Supplementary Materials

To make the transferability guidance operational, we created Table : "Comparison Table of AIGC System Implementation Parameters for Different Types of Intangible Cultural Heritage" with the following structure:

Table Dimensions:

1. **Implementation Phase**: Data Preparation, Algorithm Development, Interaction Design, Evaluation
2. **Key Tasks**: Specific activities required at each phase
3. **Standards/Parameters**: Quantitative specifications (e.g., dataset size, LoRA rank, training steps)
4. **Quality Indicators**: Performance benchmarks (FID, PSNR, cultural fidelity)
5. **Time Estimation**: Resource planning guidance
6. **Domain Examples**: Concrete specifications for Traditional Embroidery and Calligraphy Art
7. **Key Adaptation Principles Demonstrated:**

1. **Style-Based Parameter Adjustment**

(1) **Highly structured patterns** (textiles, embroidery): Lower LoRA rank (r=32-64), higher constraint weights (α=0.7-0.9)
(2) **Fluid artistic styles** (calligraphy, ink painting): Higher LoRA rank (r=64-128), moderate constraints (α=0.5-0.7)

2. **Data Scaling with Complexity**

(1) Heritage types with richer style variations require larger datasets (4,500-5,500 samples)
(2) More standardized forms can work with smaller datasets (3,000-4,000 samples)

3. **Cultural Constraint Design**

(1) Each domain requires identification of 3-5 core cultural rules (analogous to Cizhou kiln's "three-seven composition")
(2) Rules implemented as soft constraints with validation frequency every 10-20 denoising steps

Example Specifications Provided:

1. Traditional Embroidery:

(1) Parameter configuration: r=48, α=0.75, steps=25K
(2) Cultural constraints: Stitch density 150-200/cm², color transition smoothness >0.85
(3) Annotation dimensions: 18 stitch techniques, traditional 18-color spectrum, regional styles (Su, Xiang, Shu embroidery)

2. Calligraphy Art:

(1) Parameter configuration: r=64, α=0.80, steps=30K
(2) Cultural constraints: Stroke coherence verification, structural proportion checking
(3) Annotation dimensions: 5 script styles, 8 stroke types, different calligraphic schools

Table: Comparison Table of AIGC System Implementation Parameters for Different Types of Intangible Cultural Heritage

Implementation stage	Key tasks	Specific standards/parameters	Quality indicators	Time estimation	Example: Traditional embroidery	Example: Calligraphy art
Phase 1: Cultural Analysis	Work with inheritors to identify core aesthetic principles and define target users	Interview with inheritors :≥3 people Literature review :≥10 core papers User research :n≥100	Cultural rule extraction :3 to 5 items User demand coverage rate :≥80%	2-3months	Core rules: Stitch density, color matching system, composition and layout	Core rules: Stroke order standardization, structural proportion, and ink color gradation
Phase 2: Data Preparation	Multi-source data acquisition Quality screening duplicate removal Division of multi-dimensional annotation datasets	Data size: Minimum sample :3,000-5,000 Resolution :≥1024×1024 Diversity :≥80% style coverage Annotation dimensions: Morphological classification, pattern semantics, composition rules, cultural attributes, technical features Quality control: Expert review :2-3 people Cohen's Kappa:≥0.80 Deduplication threshold: Similarity >95%	Effective sample rate :≥90% Annotation consistency :≥0.80 Data division: Training 80%/ validation 10%/ Testing 10%	3-4months	Annotation example: Acupuncture techniques: flat stitch, even stitch, snatching stitch, etc., totaling 18 types Subject matter: Flowers and birds, figures, landscapes Color series: Traditional 18-color spectrum Regions: Suzhou embroidery, Xiang embroidery, Shu embroidery	Annotation example Calligraphy styles: regular script, running script, cursive script, clerical script, seal script Strokes: horizontal, vertical, left-falling, right-falling, etc. 8 types Structures: single body, left-right, up-down, etc Schools of thought: Yan, Liu, Ou, Zhao
Phase 3: Algorithm Development	Select the basic model Design constraint mechanism LoRA fine-tuning Iterative optimization	Basic model :Stable Diffusion-XL Highly structured pattern: LoRA rank r: 32-64 Cross-attention α: 0.7-0.9 Training steps :20K-30K Fluidity style: LoRA rank r: 64-128, cross-attention α: 0.5-0.7, training steps :30K-50K Cultural constraints: Core rules :3-5 Constraint weights :0.3-0.8 Verification frequency: Every 10-20 steps Hardware configuration: <5K sample GPU >10K sample :4×A100	FID: <30 PSNR: >35 dB Cultural Fidelity :>85% Generation speed :<20 seconds The accuracy rate of composition rules :>90%	4-6months	Parameter configuration :r=48, α=0.75, steps =25K, training duration :13 hours, Constraint mechanism: Pin density :150-200 pins /cm² Color transition: Smoothness >0.85	Parameter configuration :r=64, α=0.80, steps =30K Training duration :15 hours Constraint mechanism: Verification of stroke coherence, structural proportion check
Phase 4: Interaction Design	Application guidance framework Embed cultural knowledge Progressive architecture user testing	Design principles: Multi-level guidance progressive information disclosure, embedded presentation of cultural knowledge User testing: Sample size :n≥20 Task completion rate target :≥85% Operation error rate :<5%	SUS score :≥70 Task completion rate :≥85% Learning time :<15 minutes User Satisfaction :≥4.0/5.0	3-4months	Interface features: Visualization of acupuncture techniques Real-time density feedback of the selector Color scheme recommendation	Interface features: Stroke order animation demonstration Pressure-sensing simulation of structural grid assistance
Phase 5: Evaluation and Verification	Technical performance testing Research on the Cultural Effectiveness of Usability Evaluation Co-creation Experience Survey	Evaluation method: Comparative experiment :n≥100 Expert evaluation :n≥20 Questionnaire survey: Standardized scale In-depth interview :n≥15	Technical indicators FID and PSNR meet the standards Availability metrics SUS≥70 Cultural effectiveness: Knowledge accuracy rate increases by more than 30% Interest level increase >50% Experience index :MICSI≥5.0	2-3months	Expected effect: Cultural cognition accuracy rate: Over 90% User retention intention: Over 80% Work sharing rate: over 75%	Expected effect Mastery of brushwork: Over 85% Creation completion rate: Over 90% Willingness to continue using :Over80%

Practical Transferability Checklist for ICH Practitioners

To assist researchers in applying this framework to other ICH domains, we provide a systematic assessment checklist:

Phase 1: Domain Suitability Assessment

(1) Visual heritage with pattern、style characteristics.
(2) Sufficient archival materials (minimum 3,000 samples achievable).
(3) Identifiable core aesthetic rules (3-5 codifiable principles).
(4) Access to domain experts、inheritors for validation.

Phase 2: Resource Requirements

(1) Computational resources: Minimum 1×RTX 4090 GPU (or cloud equivalent).
(2) Time investment: 12-18 months for complete implementation.
(3) Team composition: 1 AI engineer + 1 cultural expert + 1 designer.

Phase 3: Adaptation Decision Tree

(1) IF heritage has highly structured patterns (textiles, ceramics, architecture):
Use r=32-64, α=0.7-0.9, dataset minimum=3,000.
(2) ELSE IF heritage has fluid artistic styles (calligraphy, painting, dance notation):
Use r=64-128, α=0.5-0.7, dataset minimum=4,500.