Mastering Sketching. StrokeAggregator

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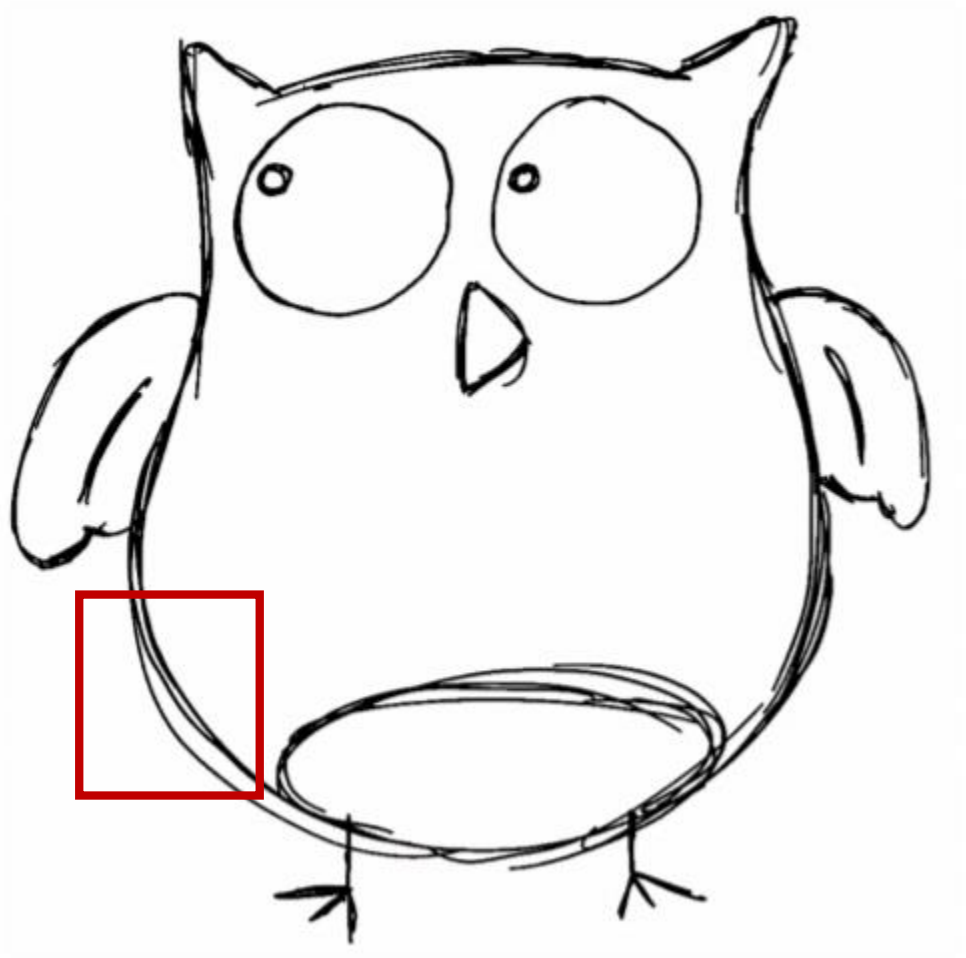
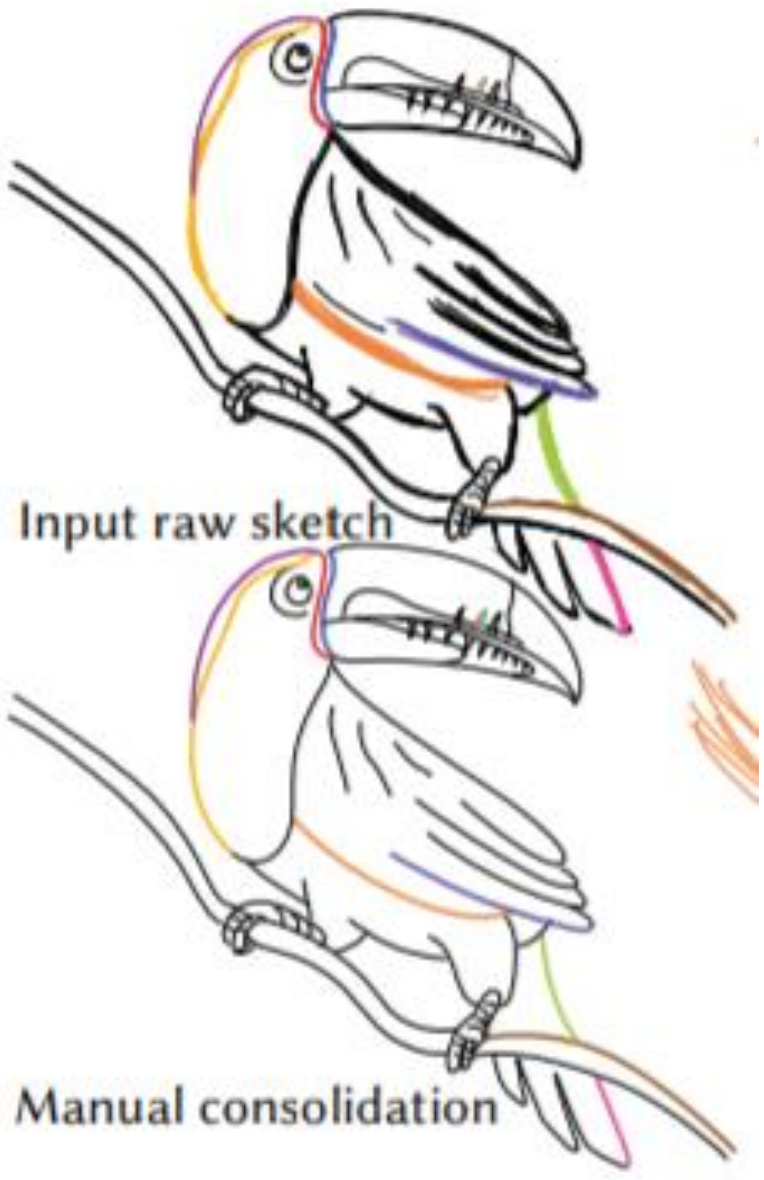
A problem

When creating line drawings, artists frequently depict intended curves using multiple, tightly clustered, or overdrawn, strokes.



