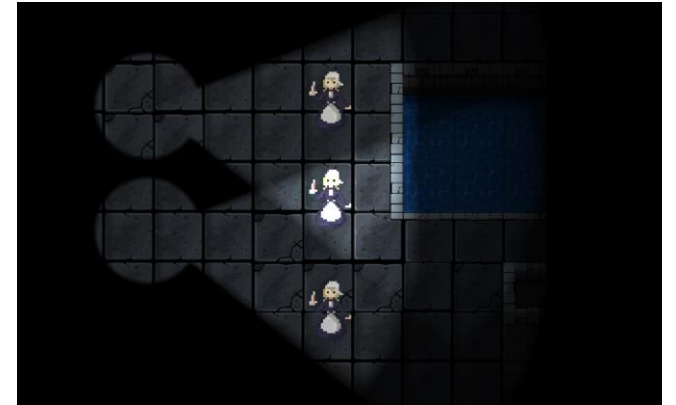*Generating Digital Painting Lighting Effects via RGB-space Geometry*
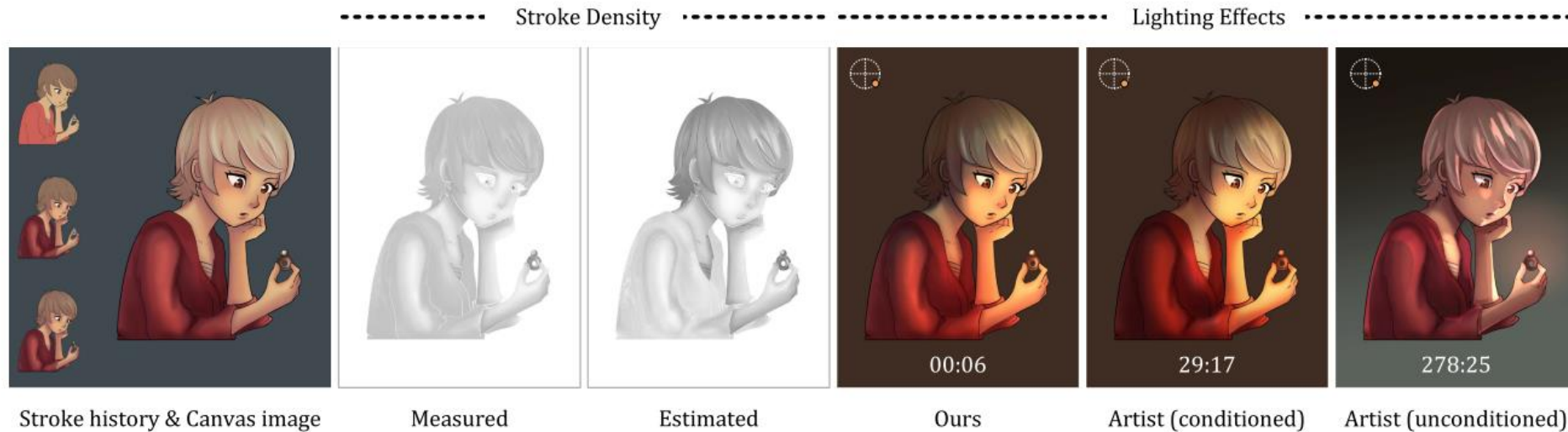
2021220160 황제웅

Motivation of paper Selection

- Algorithmically generates sprite lighting
  - Such effect required unintuitive normal drawing or complex operation

- Algorithm? Not deep learning?

- No normal?

Abstract

Stroke Density · Lighting Effects

Stroke history & Canvas image | Measured | Estimated | Ours 00:06 | Artist (conditioned) 29:17 | Artist (unconditioned) 278:25

- Algorithmically generating lighting effects from digital painting

- via Estimating "Stroke Density"

Introduction: topic

- Lighting effect takes a lot of effort
  - Automation of lighting effect is an interesting topic

DeepNormal   SpriteLamp

Introduction : methodology
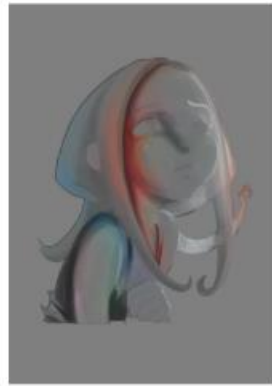

Artists' workflow
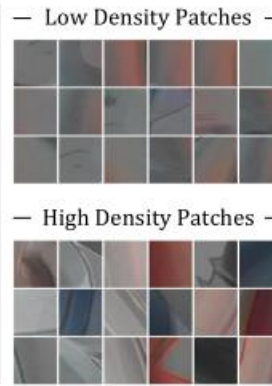
(a) Artist's real stroke history

