Ouyang Xun’s Genuine Handwriting Restoration from Ancient Rubbings and Vectorized Shape Description

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Outline

I. Background
II. Introduction
III. Ouyang Xun and His Creations
IV. Vectorized Shape Description of Handwriting
V. Modern Image Processing Techniques
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I. Background (1/3)

Eastern Asian calligraphy

- The word "calligraphy" is transliterated from the Greek words meaning "beautiful writing."

- The art of calligraphy originated and developed from China, specifically the ink and brush writing of Chinese characters.

- Calligraphy is widely practiced and revered in the East Asian civilizations that use or used Chinese characters. These include China, Japan, Korea, and to a lesser extent, Vietnam.
I. Background (2/3)

Major Chinese script styles

- Regular
- Clerical
- Semi-cursive ("running")
- Cursive (Grass)
I. Background (3/3)

Major Chinese script styles (cont.)

Regular  Clerical  Semi-cursive ("running")  Cursive (Grass)

永示彌多
II. Introduction (1/5)

- Main ancient calligrapher of regular script

Yan Zhenqing  Liu Gongquan  Ouyang Xun
II. Introduction (2/5)

- Some calligraphy documents are imitated by later generations

Calligrapher Yan Zhenqing, (709–785) Tang Dynasty.  
Tan Yankai (1880~1930)
II. Introduction (3/5)

- Some current computer fonts
II. Introduction (4/5)

- Some current computer fonts lack the value of calligraphy art
II. Introduction (5/5)

- The desired computer font of Ouyang Xun’s regular script
III. Ouyang Xun and His Creations (1/9)

- Ouyang Xun’s ancient rubbings in different periods.

**Huangfu Dan Bei**

**Jiuchenggong**

**Lichuan Ming**

**Yu Gong gong**

**Wen Yanbo bei**
III. Ouyang Xun and His Creations (2/9)

- Characters comparison of different periods.
III. Ouyang Xun and His Creations (3/9)

Structure classification of handwriting

- Type 1: Inseparable type

- Type 2: left to Right
  - 1:1
  - 1:2
  - 2:1
  - 1:1:1
III. Ouyang Xun and His Creations (4/9)

- Structure classification of handwriting (cont.)

- Type 3: Top to Bottom
  - 1 : 1
  - 1 : 2
  - 2 : 1
  - 1 : 1 : 1
III. Ouyang Xun and His Creations (5/9)

- Structure classification of handwriting (cont.)

**Type 4: Surrounded**

- Totally surrounded
- L-U-R surrounded, L-D-R surrounded
- U-L-D surrounded, **U-L surrounded**
- L-D surrounded, U-R surrounded

![Diagram of surrounded structures]

![Examples of surrounded handwriting]

右左危名在存有君
孝局府原痛著廣属
III. Ouyang Xun and His Creations (6/9)

- Radical Extraction

Some word parts in different structure type have different layout.
III. Ouyang Xun and His Creations (7/9)

Radical Extraction

from ‘Wen Yanbo bei’
III. Ouyang Xun and His Creations (8/9)

- Radical Extraction
  from ‘Wen Yanbo bei’ (cont.)
III. Ouyang Xun and His Creations (9/9)

- Character Combination

言 + 焦 → 譙
IV. Vectorized Shape Description of Handwriting (1/4)

- The zigzag phenomenon when a Bitmap image is enlarged
IV. Vectorized Shape Description of Handwriting (2/4)

- Vectorized image will prevent the zigzag phenomenon
- Handwriting is recorded in mathematic equations
- The handwriting will keep in a smooth condition
IV. Vectorized Shape Description of Handwriting (3/4)

- Bezier Curves
IV. Vectorized Shape Description of Handwriting (4/9)

- **Polynomial Curve fitting**

\[ y = p_2 x^2 + p_1 x + p_0 \]

\[ y = p_3 x^3 + p_2 x^2 + p_1 x + p_0 \]
V. Modern Image Processing Techniques (1/2)

- Median filtering

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<th>50</th>
<th>65</th>
<th>52</th>
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</thead>
<tbody>
<tr>
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<td>58</td>
</tr>
<tr>
<td>61</td>
<td>60</td>
<td>57</td>
</tr>
</tbody>
</table>

![Example of Median Filtering](image)
V. Modern Image Processing Techniques (2/5)

- Edge Detection
  - Canny Method
VI. The proposed Matlab GUI-based system (1/2) -- for restoration and vectorization of Ouyang Xun’s Genuine Handwriting
VI. The proposed Matlab GUI-based system (2/2)

- The interior file format example

- lengthdata : 5 4 5 3

- xxdata : 132 147 165 179 198......

- yydata : 107 105 101 95 91......

5

(132,107) (147,105) (165,101) (179,95) (198,91)

4

(133,107) (135,111) (138,118) (142,124)

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VII. Conclusions

- Computer fonts should improve its value of calligraphy art
- Ancient calligraphers' work should be restored and vectorized by modern techniques
- Structure classification and radical extraction can help the character combination
- A GUI-based system can help experts to finish the above work
- Video Demo
A little cultural exchange event

http://www.zennichishodou.com/cgi-bin//shodou/sitemaker.cgi?
mode=page&page=page1&category=0
Thank you for your attention!