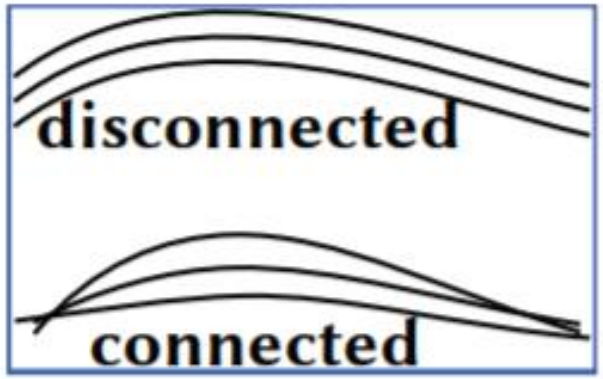
Manual consolidation

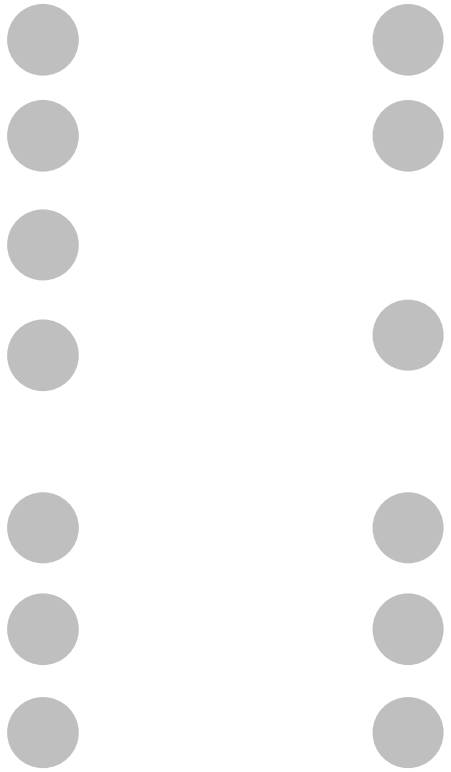
Viewers rely on angular compatibility, or the degree of similarity between stoke tangents, when grouping nearby side-by-side strokes.



How does viewers distinguish strokes?

- Angular compatibility.
- Relative proximity.
- Narrowness.
- Connectedness.





Other solutions

Traditional vectorization.

Bao and Fu

Progressive Overdrawing

Bae, Baudel, Grimm and Joshi

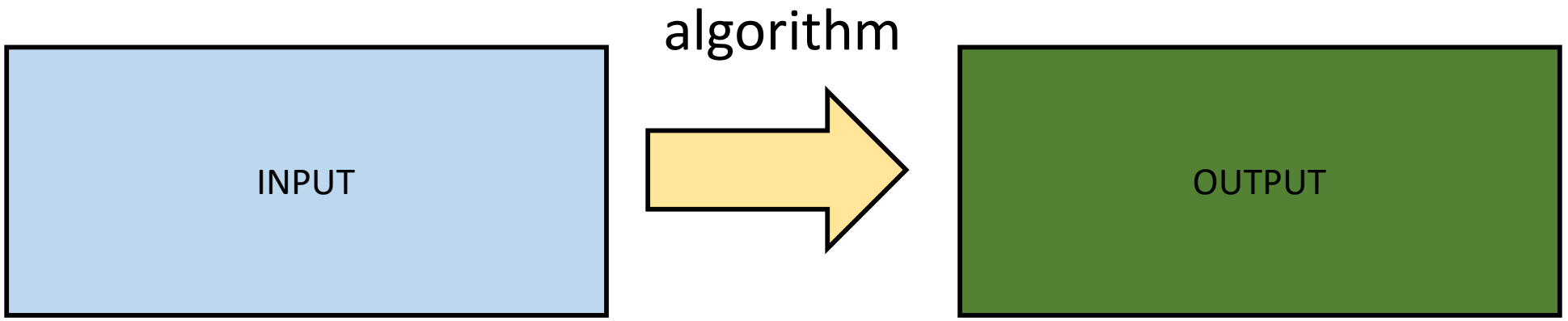
Mastering Sketching

Simo-Serra et al.