(b) Measured stroke density

(c) Artist's coarse effect layer

(d) Artist's refined effect layer
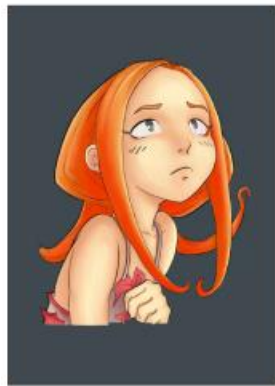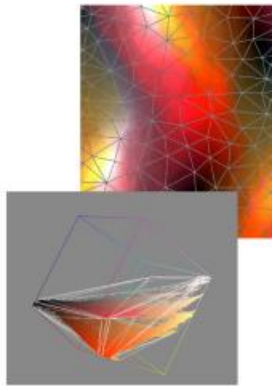
(e) Visualization of painted patches

— Low Density Patches —

— High Density Patches —

(f) Artist's final lighting effect

(g) Effect created with another style

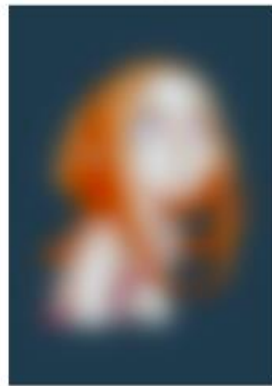33:24
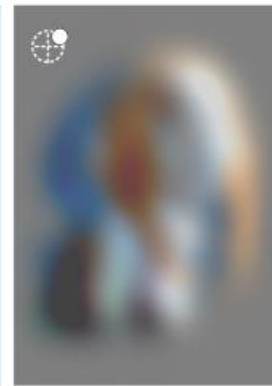
241:59

Proposed Algorithm

(h) Original image **(R)**

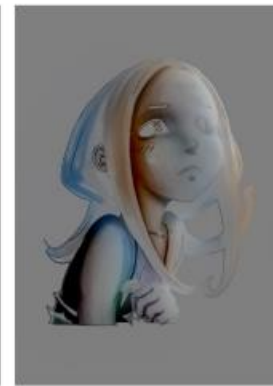(i) Extracted palette **(M)**

(j) Estimated stroke density **(K)**

(k) Normalized channel intensity **(N)**
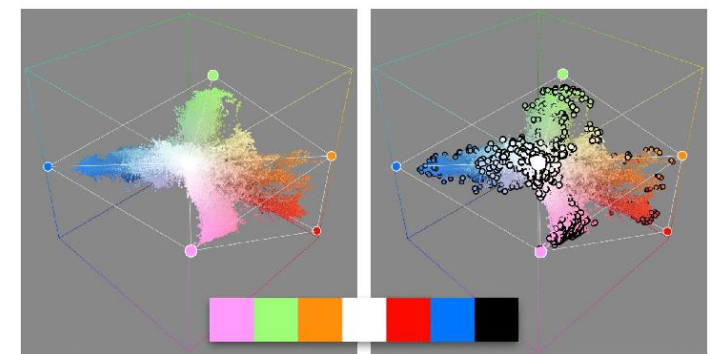
(l) coarse lighting effect **(E)**

(m) Refined lighting effect **(S)**

(n) Output **(I)**

Approach : Stroke Density

- Palette Extrication
  - Mapping RGB space into 3D and making convex hull
- Determine mix of color by palette
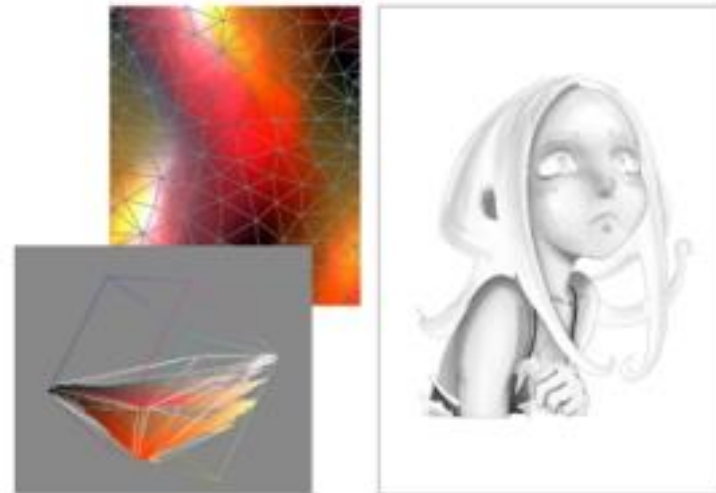
RGB Convex Hull Vertices   RGBXY Convex Hull Vertices

