

PolyU COMP – HKUST (GZ) INFH Research Student Conference: The Future in an AI-Driven World

POSTER NO. 96

Computational Interpretation of Chinese Calligraphy Layout via Graph- Based Modeling and Language Models

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Abstract

Can machines meaningfully describe Chinese calligraphy? We present a layout-centered framework that transforms spatial features of calligraphic works into interpretable textual commentary. By detecting characters, building a graph structure over the composition, and prompting a language model through a controlled two-step process, the system links visual structure to traditional aesthetic principles. A case study and expert interview assess its validity and limitations.

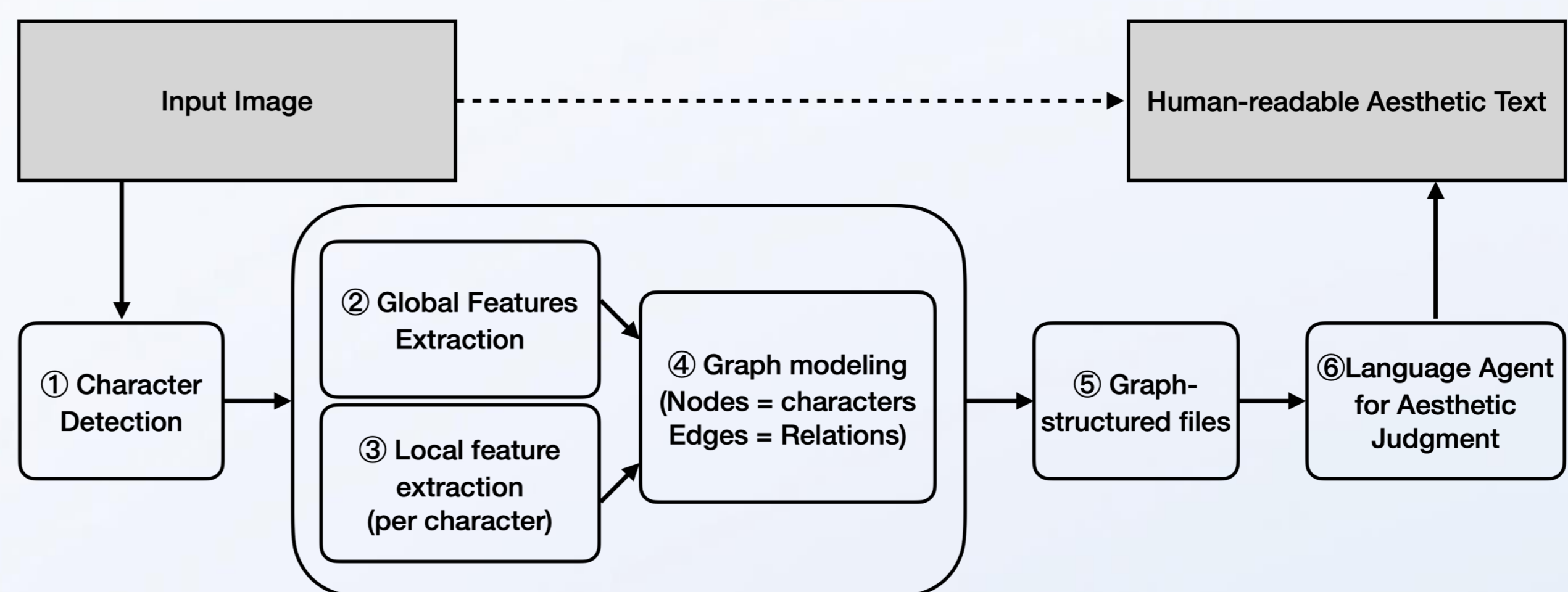
Motivation & Research Question

Most computational work on calligraphy focuses on stroke style or font classification. However, composition, spacing, alignment, white space—is central to how calligraphy is read and appreciated. Thus, we ask: **Can a machine read the spatial rhythm of a calligraphy piece and generate human-like commentary based on traditional aesthetics?**

