FlatMagic: Improving Flat Colorization through AI-driven Design for Digital Comic Professionals

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https://github.com/Nauhcnyay/flat_magic_backend
Comic Industry shifting from Paper to Digital

[Image source: Manga109 Dataset]

[Image source: Studio Zilpung]
Problems in AI-assistant Drawing

[Qu et al. 2005]

(a) Input
(b) Flood-fill
(c) Optimization
(d) Our result

[Shi et al. 2020]

Furusawa et al. 2017

[Zhang et al. 2018]

(Zhang et al. 2020)

(d) Data-driven Colourisations

[Zheng et al. 2020]

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Formative Study: Interviews about Colorization

5 Professional Cartoon Artists

1 hour each

Understand

- Workflow
- Challenges
- Perception of AI tools
- Feature wish list
- Factors behind intention to adopt
Common Workflow in Comic Colorization

Line Drawing  Flatting  Shading  Lighting  Special Effects
What is Flatting / Flat coloring?
Flat Consistency
Flat Completeness

Complete Segmentation
Flat Completeness

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Why AI-driven Tools Don’t Help?

Style2Paint
[Zhang et al, 2018]

Colorization Instructions

Adjustment
Formative Study (S1) - Conclusion
Formative Study (S1) - Conclusion

Costly
Manual
Flatting

Costly
Adjustment
Formative Study (S1) - Conclusion

Automate Flatting

FlatMagic Adjustment
Formative Study (S1) - Conclusion

Automate Flatting

FlatMagic Adjustment

Manual Further Colorize

Manual Adjustment

Style2Paint [Zhang et al, 2018]
Formative Study (S1) - Conclusion

Automate Flatting

FlatMagic Adjustment

Manual Colorize

Manual Adjustment

Style2Paint [Zhang et al, 2018]
Flat Magic – Neural “re”drawing

Input

Naive Bucketing

Flatting Result

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Flat Magic – Neural “re”drawing

Input

Neural Redrawing

Simplified Line Drawing

FlatMagic Bucketing

Ideal Flatting Result
Flat Magic – Automate Initial Flatting

Input
Neural redrawing
Trapped ball Filling
Post processing
Flat Magic – User Interface
Experimental Study – Flattening Time

More people close to the bottom (used less time) is better

Baseline

FlatMagic
Experimental Study - Flatting Quality

Color match test

Shape match test

More pass result is better

Baseline

FlatMagic
Intermediate Representation

AI Over-Scoping

Input

Stage 1 | Stage 2 | Stage 3 | Stage 4 | Stage 5

Scope of automation

Difficult and Costly

Easy and Cheap

Output
Intermediate Representation

**AI Over-Scoping**

**Intermediate Representation**

**Easy and Cheap**

**Difficult and Costly**

Stage 1  Stage 2  Stage 3  Stage 4  Stage 5

Scope of automation

Stage 1  Stage 2  Stage 3  Stage 4  Stage 5

Scope of automation 1

Scope of automation 2

Easy and Cheap
Intermediate Representation

#1. **Understand** a detailed, stage-by-stage workflow
#2. Then consider the **AI usefulness** and the **User intention** for a given AI tool
The most promising tool. Likely to be adopted.
Find a better strategy to convince a user to adopt.

The most promising tool.
Likely to be adopted.
AI/intention quadrant

The most promising tool. Likely to be adopted.

Find a better strategy to convince a user to adopt.

Find a more reasonable automation scope for AIs first.
AI/intention quadrant

Positive Intention

Useful AI

The most promising tool.
Likely to be adopted.

S1

Negative Intention

Not Useful AI

“Back to the drawing board.”

Find a better strategy to convince a user to adopt.

S2

Find a more reasonable automation scope for AIs first.

S3

S4
#3. **Be careful of merging the automation scope** when building the tool.
Collaborators

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Thanks for listening
Flat Magic - Automate Initial Flatting
Experimental Study - Flatting Time Improvement

People Groups with different skills

Line Drawing Groups with different complexities

Very fast  Fast  Average  Slow  Very slow

Simple  Normal  Complex
Experimental Study – User Feedback


**Future Work**

- **Stage-Focused Design**
  - More accurate initial Flatting result
  - Interactive Shadowing
  - Inter-color harmony

- **Working on Multiple Panels**
  - Semantic-based batch flat
  - Headless and batch processing
Possible Questions

- How long did the FlatMagic to process one image?
- Why the gap under the lines in native bucket-fill result matters?
- More details of the backend?
- How did user feedback on using FlatMagic?