CO-LOCATING STYLE-DEFINING ELEMENTS ON 3D SHAPES

RUIZHEN HU¹ WENCHAO LI² OLIVER VAN KAICK³
HUI HUANG¹,² MELINOS AVERKIOU⁴ DANIEL COHEN-OR¹,⁵ HAO ZHANG⁶

¹ Shenzhen University ² SIAT ³ Carleton University
⁴ University of Cyprus ⁵ Tel Aviv University ⁶ Simon Fraser University
MOTIVATION

- *what* and *where* of style elements

**explicit** and **localized** geometric elements
MOTIVATION

• *what* and *where* of *style elements*

“a **distinctive** manner which permits the **grouping** of works into related **categories**”

-- Eric Fernie [1995]
INPUT

• A set of shapes organized into different style labels

Ming  Children  Japanese  European
• A set of *defining* elements for each style group
• A set of *defining* elements for each style group
**KEY IDEA**

\[ \text{localized} = \text{concrete surface patches} \]

\[ \text{defining} = \text{discriminative} + \text{complete} \]

- Iterative optimization
- Feature selection
RELATED WORK

Saliency detection

Style similarity measure

[Shtrom et al. 2013]

[Liu et al. 2015]

[Lun et al. 2015]
OVERVIEW

Initial elements

Candidate elements

Discriminative elements

Defining elements
INITIAL ELEMENTS

Geometric features
OVERVIEW

Initial elements → Candidate elements → Discriminative elements → Defining elements
CANDIDATE ELEMENTS

- Density peaks – frequently appearing
CANDIDATE ELEMENTS

- Density peaks – frequently appearing
CANDIDATE ELEMENTS

• Density peaks – frequently appearing

European

Ming
CANDIDATE ELEMENTS

- Element distance measure
  - Refinement: style-sensitive feature weights
CANDIDATE ELEMENTS

- Element distance measure
  - Refinement: style-sensitive feature weights

Nearest Neighbors (after):
OVERVIEW

Initial elements → Candidate elements → Discriminative elements → Defining elements
DISCRIMINATIVE ELEMENTS

- Element selection – “feature” selection

![Diagram showing element selection and combination examples]

- E1 + E2 + E3
- E1 + E3 + E5
- E4 + E2 + E5
DISCRIMINATIVE ELEMENTS

- Shape representation – bag-of-words model
DISCRIMINATIVE ELEMENTS

- Feature selection + classification per style

Positive

Negative
OVERVIEW

Initial elements → Candidate elements → Discriminative elements → Defining elements
DEFINING ELEMENTS

• Iteratively combine the selected discriminative elements:

iter #1:

Positive

Negative
DEFINING ELEMENTS

• Iteratively combine the selected discriminative elements:

iter #2:

Positive

Negative
DEFINING ELEMENTS

- Iteratively combine the selected discriminative elements:

iter #3:

Positive: [Chair, Crib, ...]

Negative: [Sofa, Stool, ...]
RESULTS

• Positive defining elements for European furniture
RESULTS

• Positive defining elements for Ming furniture
RESULTS

• Examples of style-defining elements

(a) Furniture

(b) Drinking vessels

(c) Cars

(d) Furniture legs

(e) Buildings
EVALUATION

- Defining element **occurring frequency**
  - Entry \((i, j)\): average percentage of defining elements of style \(i\) that appear in shapes of style \(j\)
EVALUATION

- Defining element occurring frequency
EVALUATION

- Style classification accuracies (discriminative)
STYLE-AWARE APPLICATIONS

• Style-revealing scalar field
STYLE-AWARE SAMPLING

- Place more samples on style-related regions
STYLE-REVEALING VIEW SELECTION

Style-revealing viewpoints

Saliency-based viewpoints
STYLE-DRIVEN MODELING

[Diagram of various stylistically driven modeling examples]
CONCLUSION

• **Localized style-defining elements**
  – Localized = concrete surface patches
  – Defining = discriminative + complete

• A novel iterative method based on feature selection

• **Style-aware** applications
LIMITATION AND FUTURE WORK

• Initial elements are local and isotropic patches
  – Anisotropic, structural, and more global

• The defining elements of a style are not intrinsic to the style, but are defined relative to other styles
  – Explore in an intrinsic manner and from a set of example shapes with a single style
THANK YOU!

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