Contextual angle and proximity metrics

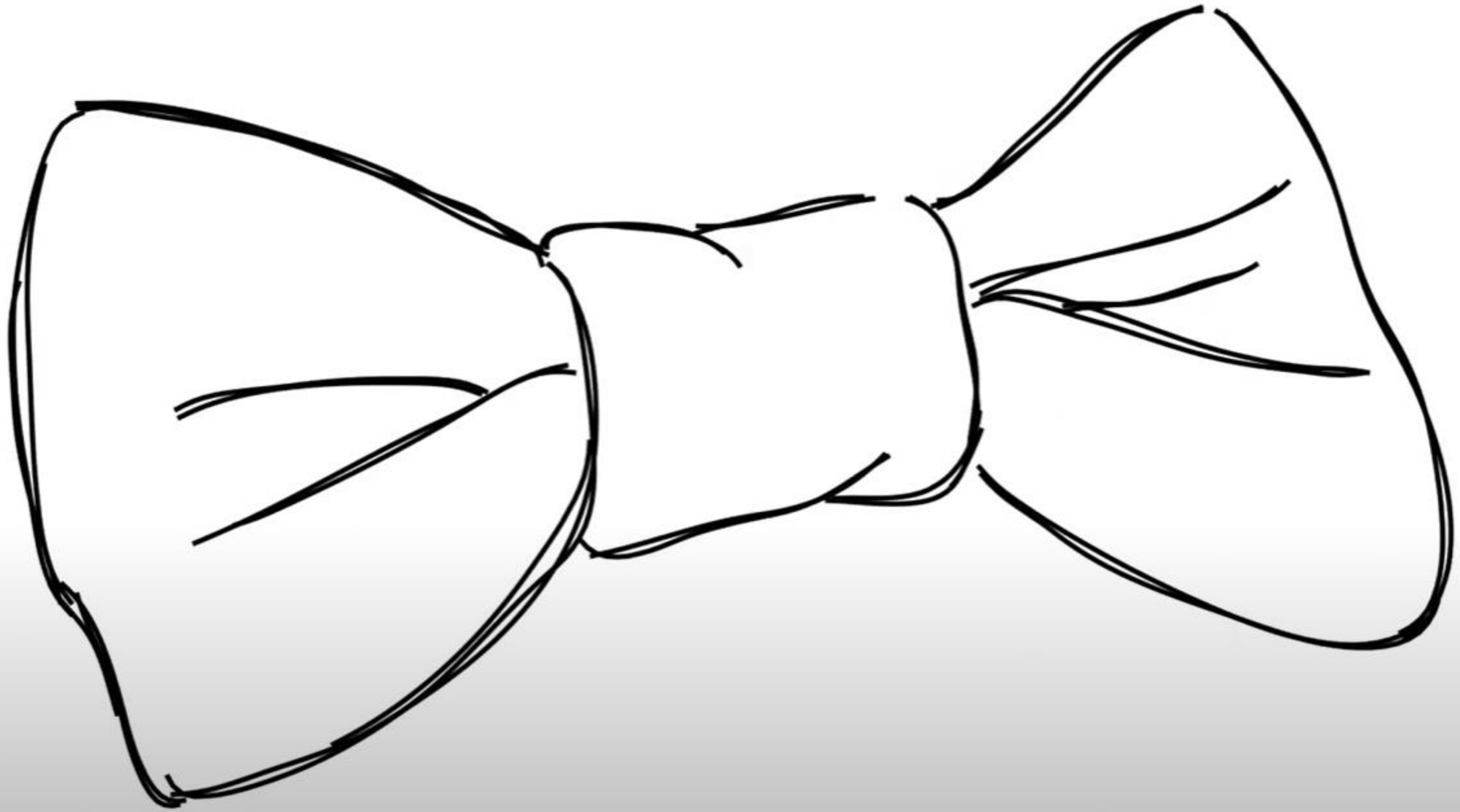
Liu et al

StrokeAggregator

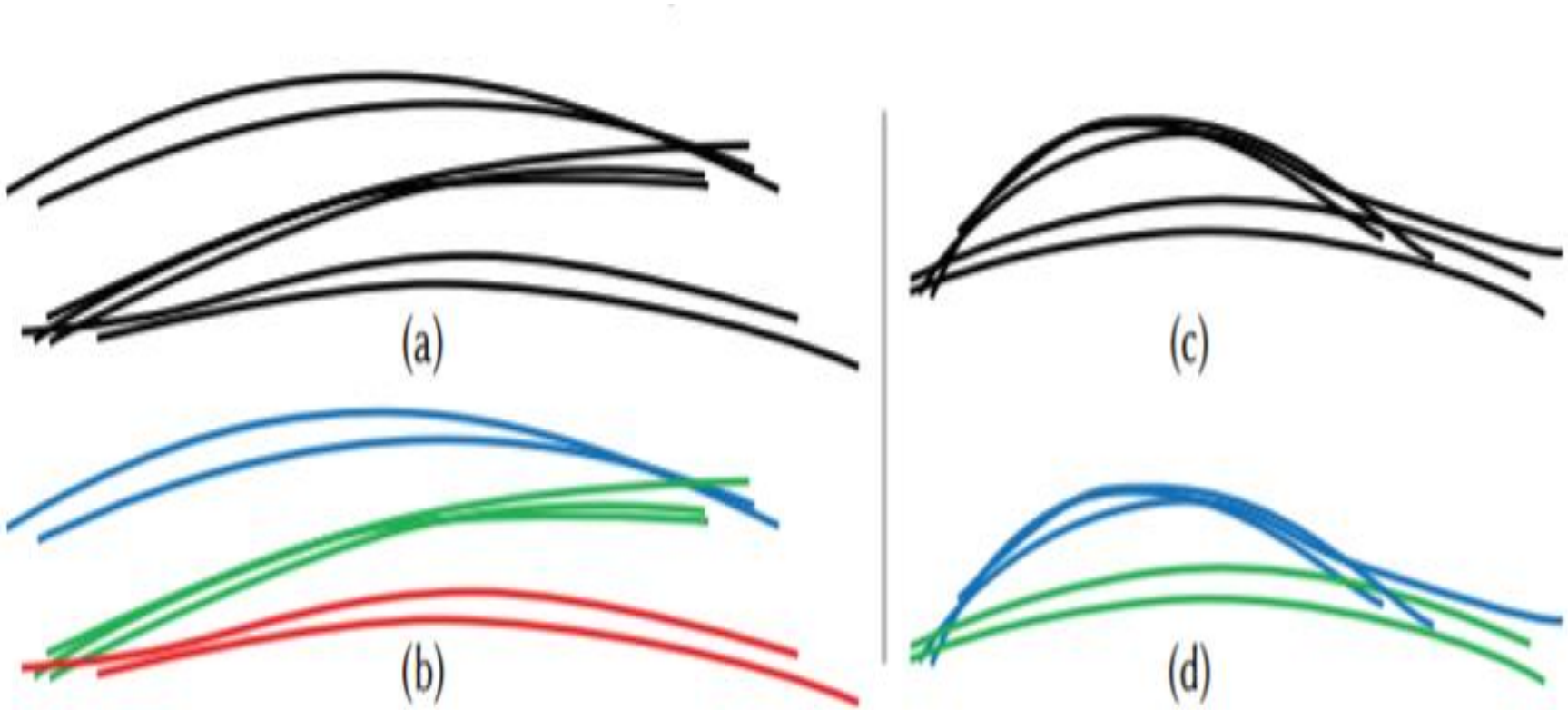


a line drawing in vector format

clustering output images

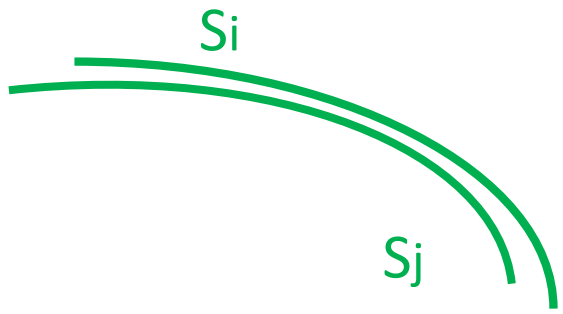


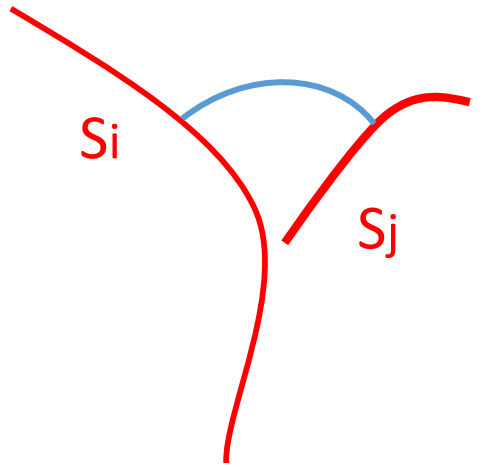
Algorithm



Coarse Clustering

Two nearby strokes Si and Sj are more likely to depict the same aggregate curve when they are fully or partially parallel and are less likely to belong together when they are orthogonal to one another.

