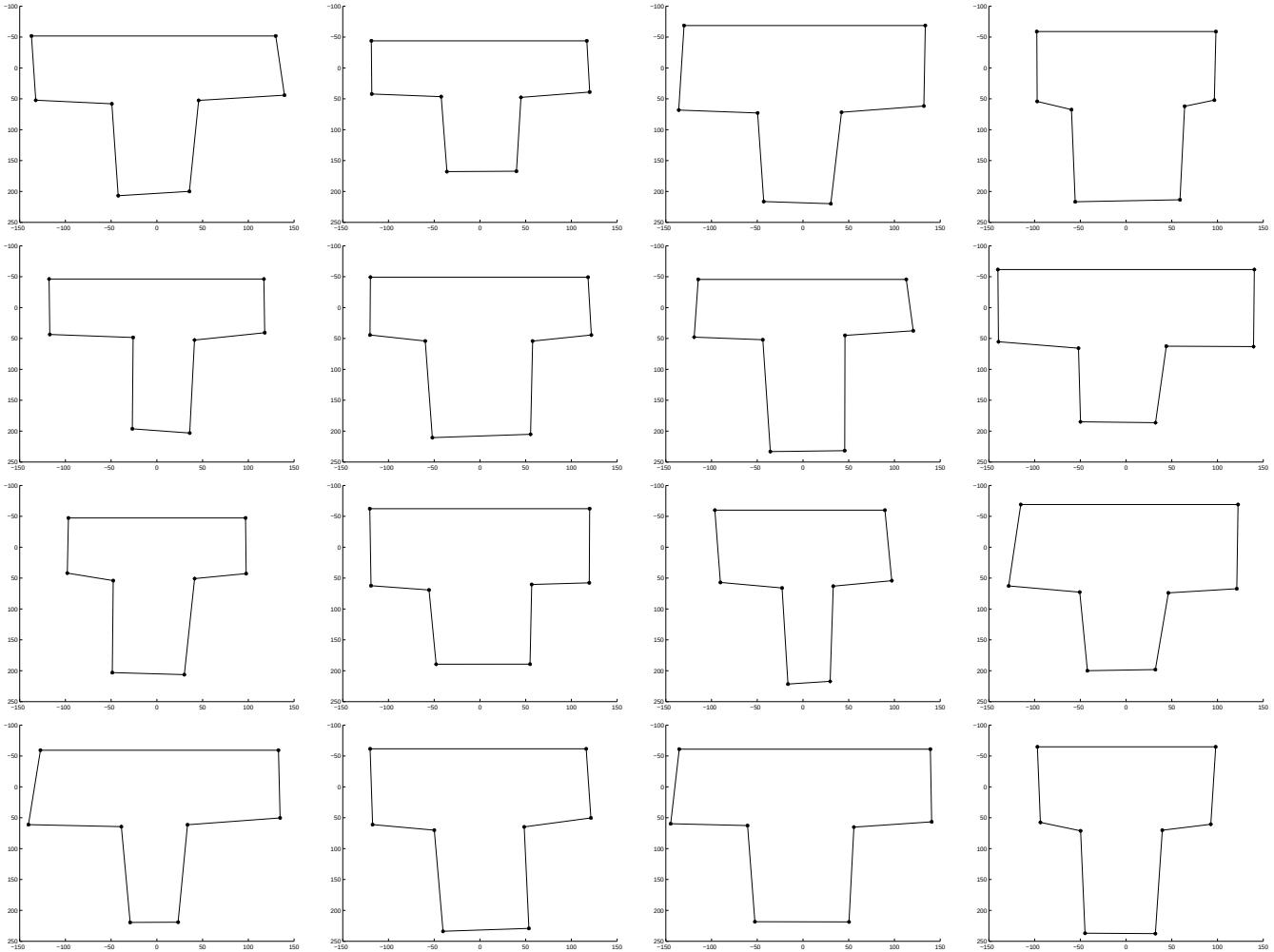
Representing the TEEs using PDMs II

Each corner point in the TEE model has a:

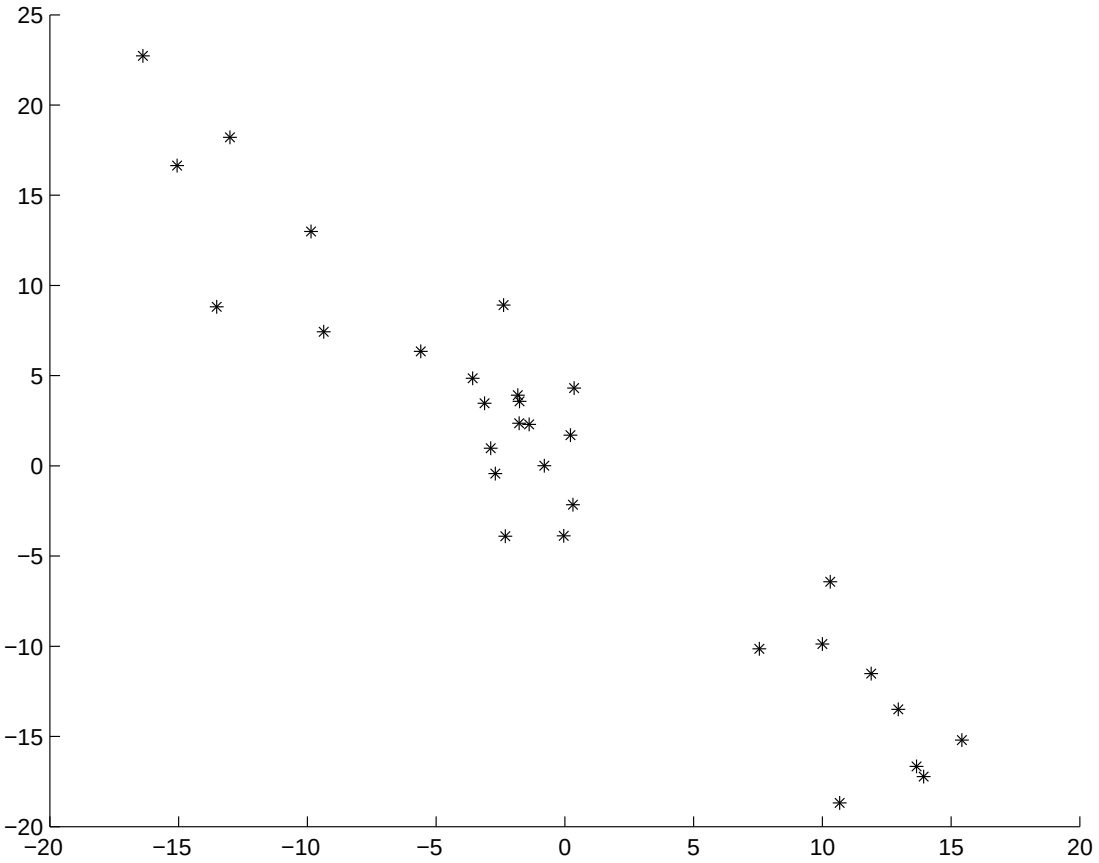
- Standard position
- Modified by shape variations

Use a Point Distribution Model (mean + PCA based main variation vectors) to represent structural variations and statistical model (mean + covariance matrix) to represent in-class variation

