

# 繪本圖片的美學、情感、主題及風格類型-- CNN 的應用研究

## A deep learning perspective on image aesthetics, visual sentiment and content emotions of artwork from picture books

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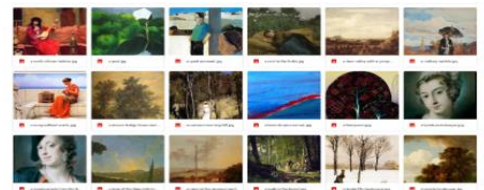
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This study is inspired by Cetinic et al.'s study on employing convolutional neural networks (CNN) to predict scores related to human perception: aesthetic evaluation of the image and sentiment evoked by the image [1]. These scholars used different decision tree-based models to analyze the relative importance of various image features related to the content, composition, and color in determining image aesthetics and visual sentiment scores. In this study, JenAesthetics dataset was used to evaluate aesthetic scores, whereas WikiArt Emotions were analyzed to understand the linkage between the predicted sentiment scores and eight different emotional categories: happiness, love, optimism, trust, sadness, disgust, fear, and pessimism. In contrast to the popular trend of photos, JenAesthetics [2] was one of the first attempts to build up a database for aesthetic paintings for the computer vision and image processing community to evaluate different aesthetic properties with approaches comparable to one another. The researchers took advantage from the Google Art Project and employed 1,628 art images from Western traditional oil paintings as stimuli, and 129 participants reported subjective scores on five properties: aesthetic, beauty, liking of color, liking of composition, and liking of content. On the other hand, WikiArt Emotions [3] was one of the first efforts to develop an annotated dataset of emotions evoked by art, with 4,105 Western paintings collected from WikiArt.org's collection, annotated with 308 people coding between 20 and 1,525 pieces of art via crowdsourcing for one to more of twenty emotional categories.

With the intention to construct the first picture book artwork dataset as traditional painting's sub-genre that has more linkage to contemporary human life, and examine the association of image sentiment to the aesthetic properties (e.g. color, composition, style), and to the theme and subjective meanings for people, this one-year pilot project has accomplished the following:

1. Identified more than 4000 picture book artworks by Internationally renowned artists and invited Fine Art



WikiArt Emotions dataset: Paintings labeled for Happiness



Picture Book dataset: Artworks labeled for Happiness



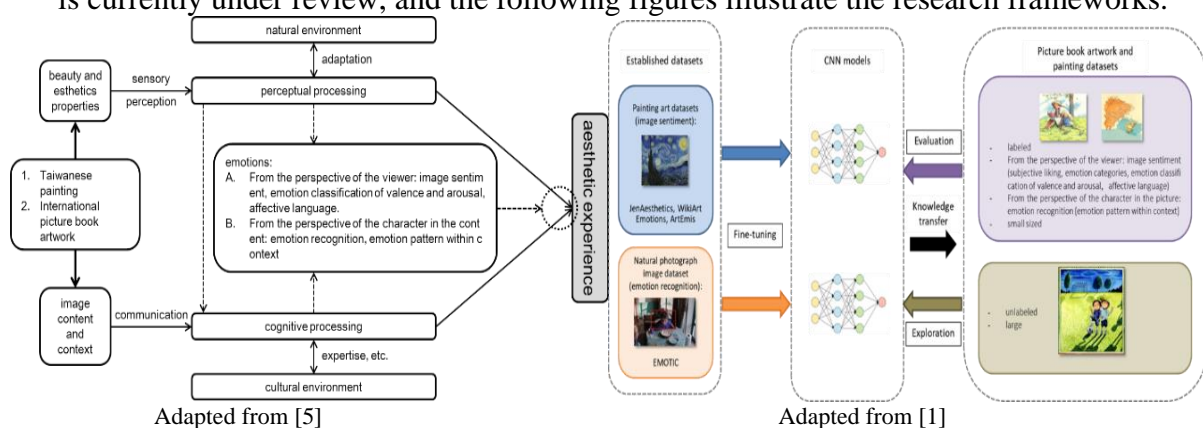
Picture Book dataset: Artworks labeled for Sadness



Picture Book dataset: Artworks labeled for Trust

and Psychology experts to build up frameworks for emotional category, theme, and style.

2. Completed a coding process upon emotions, themes and styles on the 4000 artworks based on the frameworks with a single coder, and trained data to explore the possibilities as well as the challenges regarding image classification.
3. Learned other approaches for image sentiment understanding, such as providing affective language as coding strategy for artwork (e.g. ArtEmis [4]), to explore the translation between image sentiment and text sentiment.
4. Selected 630 artworks out of the picture book database, invited 10 coders per artwork to provide image sentiment and affective language, and found that (a) color, composition, style, and character outlook are strong predictors for image aesthetics; (b) artwork theme and a sense of personal connection to the artwork are strong predictors for level of emotion aroused; (c) theme, style, color, character outlook, personal connection are predictors for subjective liking; (d) happiness, love, optimism, and trust are among the most frequent positive emotions aroused, (e) tranquillity and surprise, neutral emotions, (f) fear, sadness, loneliness, and disgust, negative emotions; and (g) the corresponding affective language (e.g. emotional adjectives, nouns-objects, nouns-landscapes, verb, color) are associated with each emotional category and with specific artwork.
5. Discovered emotional recognition (the emotional status of characters within the artwork) is to be differentiated from image sentiment (emotion aroused looking at an artwork).
6. Based on the aforementioned findings, completed a MOST proposal, entitled “TAI-Painting image AI research and application on technology art creation” with three sub-projects. Being the PI for this 3-year interdisciplinary proposal, and also PI for sub-project 1, entitled “The study of AI technologies on image sentiment and style setting”, I intend to explore whether AI can generate emotional thinking through image judgment. The proposal is currently under review, and the following figures illustrate the research frameworks.



## References

- [1] Cetinic E, Lipic T, Grgic S. A Deep Learning Perspective on Beauty, Sentiment, and Remembrance of Art. *IEEE Access* 2019, 7: 73694-73710.
- [2] Amirshahi SA, Hayn-Leichsenring GU, Denzler J, Redies C. Jenaesthetics subjective dataset: Analyzing paintings by subjective scores In *Computer Vision - ECCV 2014 Workshops* 2014, pp. 3-19.
- [3] Mohammad SM, Kiritchenko S. WikiArt Emotions: An Annotated Dataset of Emotions Evoked by Art. In *Proceedings of the 11th Edition of the Language Resources and Evaluation Conference (LREC-2018)*, May 2018, Miyazaki, Japan
- [4] Achlioptas P, Ovsjanikov M, Haydarov K, Elhoseiny, M Guibas L. Artemis: Affective language for visual art. *arXiv preprint arXiv* 2021:2101.07396 .
- [5] Hayn-Leichsenring GU. The Ambiguity of Artworks -A Guideline for Empirical Aesthetics Research with Artworks as Stimuli. *Front Psychol.* 2017, 8: 1857.