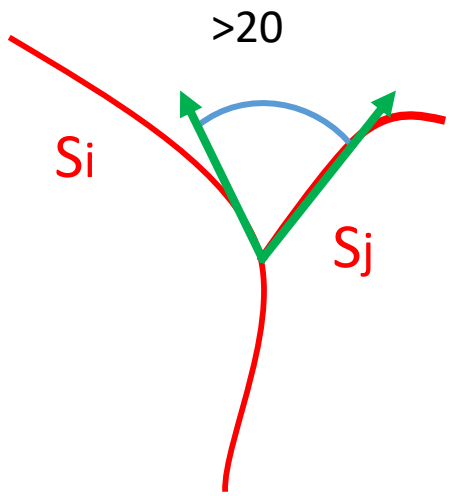




Pairwise Angular Compatibility Score

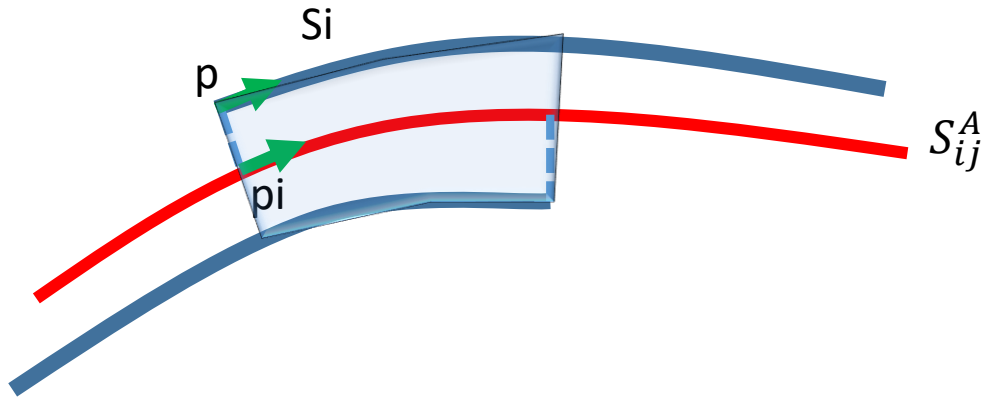
Da is angular distance between each stroke and the aggregate curve :

Da(S_i, S_j) = max(Da(S_i , S_{ij}^A),Da(S_j,S_{ij}^A)).



Angular Distance

$$D_a(\mathcal{S}_i, \mathcal{S}_{i,j}^A) = \frac{1}{|\mathcal{I}_1|} \sum_{\mathbf{p}' \in \mathcal{I}_1} A_i(\mathbf{p}')$$