Approach : Lighting Effect

- Using 'blurred' channel intensity*,
  generate coarse lighting effect w/ shape-from-shadow
  algorithm.

- Multiply stroke density and coarse lighting layer to gain
  lighting effect.
  - Hadamard product
  - Ambient intensity
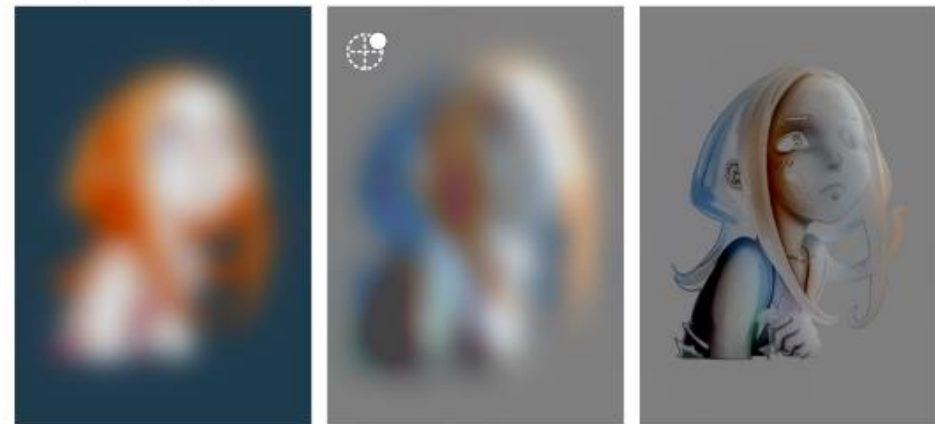
Approach : Lighting Effect

