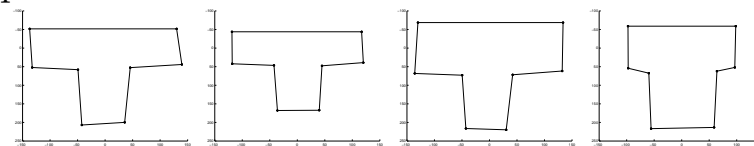# PDM Example

Robert B. Fisher
School of Informatics
University of Edinburgh

Representing the TEEs using PDMs

Have 8 2D points for each TEE in standard position

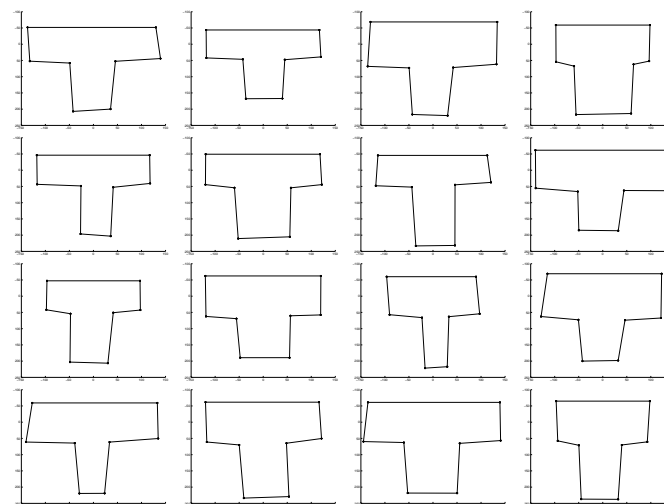Have $N = 31$ instances with variations