$$A_i(\mathbf{p}') = \arccos(\mathbf{t} \cdot \mathbf{t}')$$

Average Proximity Based Clustering

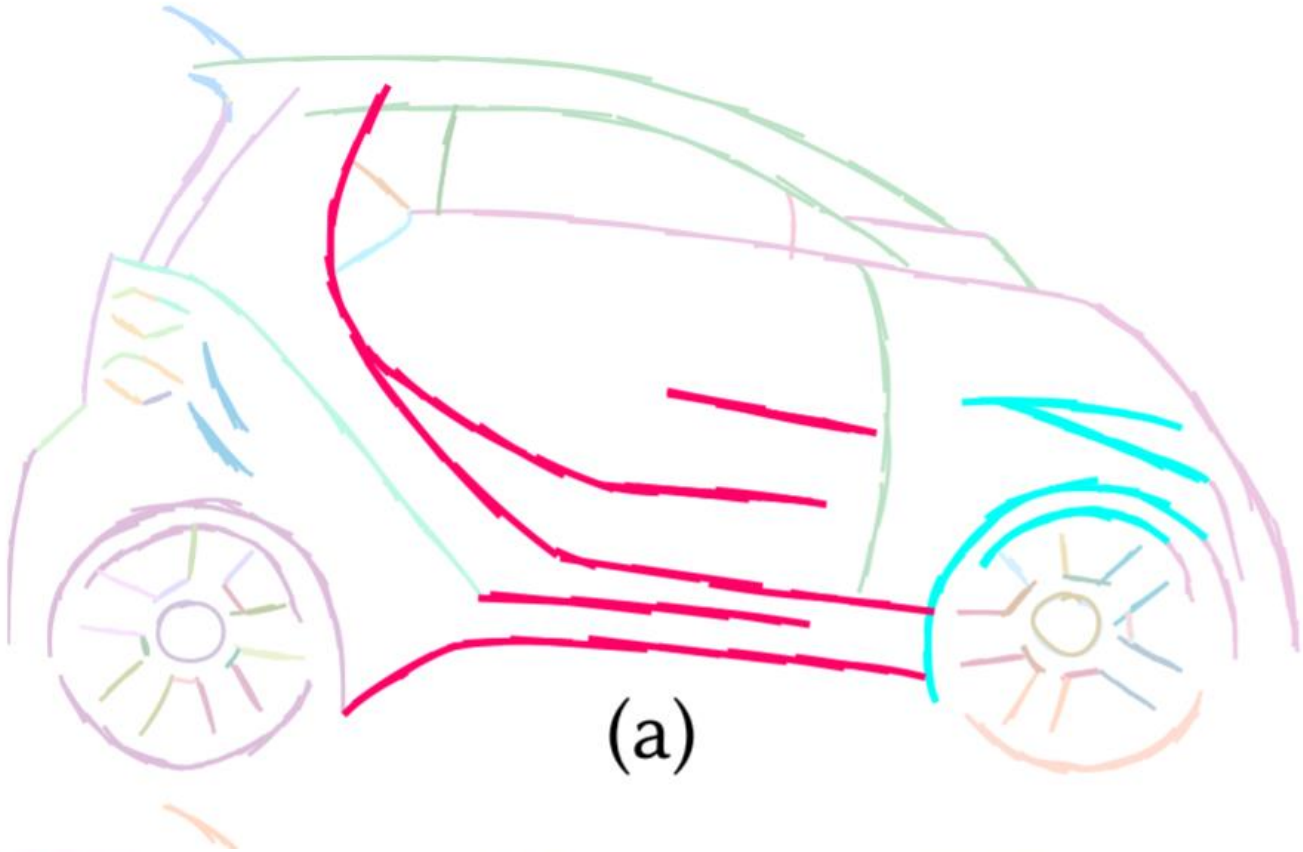
Clustering stages:

(a) angle based clustering output

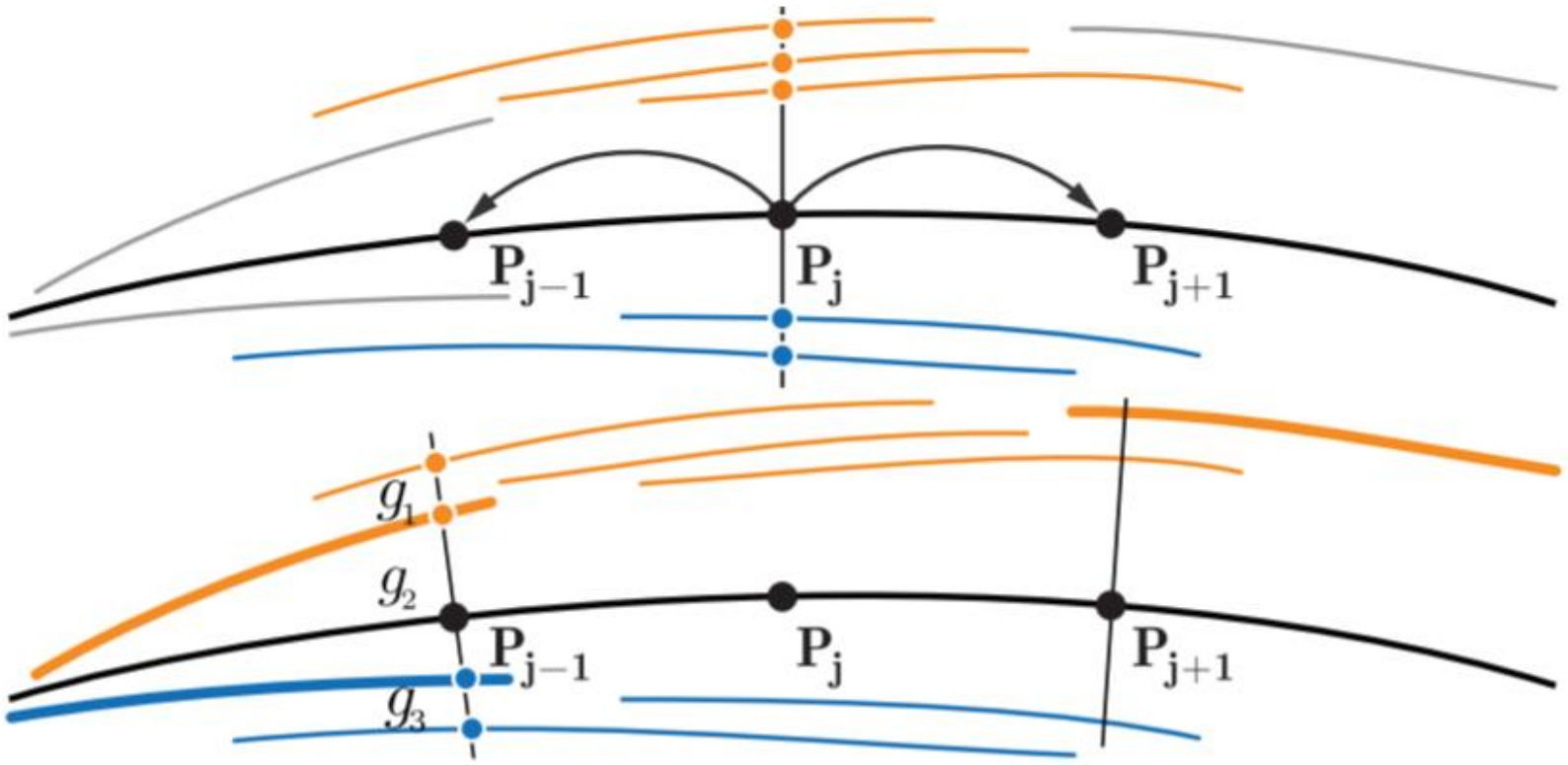
(b) average proximity based clustering breaks these two clusters into roughly evenly spaced distinct components;

(c) (c) local refinement separates branches producing uniformly narrow clusters;

(d) consolidated output.