Some of Training Data

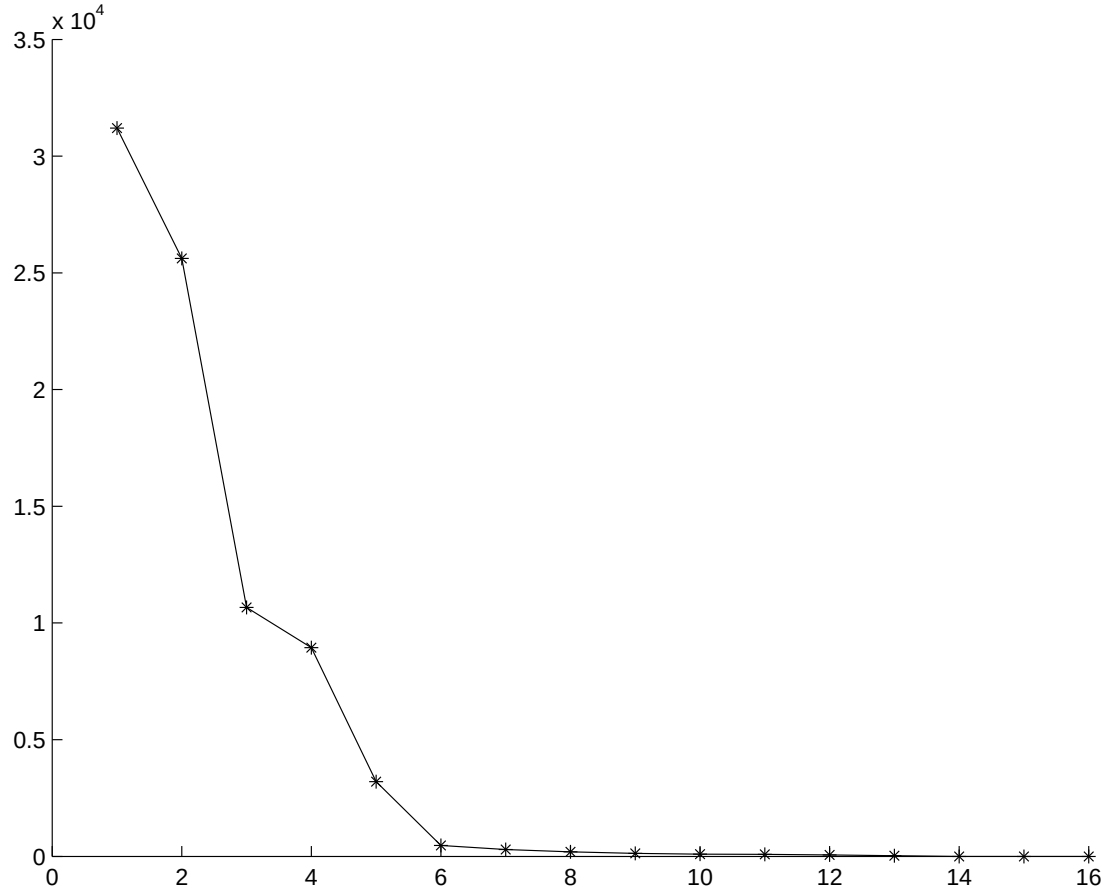


Correlation of x_1 and x_2



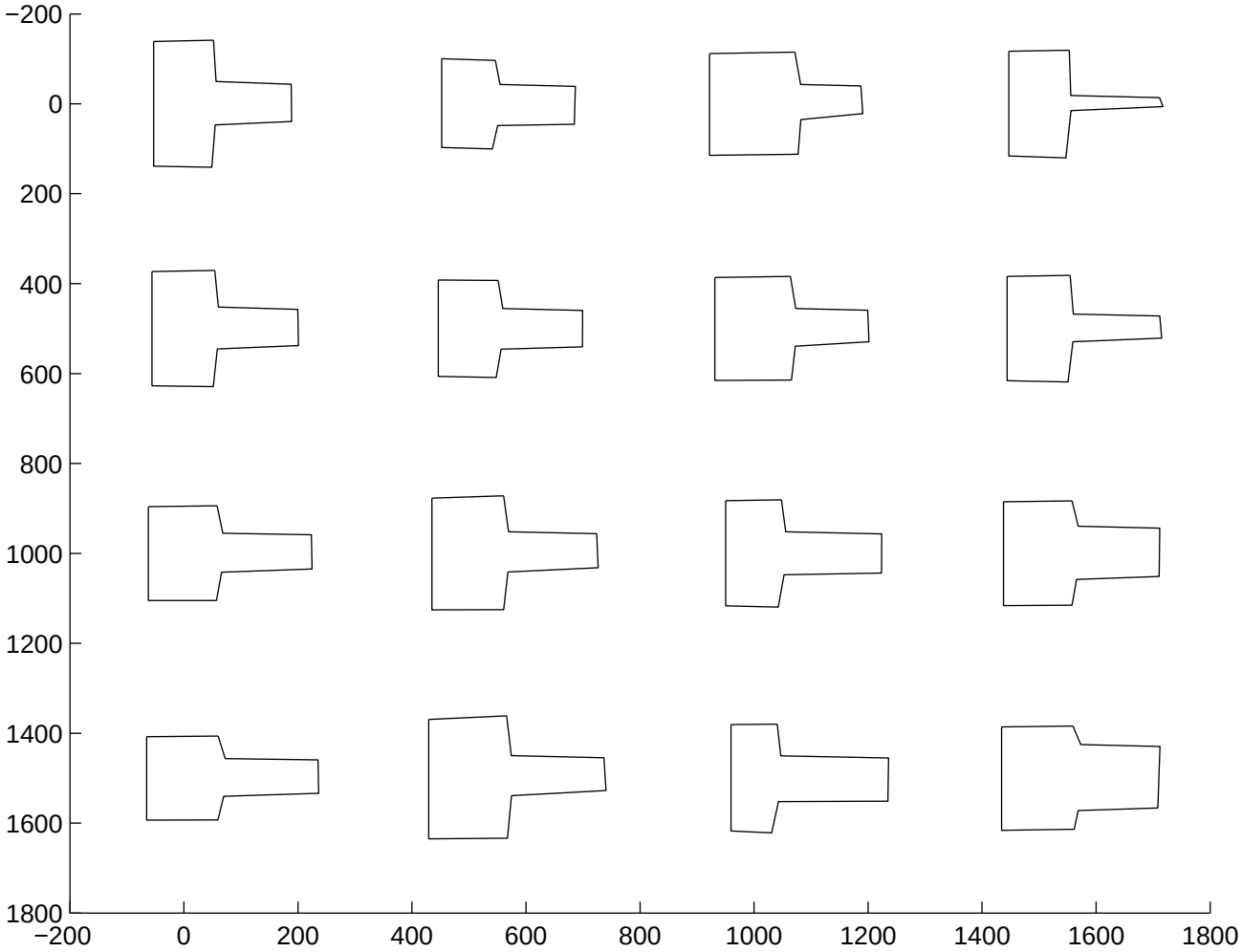
Note strong correlation

Eigenvalues of Scatter Matrix for TEE corners