- Multiply effect to image to get final result

Experiment : Qualitive

Stroke Density ···· Lighting Effects

| Original Image & Stroke History | Measured | Estimated | Ours | Artist (Conditioned) | Artist (Unconditioned) |
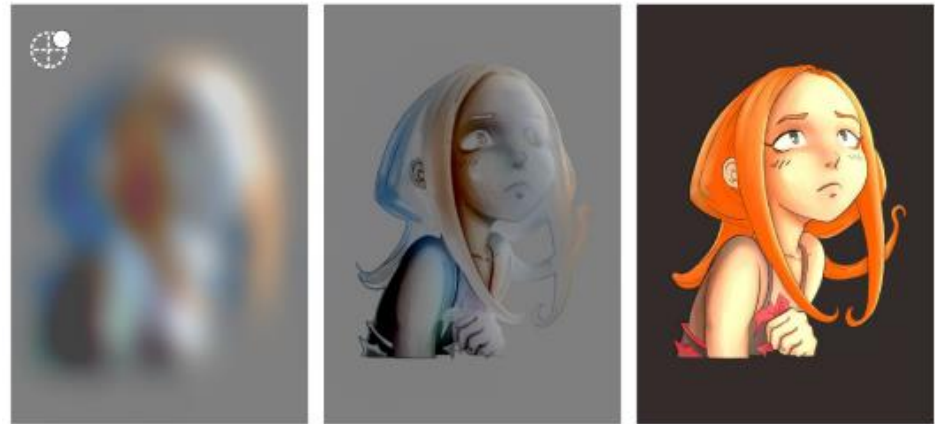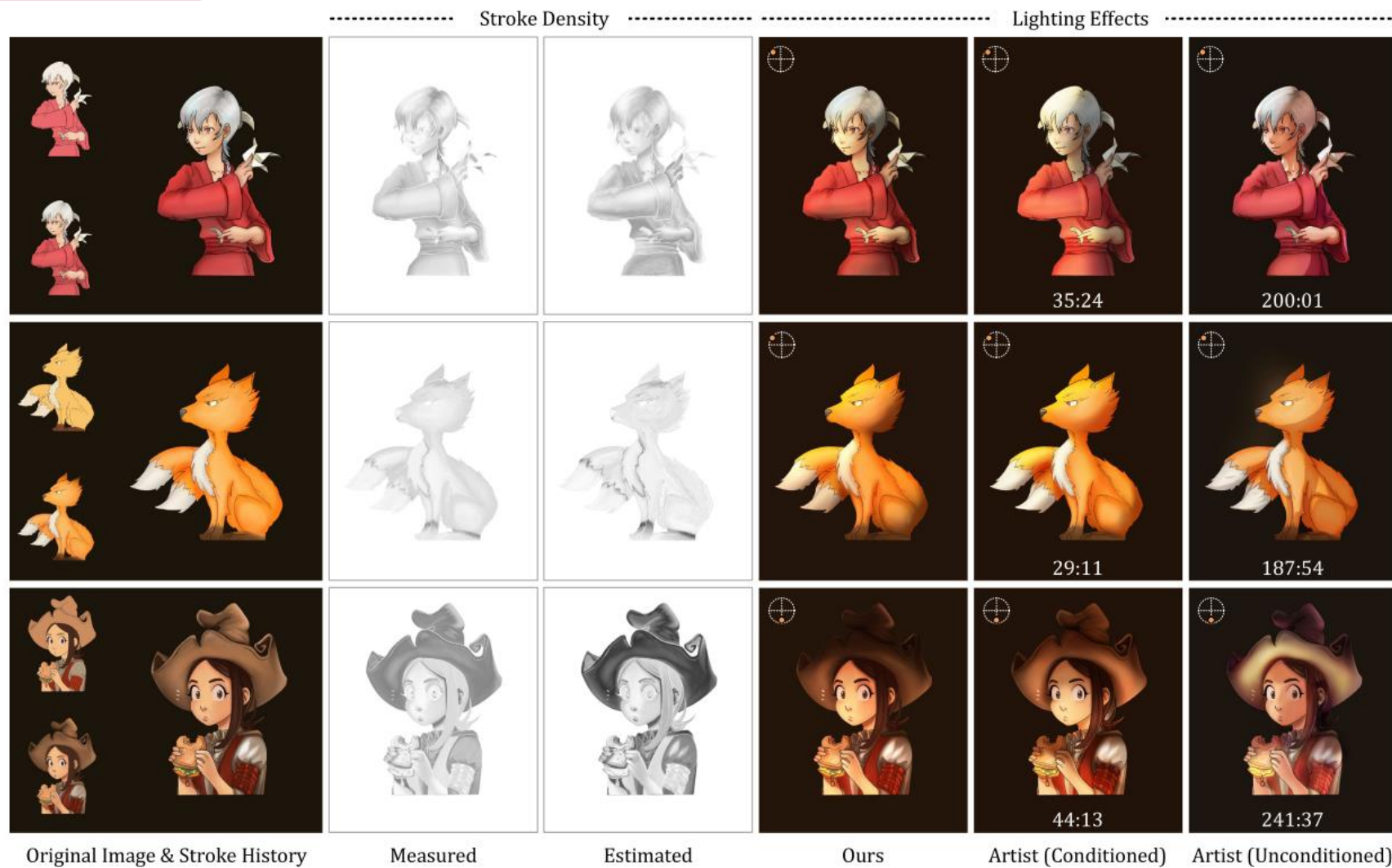
Experiment : Connection among Colors, Strokes and Manually Painted Artistic Lighting Effects