Potential Clusters



Separation assessment

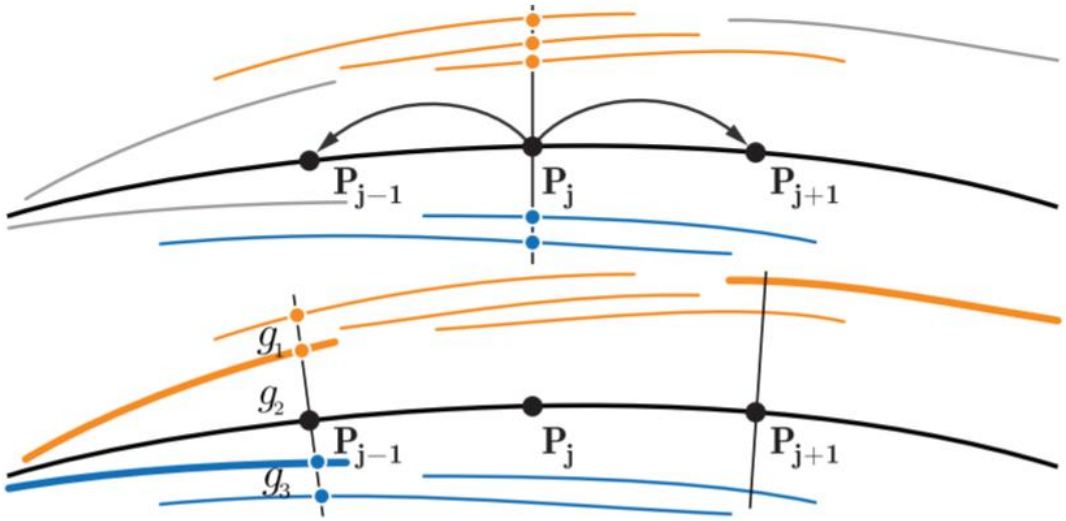


Fig. 7. Local cluster refinement

$$r = g/((g_L + g_R)/2)$$

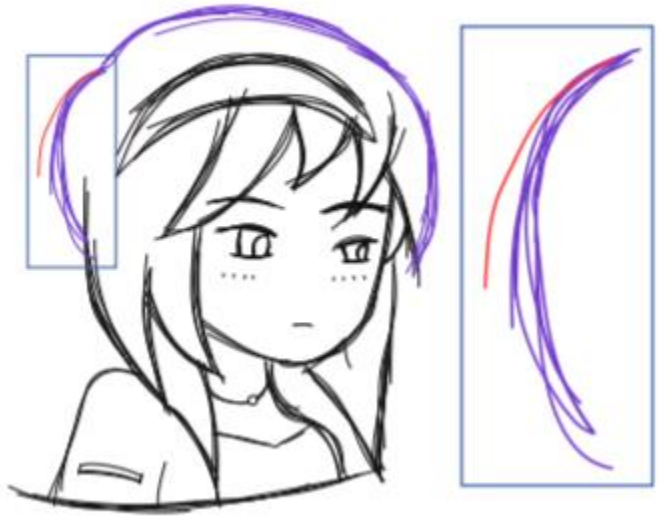
Cluster Unification

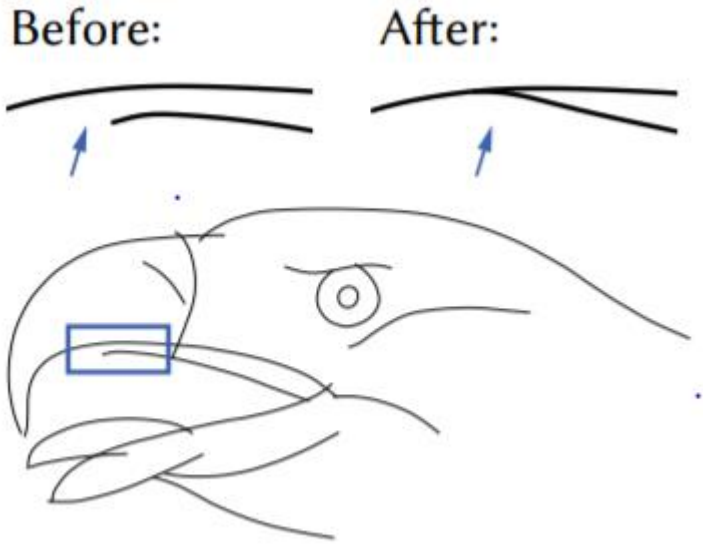
Pairwise Assessment – if clusters are separated.

Proximity Assessment – to overcome local noise.

Single-stroke cluster’s problem.

Enforcing curve connections.