Use first five

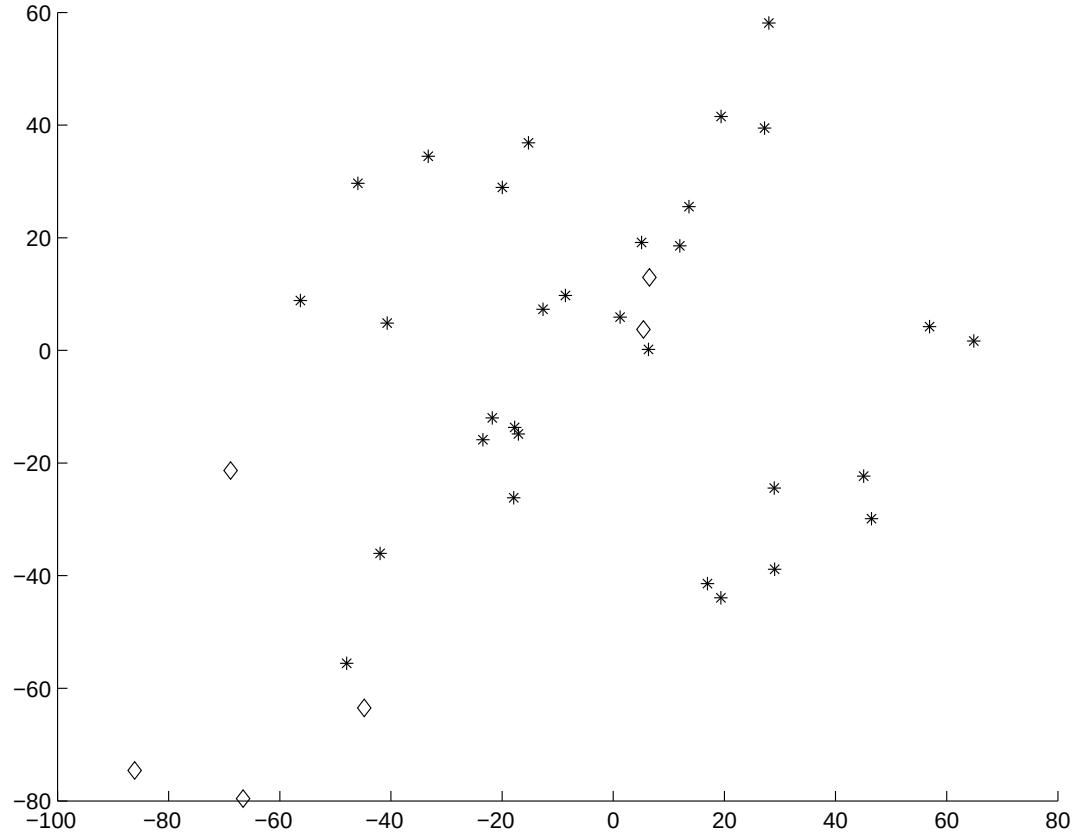
First Four Modes of Variation



Column goes from -2 to +2 standard deviations

Correlation of c_1 and c_2 (of c_1 ... c_5)