- Uses PSNR
  - roughly 26

Experiment: Significance of Using Stroke Density

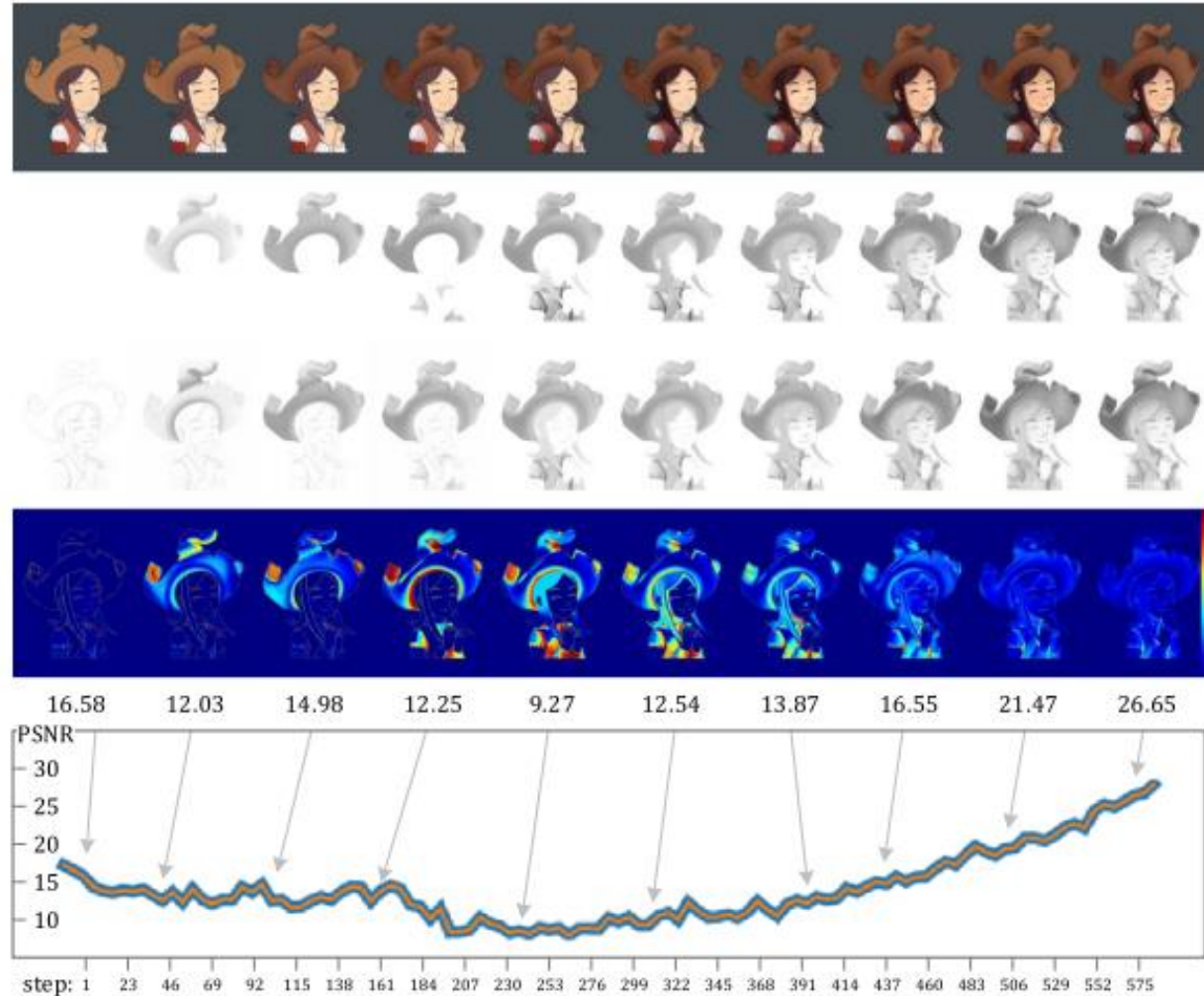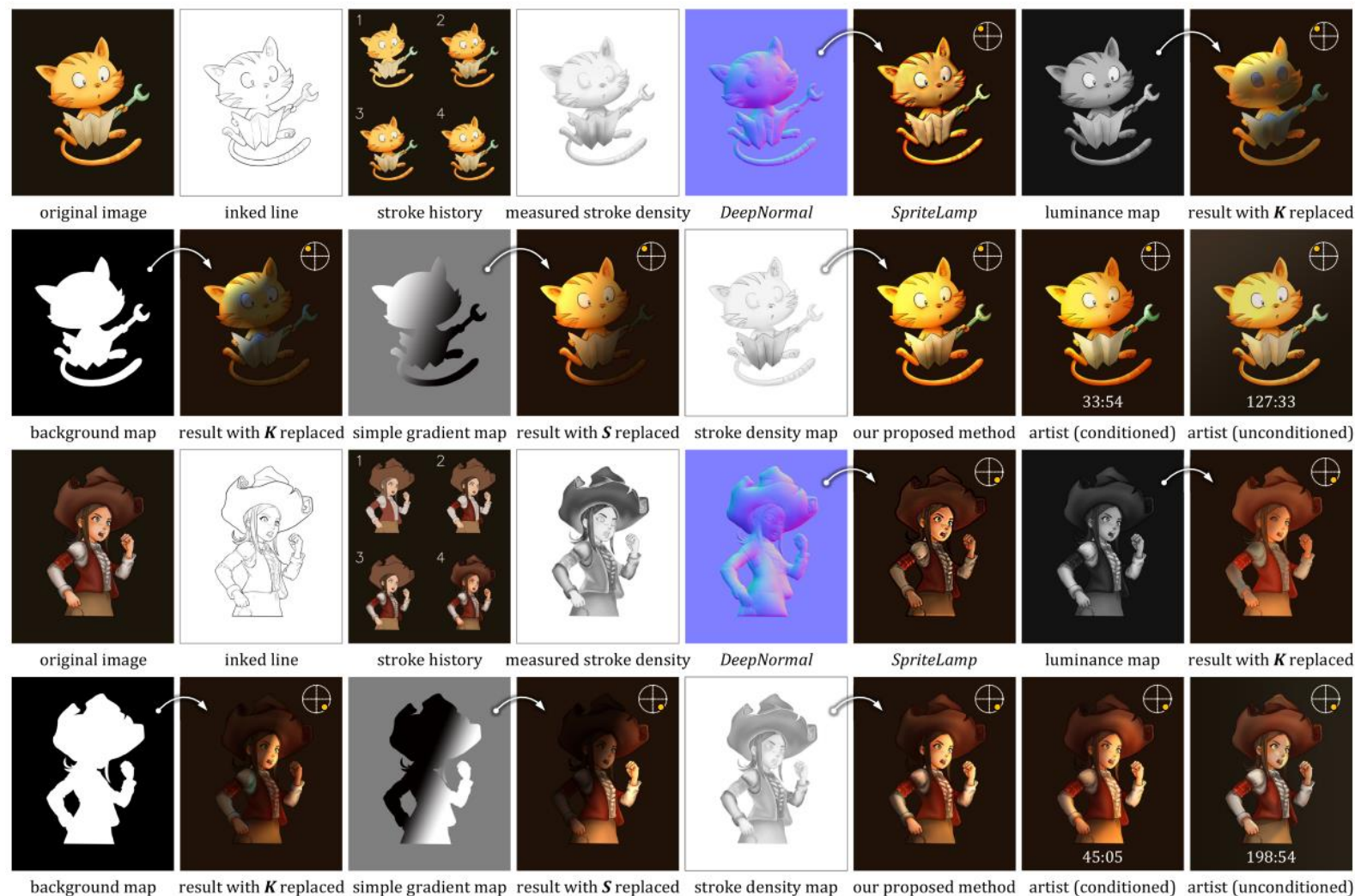| original image	inked line	stroke history	measured stroke density	*DeepNormal*	*SpriteLamp*	luminance map	result with *K* replaced
background map	result with *K* replaced	simple gradient map	result with *S* replaced	stroke density map	our proposed method	artist (conditioned) 33:54	artist (unconditioned) 127:33
original image	inked line	stroke history	measured stroke density	*DeepNormal*	*SpriteLamp*	luminance map	result with *K* replaced
background map	result with *K* replaced	simple gradient map	result with *S* replaced	stroke density map	our proposed method	artist (conditioned) 45:05	artist (unconditioned) 198:54

