MAT 594X
Computational Systems for
Visual Art and Design

# Final Project Proposal

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Project Title: A computational tool for recoloring images based on user emotions

## 1. Purpose

While working on the previous course assignment, I found the color picker assignment interesting. As shown in *Concerning the Spiritual in Art* [1], Kandinsky believed that looking at colors can result in a psychic effect and different colors can convey certain emotions. Inspired by this report, I would like to create a new computational tool that will automatically recolor images based on user-defined palettes. Figure 1 is an example of image recoloring from Zhang et. al's paper [2].

Figure 1: An example of image recoloring. [2]

## 2. Steps of my approach

Given the image emotion dataset with valence and arousal values, we first perform automatic color palette selection for each image to generate a set of predefined color palettes. Then the user chooses one of the palettes and create a drawing with it. After drawing, the user shows a series of emotions while looking at the camera. The system then evaluates the emotional state of the user using facial emotion detection. Then it searches the emotion dataset and finds the best matching target palettes for each emotion. Finally, the drawing is recolored referencing the colors in the target palette.

## 3. Model of emotion

As the user interface in this project will be heavily dependent on the performance of emotion detection, I would like to first define the model of emotion. The Valence-Arousal model [3], a two-dimensional emotional space widely used in the field of psychology, will be used (Figure 2). Valence represents the degree of pleasantness of the individual and varies from 1 to 9 (1 means "negative" and 9 "positive"). Arousal represents the degree of activation of emotions and varies from 1 ("calm" and "inactive") to 9 ("excited" and "active"). This model will be used both for the analysis of facial emotion and color palette generation.

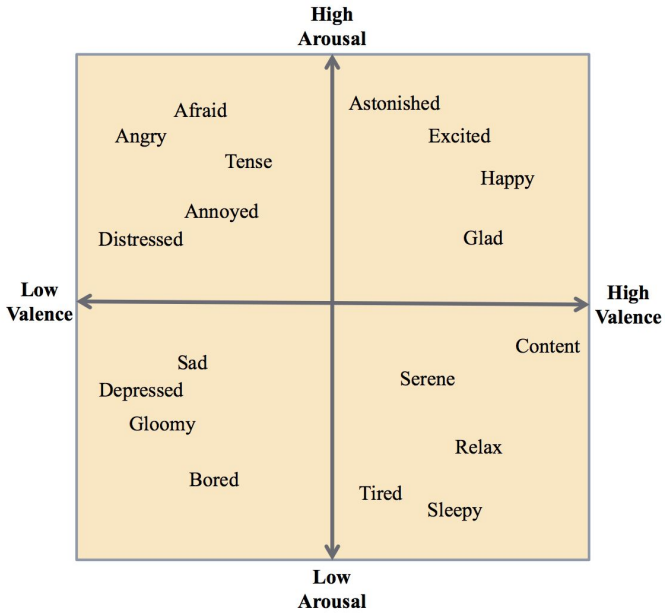


Figure 2: Valence-Arousal emotional space. [3]

## 4. Aff-Wild Database

As the user interface in this project will be heavily dependent on the performance of emotion detection, I would like to use the deep learning technology for the emotional recognition. Kollias et al. [4] have created the Aff-Wild database, which contains about 300 videos annotated for valence and arousal, all captured 'in-the-wild' (the main source being Youtube videos). In addition, AffWildNet, a deep learning architecture which produced state-of-the-art results on the Aff-Wild Challenge. Kollias et. al have the Aff-Wild database and the trained weights of various models on GitHub: https://github.com/dkollias/Aff-Wild-models. Valence and arousal value of input images will be predicted using this model.

5. Automatic color palette selection & recoloring

As Kim et al. have built the image emotion dataset [5] with valence and arousal values, I would like to utilize it to make a set of predefined colors for different emotions. In this process, I will modify Todo's implementation of automatic color palette selection [6] on GitHub: https://github.com/tody411/PaletteSelection.

## References


[1] Kandinsky, Wassily. *Concerning the spiritual in art*. Courier Corporation, 2012.
[2] Zhang, Qing, et al. "Palette-based image recoloring using color decomposition optimization." *IEEE Transactions on Image Processing* 26.4 (2017): 1952-1964.
[3] Russell, James A. "A circumplex model of affect." *Journal of personality and social psychology* 39.6 (1980): 1161.
[4] Kollias, Dimitrios, et al. "Deep affect prediction in-the-wild: Aff-wild database and challenge, deep architectures, and beyond." *International Journal of Computer Vision* 127.6-7 (2019): 907-929.
[5] Kim, Hye-Rin, et al. "Building emotional machines: Recognizing image emotions through deep neural networks." *IEEE Transactions on Multimedia* 20.11 (2018): 2980-2992.
[6] Chang, Huiwen, et al. "Palette-based photo recoloring." *ACM Trans. Graph.* 34.4 (2015): 139-1.