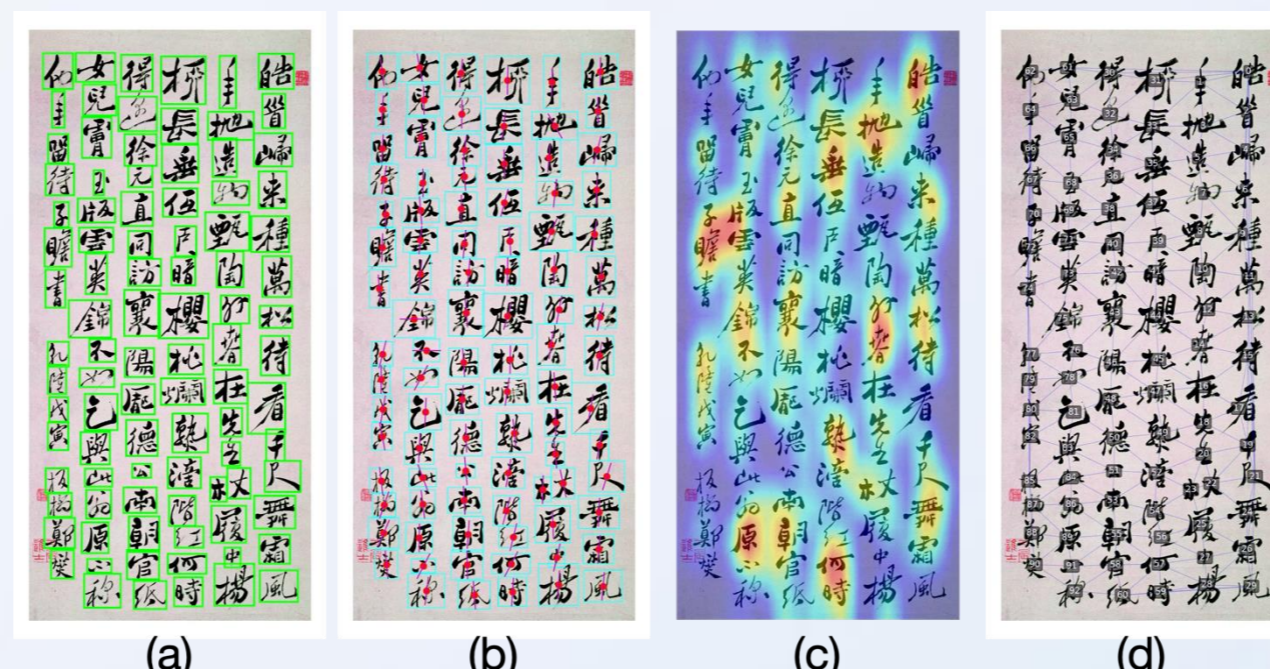
Contributions & Takeaways

- Propose a **graph-based spatial model** of calligraphy layout
- Link layout metrics to human-readable commentary
- Show that **visual structure alone** provides rich interpretive cues
- Reveal gaps between computed structure and expert judgment
- Lay groundwork for computational aesthetics in traditional art domains

Method: Our Framework



Case Study



```
file_graph.json
nodes (List)
- cx, cy, w, h
- shape, tone, symmetry
- asking, ang, tilt
- features: ink, lptex, hqf, ...
- points (List of [x,y])
...
node_2

file_graph.gexf
<gexf>
<graph>
<nodes>
<node id="0" label="char" />
<node id="1" label="char" />
...
</nodes>
<edges>
<edge source="0" target="1" />
...
</edges>
</graph>
</gexf>
```

Prompting Guidance

Step 1
Prompt: You are a digital calligraphy analysis officer. The following is a graph file of calligraphy descriptions, with fields simplified. Please decode + analyze + only return a JSON that you have learned.

Step 2
Prompt: You are a digital calligraphy analyst, skilled at translating structured data into calligraphic commentary. Please generate 7 short Chinese commentaries based on the summary and artwork data.
*Summary sentence (under 50 characters, using traditional calligraphy terms)
*Example sentence (under 50 characters, citing no more than 4 IDs)
Continue in this format for all 7 dimensions listed below. Do not use numbers, technical field names, evaluative language, or suggestions. Avoid poetic or vague expressions. Maintain a factual, instructional tone.
Dimension List:
1. Composition Balance and Margins. Definition: ...
2. Line Continuity and Spacing Rhythm. Definition: ...
3. Ink Contrast and Rhythmic Flow. Definition: ...
4. Density and Structural Echo. Definition: ...
5. Character Tension and Ink Layers. Definition: ...
6. Interline Dialogue and Breath Flow. Definition: ...
7. Character Tilt and Vertical Axis Flow. Definition: ...

