

# Visualization of multivariate functions, sets, and data; prototypes

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1. Figure 1 shows a visualization of a multivariate probability density function. The visualization applies the level set tree technique. Level set tree based visualization techniques may be applied in exploratory data analysis, to make graphical inference on the existence of the modes, and to apply graphical methods to the smoothing parameter selection.

Level set tree technique may be applied with several density estimators.

- (a) Figure 2 shows a visualization of kernel estimates,
- (b) Figure 3 shows a visualization of CART-histograms,
- (c) Figure 4 shows a visualization of a bootstrap aggregated greedy histogram.

2. Shape isomorphic transforms may be used to visualize multivariate sets.

- (a) Figure 5 visualizes a multivariate set with a shape isomorphic transform.
- (b) Figure 6 uses shape isomorphic transforms to visualize anisotropic spread of a unimodal density.
- (c) Figure 7 visualizes a multivariate data set with a shape isomorphic transform.

Figure 1, Figure 5, and Figure 7, show visualizations of objects of three different types: a function, a set, and data. These three objects have something in common: they are all 3-modal objects. The visualizations in the figures reveal the modality of the objects, by using shape isomorphic transforms.

3. Figure 8 shows a scale and shape visualization table. This is a dynamic tool which helps to zoom into a scale of density estimates and to zoom into the level set structure of individual estimates.

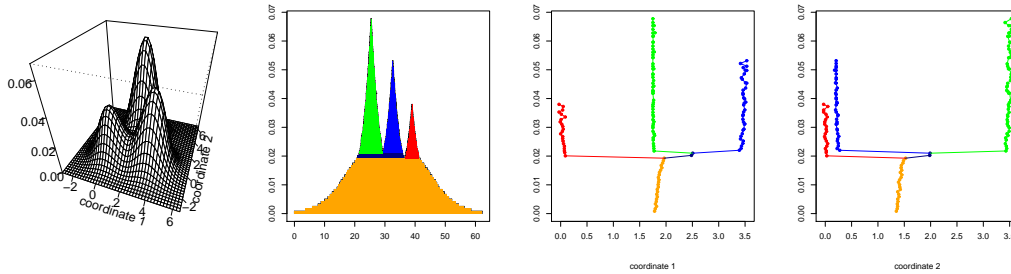


Figure 1: A perspective plot, volume plot, and barycenter plot of a 3 modal density.

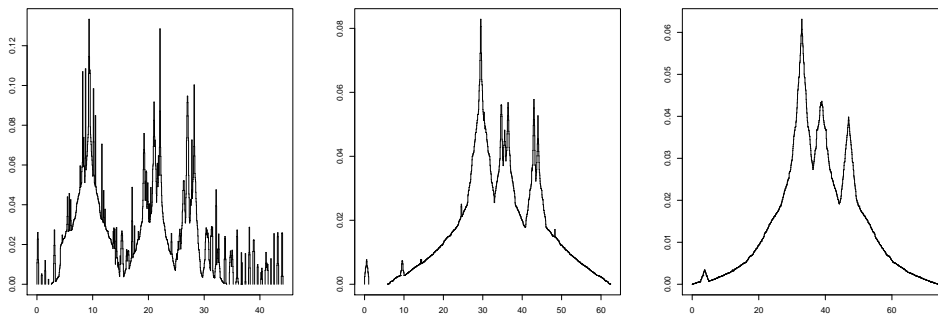


Figure 2: Multivariate kernel estimates corresponding to three different smoothing parameters; smoothing parameter selection with mode isomorphic transforms.

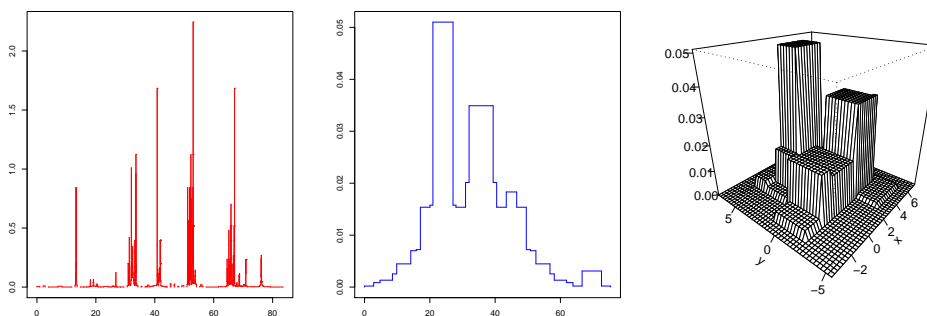


Figure 3: Multivariate CART-histograms and shape isomorphic transforms.

