A Multi-level Sketch-based Interface for Decorative Pattern Exploration

Supplementary File: Methodology Details

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Shape Feature

When computing the distance between two Tensor descriptors, the empty cells of the input sketch are masked off. Since a sketch is usually much simpler than decorative images, this method can avoid the tendency for images that are as sparse as the sketch.

Reflection feature

Denoting the reflection feature of the input sketch as $V_{sketch}\{v_1, v_2, \dots\}$, the minimum distance between a unit vector $v \in V_{sketch}$ and another reflection feature V_{image} is

$$f(v, V_{image}) = min_{v_k \in V_{image}} \angle(v, v_k),$$

where $\angle(\cdot,\cdot)$ maps the angle between two vectors to $[0, \pi/2]$, and the result is set as the maximum $\pi/2$ if V_{image} is a null set. The sum of such minimum distances represents the distance from V_{sketch} to V_{image}, vice versa. Therefore, the distance between two reflection features is defined as

$$D_{ref} = \sum_{\hat{v} \in V_{sketch}} f(\hat{v}, V_{image}) + \sum_{v \in V_{image}} f(v, V_{sketch}) \cdot (1 - \alpha\beta),$$

where $\alpha = 0.5$ in our implementation.

Rotation feature

Denoting the specified rotation feature as C_{sketch} and another feature as C_{image}, the two rotation symmetries are hierarchical if

$$C_{sketch} \ mod \ C_{image} = 0$$

Translation feature

Denoting the translation feature as $T_{sketch}\{v_1, v_2, \dots\}$, the distance between it and another translation feature T_{image} is represented as

$$D_{trans} = \sum_{\hat{v}_i \in T_{sketch}} \left[min_{v_j \in T_{image}} \angle(\hat{v}_i, v_j) + \omega \left| |\hat{v}_i| - |v_j| \right| \right] + \lambda \sum_{v \in T_{image}} f(v, T_{sketch}),$$

where the weight $\lambda = 0.3$ in our implementation and ω is a binary number which equals to 1 when a lattice is sketched.