Expert Feedback

We interviewed 2 university-level calligraphy teachers (10+ years of experience). The session followed a semi-structured format (60 mins, recorded).

Findings

✔ **Structure matches visual intuition**

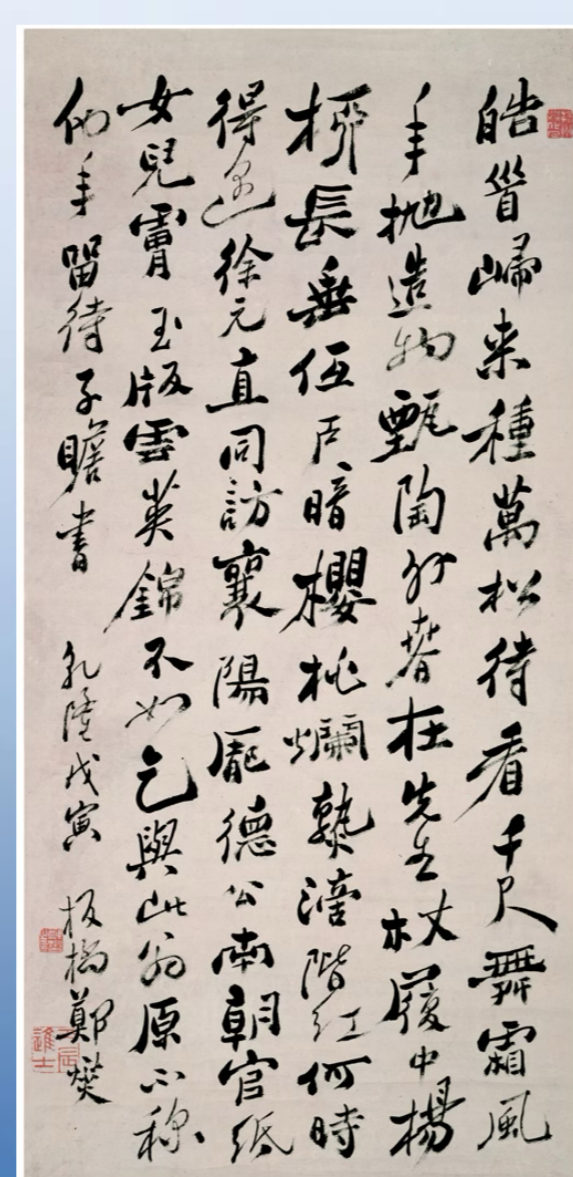
Expert praised the heatmap for expressing “虚实对比” (contrast between full and empty).

✔ **Commentary is beginner-friendly**

Model output could help students learn basic composition.

⚠ **Lexical mismatch**

Some terms felt too technical. She preferred “气息” over “呼吸感” to describe flow.



1. Composition and White Space

The overall structure has a stable central axis, with slightly wider margins on the sides and tighter spacing at the top and bottom. For example, id=0 and id=74 are placed at the edges, forming a horizontally stretched visual boundary.

2. Line Flow and Spacing

Each line of characters is aligned neatly, with even spacing between characters within the lines. From id=3 to id=27, the sequence forms a clear visual path, supporting a smooth line rhythm.

3. Ink Contrast and Rhythmic Energy

The variation of dark and light ink strokes creates contrast and enhances visual energy. For example, id=14 is deeply inked and visually heavy, while id=30 is lighter, forming a dynamic balance.

4. Density Balance and Structural Echo

The layout features a clear rhythm in both dense and sparse areas, creating a dynamic tension. Characters like id=12, id=13, and id=14 are placed closely, while nearby regions like id=16 are more open, creating diagonal echoes.

5. Character Structure and Ink Layers

The character shapes alternate between expansion and contraction, with visible layering in ink tone. For instance, id=31 expands outward with rich ink, while id=33 is more compact and lighter, forming a complementary contrast.

6. Line Interaction and Flow Continuity

There is visual alignment and staggered interplay between lines, maintaining continuity of energy. id=35 and id=37 visually respond to each other horizontally, and also connect upward to id=5, enhancing flow.

7. Tilt and Axis Movement

Some characters show a slight tilt, but the central axis remains stable overall, with natural visual motion. For example, id=23 leans slightly left, while id=25 stays upright, creating a contrast in tilt.