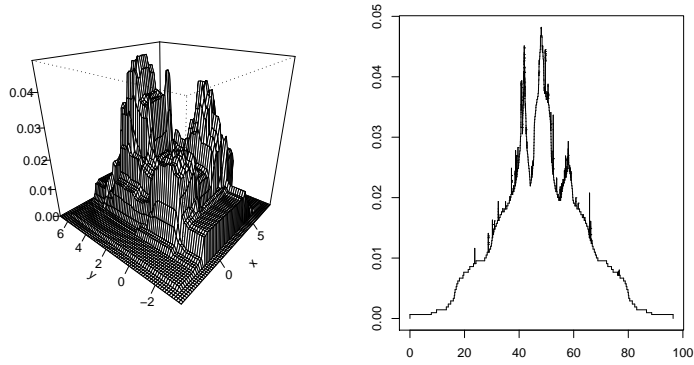


Figure 4: Bootstrap aggregation and a shape isomorphic transform.

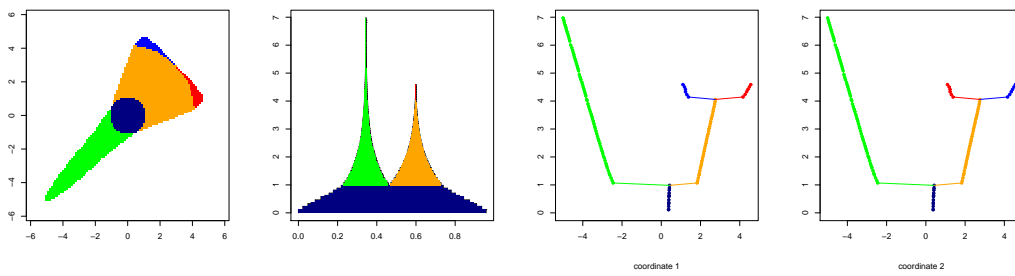


Figure 5: Visualization of a multivariate set with a shape isomorphic transform.

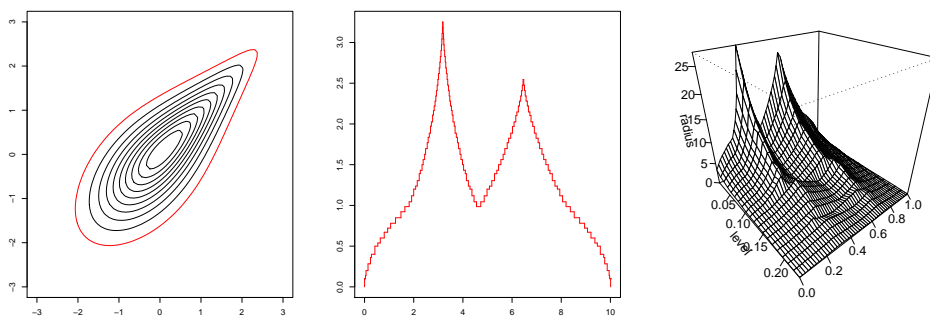


Figure 6: Visualization of anisotropic spread with a shape isomorphic transform.

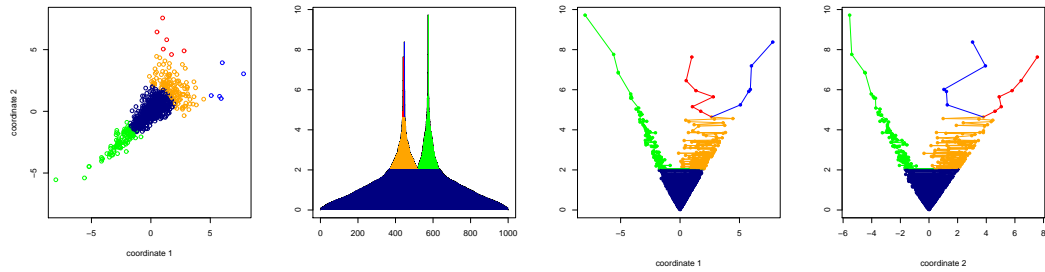


Figure 7: Visualization of multivariate data with a shape isomorphic transform.