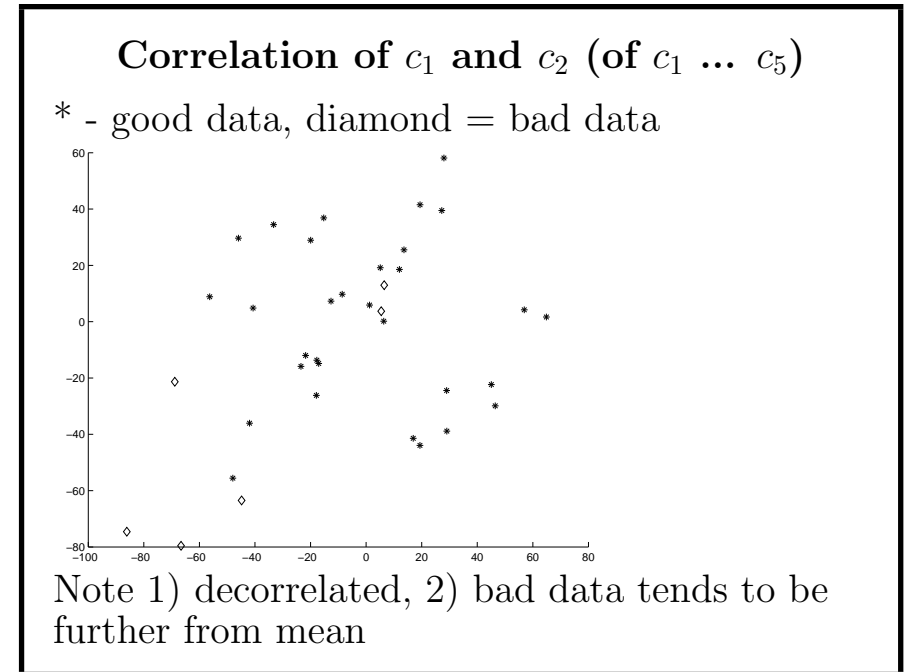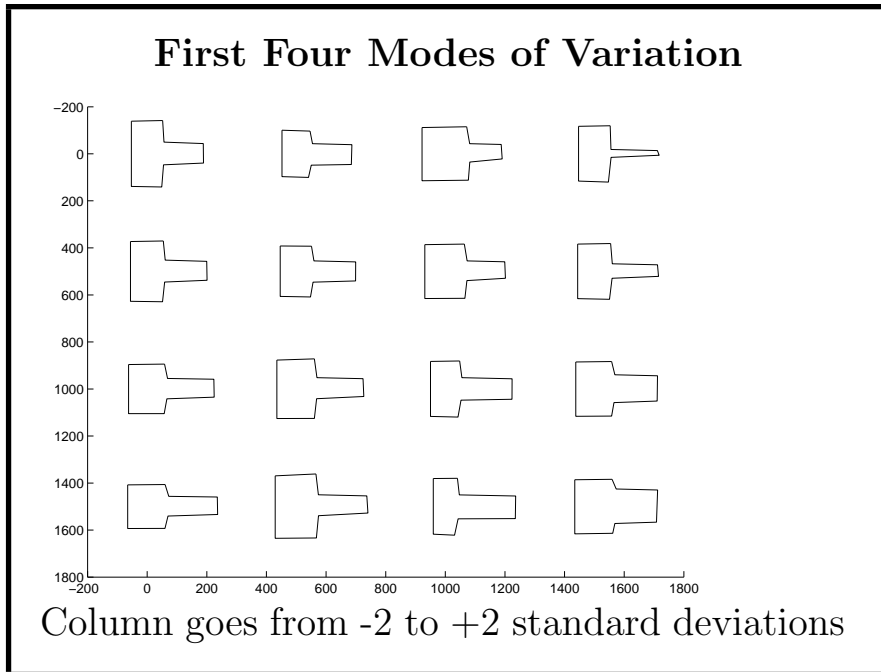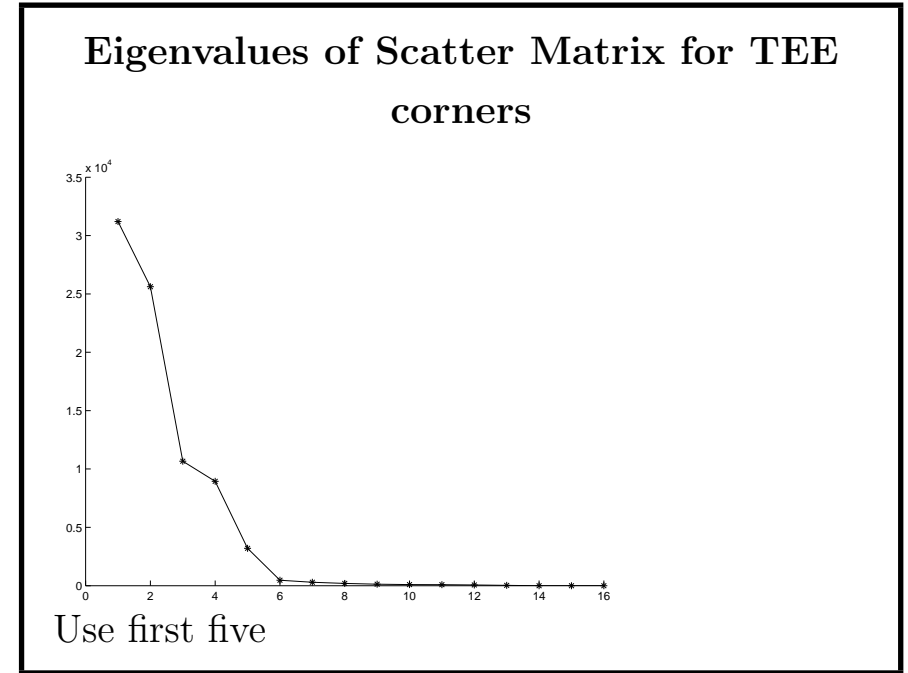Can we make a model of the TEEs? **YES!**
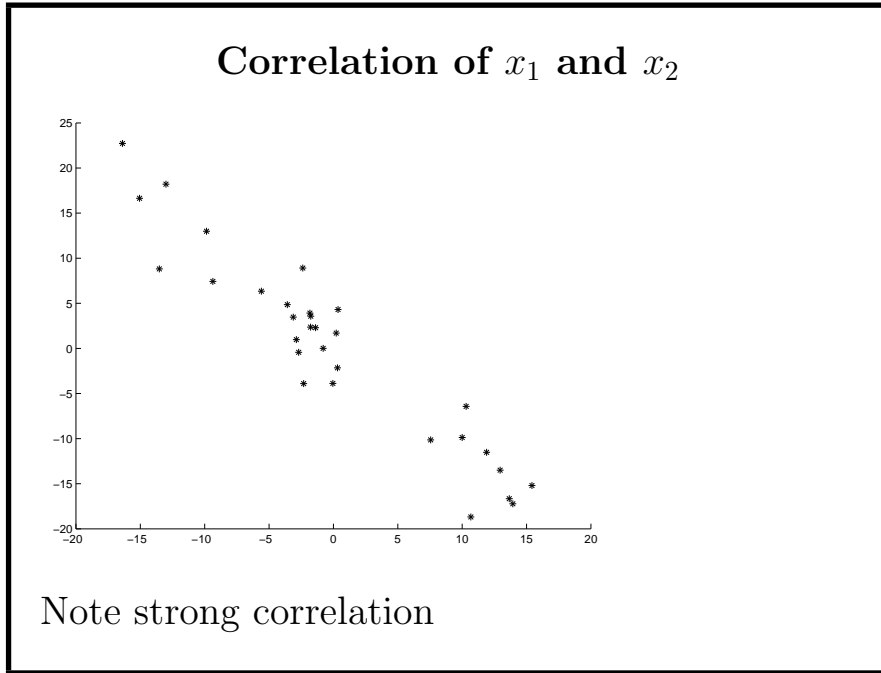
Representing the TEEs using PDMs II