* - good data, diamond = bad data

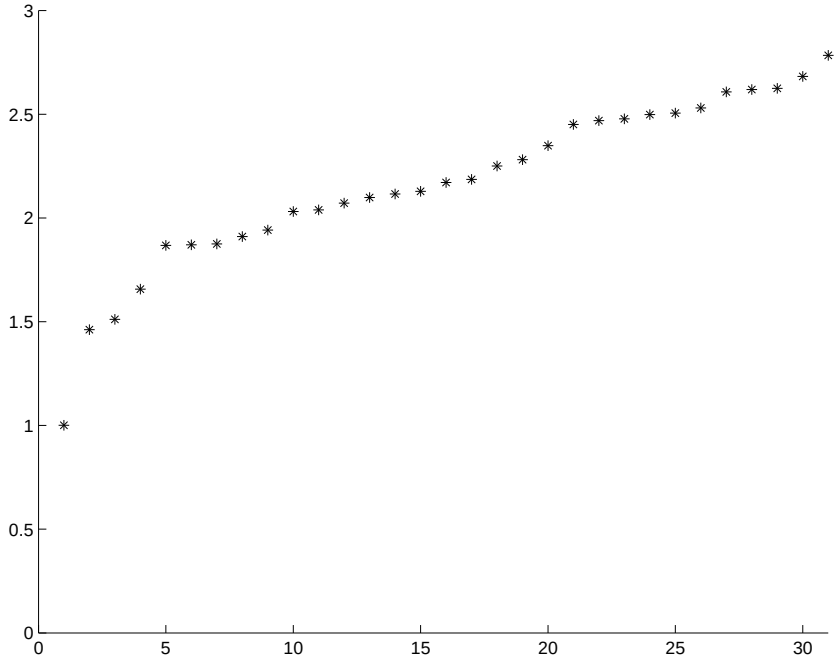


Note 1) decorrelated, 2) bad data tends to be further from mean

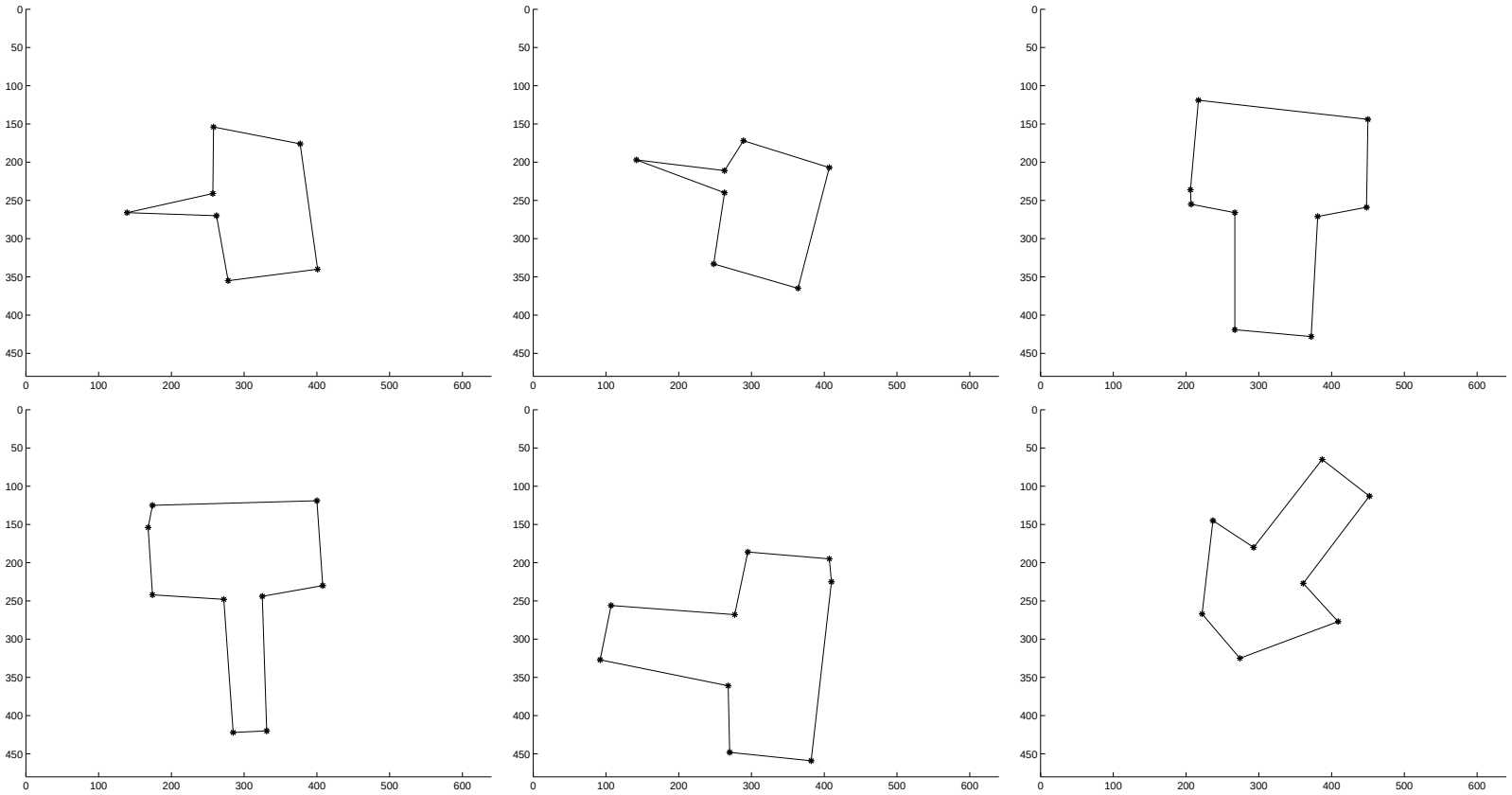
Good TEE Results

All TEEs recognized

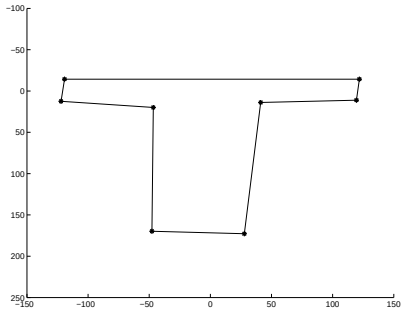
Plot of Mahalanobis distances for training data
Distributed Chi-squared mean: 5/2, std. dev.: sqrt(2*5)
'3-sigma' test threshold: $3\sqrt{Dim} = 3\sqrt{5} = 6.7$

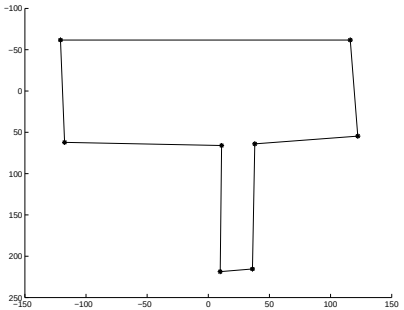