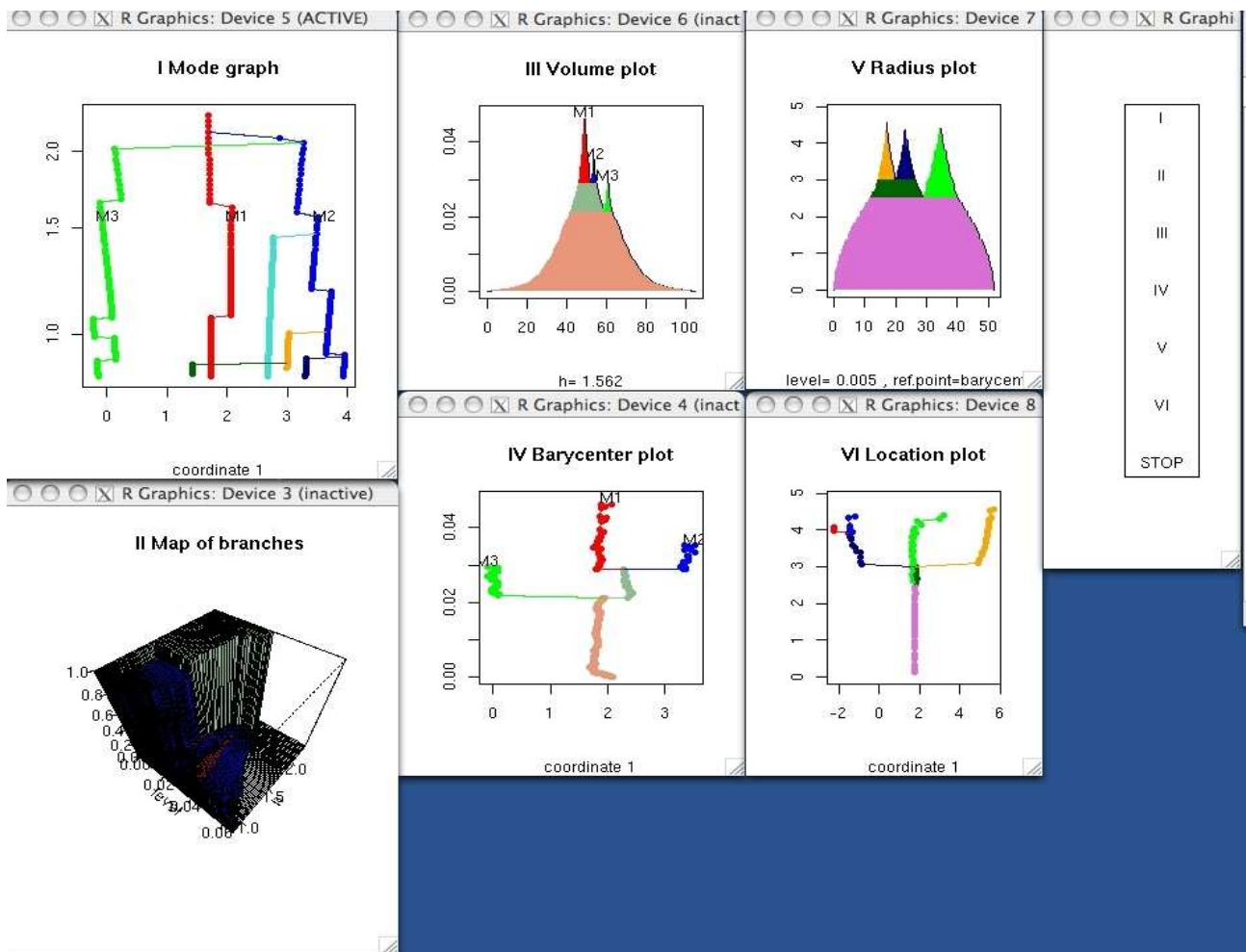


Figure 8: A screenshot of a scale and shape visualization table.