How to Draw Illustrative Figures?

Yuki Morimoto, Tokyo Denki University (ISIT until March), morimoto@im.dendai.ac.jp
Daisaku Arita, ISIT

1. Goal: Illustrative Beautification of Photograph

![A photo of neuron][1] ![Illustration of neuron][1]

2. System Overview

![Input][2] → ![Contours][2] → ![Measuring & smoothing][2] → ![Optimization][2]

3. Key Idea

- Feature preserving & enhancing filtering [3]
  - (a) Values of before & after the filtering
  - (b) An effect of the filtering

<Assumption> Applying the filtering to design factors, which are parallelism, collinearity, curvature smoothness, etc., result in enhanced illustrative figures.

4. Measuring & Detection of Design

- (d) For parallelism, we measure an average distance between the target vertex and connected vertices.
- (c) For collinearity, we measure curvatures which is the most smooth and connected vertex using the method [4].

5. Anisotropic Diffusion Pass

- (a) Diffusion pass for curvature smoothing filtering.
- (b) Diffusion pass for unsigned curvature smoothing filtering.
- (c) Diffusion pass for collinearity filtering.
- (d) Diffusion pass for parallelism filtering.

6. Optimization for Fitting

\[
E_{sm} = \int_{\Omega} (\kappa - \kappa') ds, \quad E_{d} = \int_{\Omega} (d - d') ds, \\
E_{c} = \int_{\Omega} (\kappa_{c} - \kappa_{c}') ds, \quad E_{si} = \int_{\Omega} (\kappa_{i} - \kappa_{i}') ds, \quad E_{p}, E_{in}
\]

\[
E = k_{sm} E_{sm} + k_{d} E_{d} + k_{c} E_{c} + k_{si} E_{si} + k_{p} E_{p} + k_{in} E_{in},
\]

Measured and detected values are enhanced by the filtering.

Then we apply the fitting method [5] to solve the optimization program.


7. Experimentation

The figure above is our experimental results with parameters that enhance parallelism. The step numbers indicate how many times the filtering & optimization were applied.

We have other experimental results with parameters that enhance curvature smoothness, collinearity and unsigned curvatures smoothness (which enhanced local similarity).

8. Results

Original contours → Result → Comparison → Experimental result by UI

9. Future Work

- Sensitive parameter setting
- Apply this to drawing application