Experiment: Comparison with Non-digital-painting Relighting

Original Image — Surface Optimizing (Wu et al. 2008) — CNN Normal Estimation (Yu & Smith 2019)— Generated Digital Painting Effects (ours)—
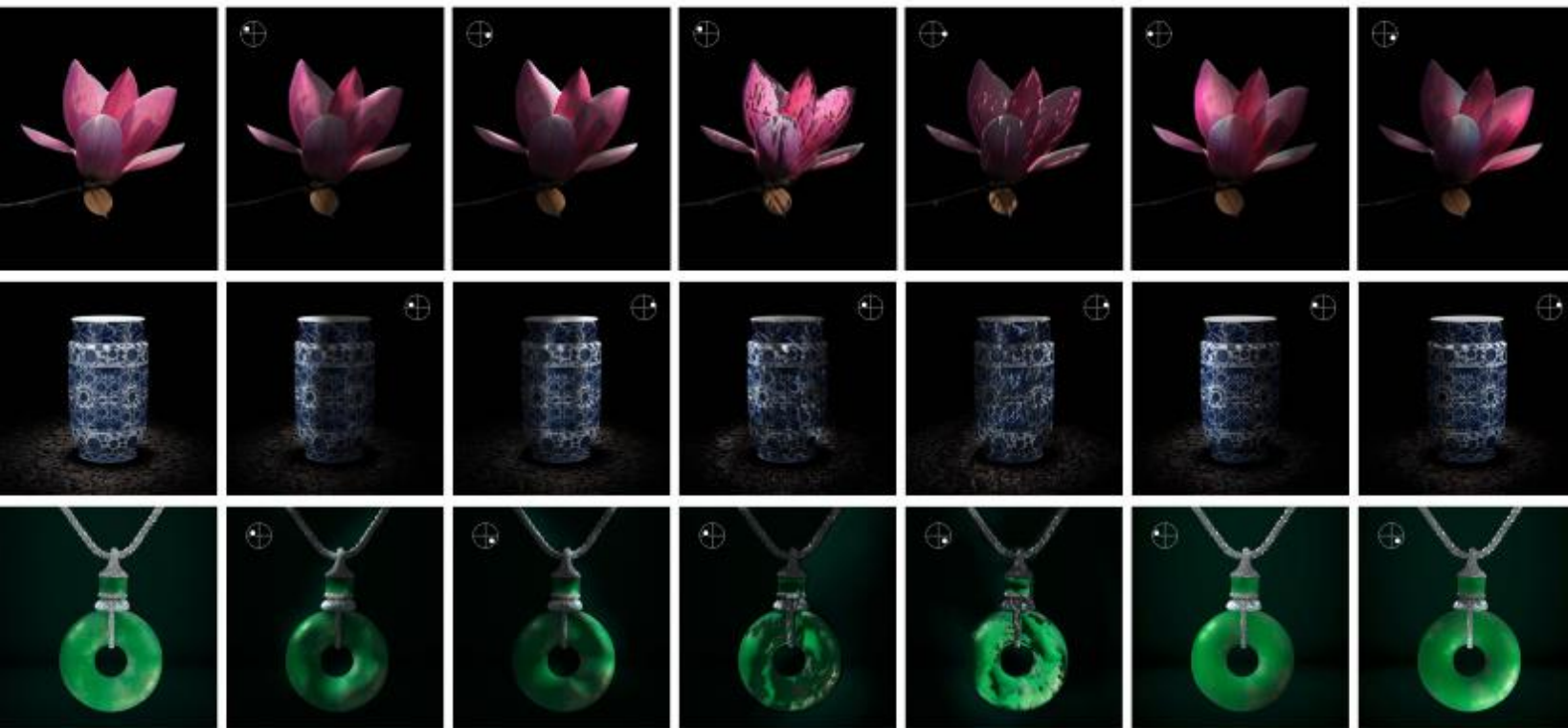
Original   Kender&Smith 1984   Ours   Ours

Experiment: Perceptual User Study

- Time
  - time takes to make the lighting effect
- PT
  - photoshop hand-redraw lighting effect

Single Tool / Combinations	Time (s)	Preference Rank
[Kender and Smith 1992]	14.4	1.8 ± 0.4
[Wu et al. 2008]	18.1	3.0 ± 0.0
[Yu and Smith 2019]	24.6	1.2 ± 0.4
Ours	**7.2**	**4.0 ± 0.0**
Professional Tool (PT) only	46.6	4.1 ± 0.3
PT + [Kender and Smith 1992]	66.8 + 14.4	1.8 ± 0.4
PT + [Wu et al. 2008]	58.5 + 18.1	3.0 ± 0.0
PT + [Yu and Smith 2019]	73.7 + 24.6	1.2 ± 0.4
PT + Ours	**17.9 + 7.2**	**4.9 ± 0.3**

Limitation

- Halos
- Hard Shadows

| Original Image | Lighting Effect | Output |

| Original image | Lighting effects | Ours |

Thank you

GENERATING DIGITAL
PAINTING LIGHTING EFFECTS
VIA RGB-SPACE GEOMETRY