Fitting

Modified Moving-Least Squares (MLS) fitting algorithm

1. Perform an initial MLS optimization
2. Compute an initial aggregate polyline
3. Align the edges of the polyline

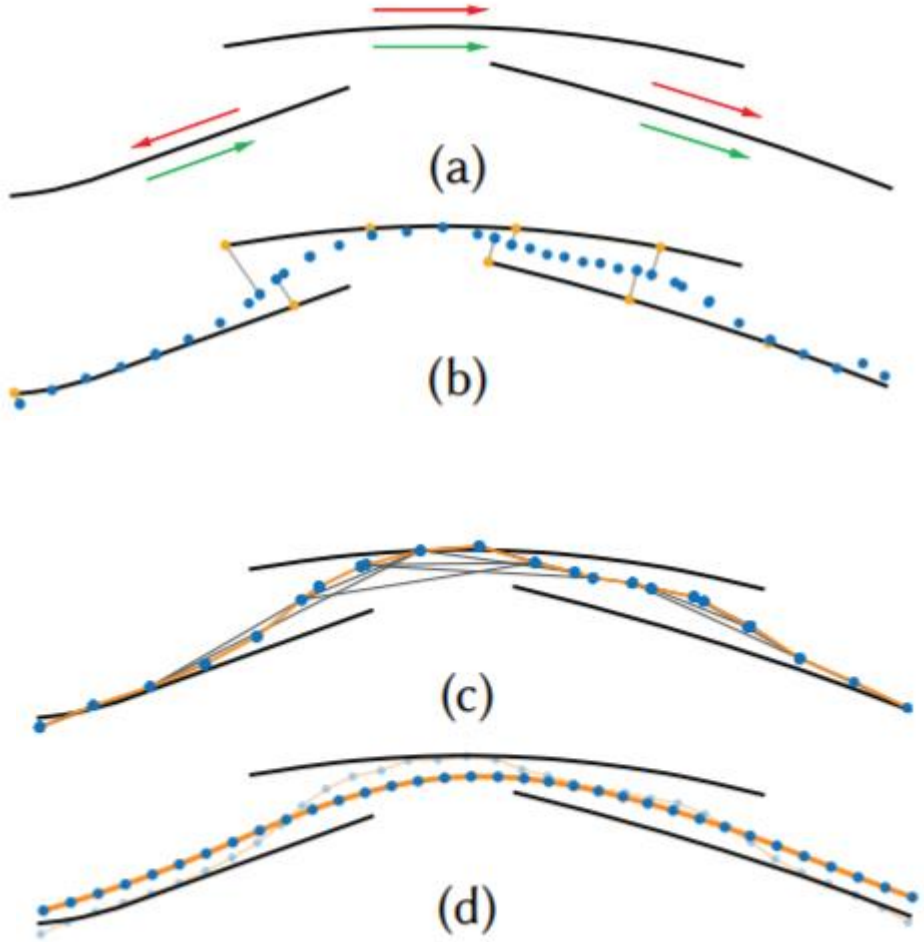
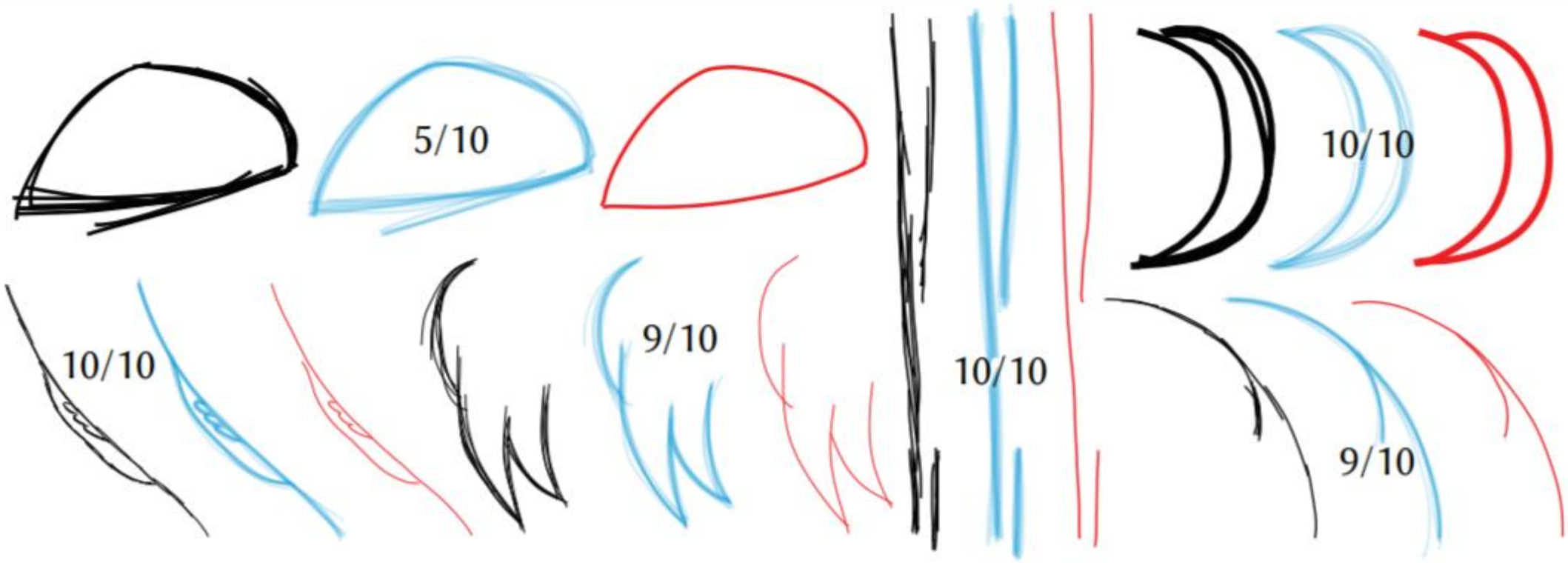