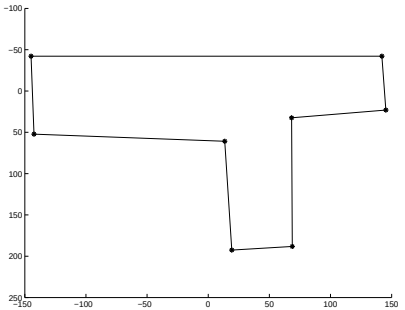
Bad TEE Shapes: Corner (5) & Rotation (1) Failures

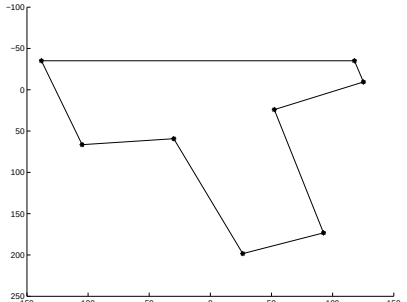


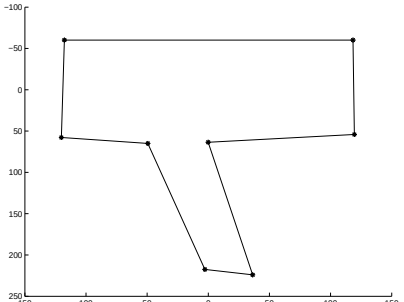
‘Invalid’ TEE Shapes Aligned and Classified

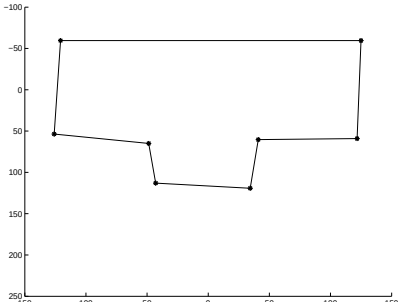
5.8: 

5.8: 

8.5: 

9.3: 

2.7: 

5.5: 

Values are Mahalanobis distances

What We Have Learned

1. Usually can use fewer eigenvectors/PCs
2. PCs may represent standard modes of variation
3. Can recognize good examples using statistical model