

Statistical Geometry Processing

Winter Term 2011/2012

Assignment Sheet #5: The Space of your Handwriting

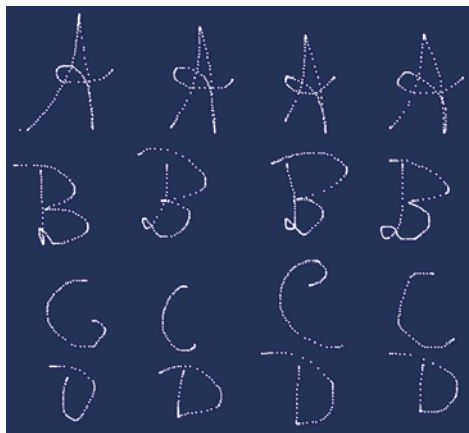
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Due: Feb 1st 2012

Assignment 5.1: Input (practice)

(score: 10%)

Create a GeoX experiment that allows the user to input characters with the mouse and record multiple examples of these. See screenshot below:



For simplicity, you can assume that every character is drawn as a single stroke. Build a list of characters of your handwriting, one list for each type (use for example 3-4 different characters and 5-10 examples each; you might also acquire examples of the same character from different members of your group).

Assignment 4.2: Correspondences (practice)

(score: 50%)

We now need to establish dense correspondences between the curves. This means, we interpret the sampled curves from the mouse strokes as curves $f: [0,1] \rightarrow \mathbb{R}^2$, where the same parameter positions should correspond to matching points (for example, the tip of the A should match). We try this in two steps:

- Implement a simple version that establishes correspondences via arg-length parametrization.
- Develop a better method that matches meaningful parts automatically. As an example, one could look for sharp peaks, and fix the correspondences of sharp peaks (say, angle $>30^\circ$) before parameterizing the resulting intervals. If necessary, you can also use additional user annotations (of sharp features, for example).
- After performing either (a) or (b), resample the curves for each character as fixed-size vectors: By linear interpolation between mouse event points, we can define a smooth curve. From corresponding curves, build vectors $[\mathbf{x}_1, \dots, \mathbf{x}_n] \in \mathbb{R}^{2n}$ that sample the input curves at corresponding points.

Assignment 4.3: Analysis and Synthesis with PCA (practice)

(score: 40%)

Let $[\mathbf{x}_1, \dots, \mathbf{x}_n]_{(1)} \dots [\mathbf{x}_1, \dots, \mathbf{x}_n]_{(k)}$ be k different examples of a single character (for example, different ways to draw an "A").

(a) Apply PCA to this space to compute the eigenspace of your handwriting (of "A", that is). Visualize the result by morphing characters into different shapes by modifying the eigenvalues and displaying the result. A "slider" interface for continuously varying the eigenvalues is useful for display.

(b) Let different people draw the same character and visualize the embedding in the PCA space (as a 2D or 3D point cloud after dimensionality reduction by projecting on the principal eigenvectors of the PCA). Can you distinguish the handwriting of different subjects?