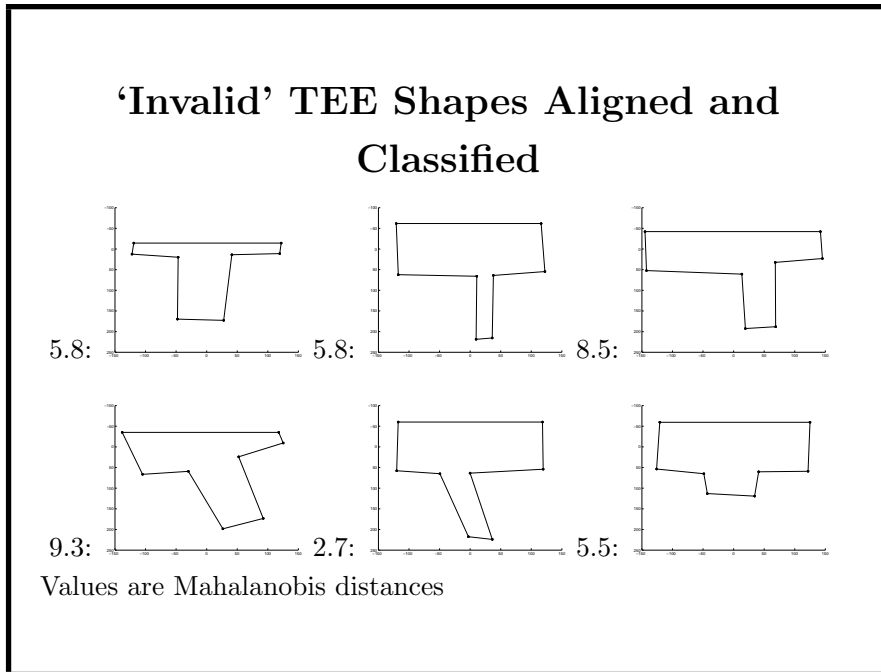Each corner point in the TEE model has a:

- 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