Fig. 7. Aggregate curve fitting

Experiments

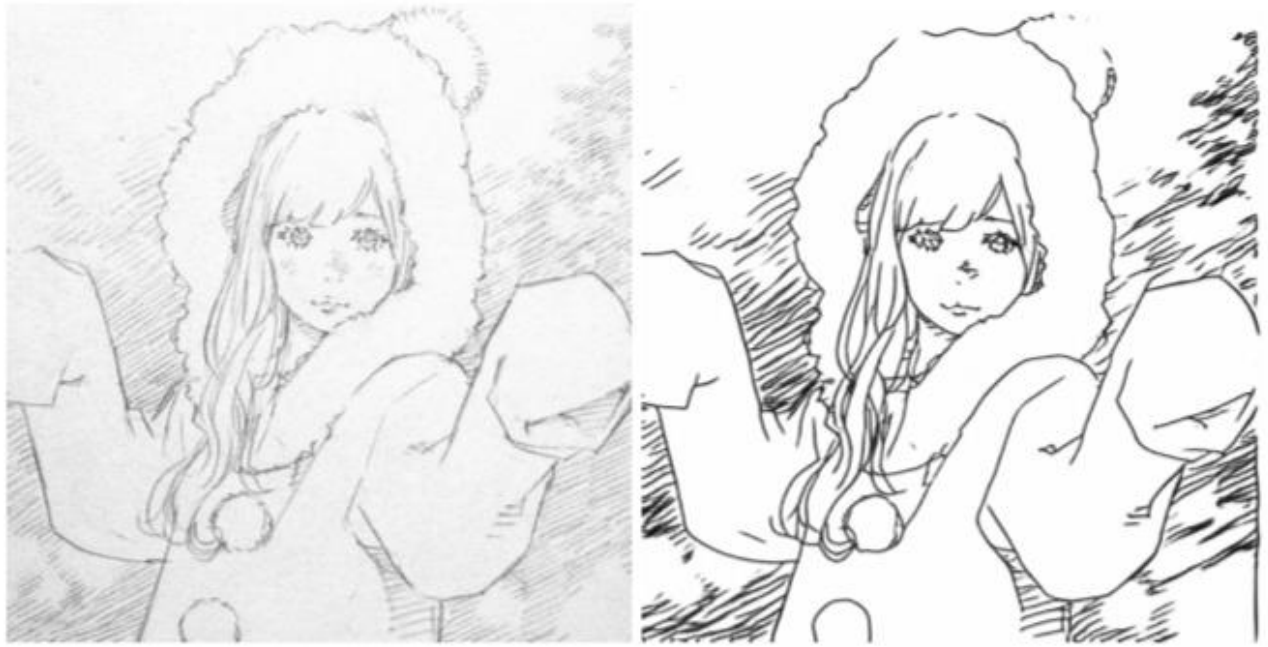


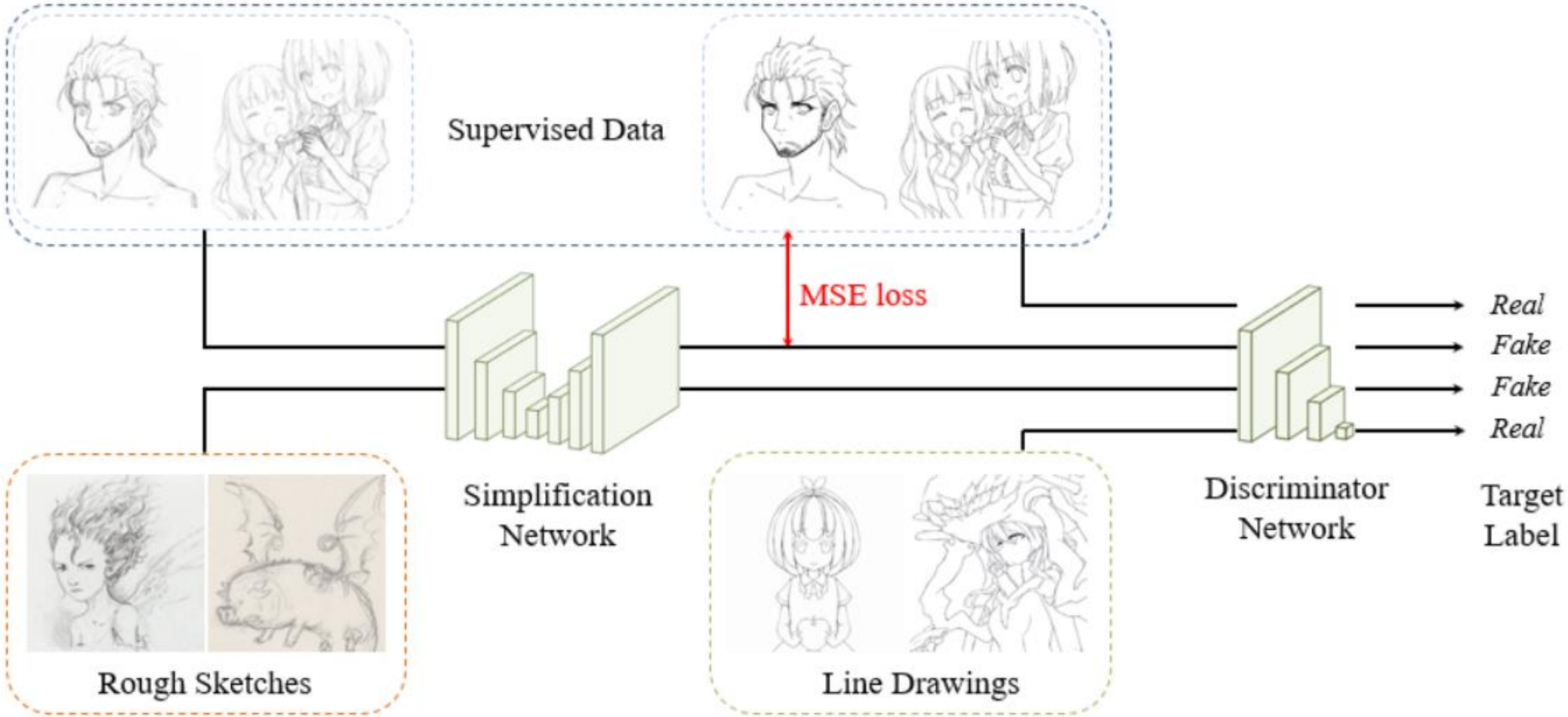
Results

Time consuming: 2,5 minutes per drawing.

Mastering Sketching

- Simo-Sera, Iiizuka, Ishikawa, (2018)
- Integral framework for training sketch simplification networks that convert challenging rough sketches into clean line drawings.




Supervised Data
MSE loss
Simplification Network
Discriminator Network
Real
Fake
Fake
Real
Target Label
Rough Sketches
Line Drawings

Results

Authors validated their framework with two user tests, where their approach is preferred to the state of the art in sketch simplification 92.3% of the time and obtains 1.2 more points on a scale of 1 to 5.

Thank you for your attention!