Infant Vision

Ashna Chalil Abraham

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Description of Identified Infant Vision Property

I identified color perception as another aspect of infant vision that evolves over time. In their study, the authors in [1] define visual discriminations based on hue or saturation differences as chromatic discriminations. They propose that infants experience difficulties in chromatic discrimination, which they attribute to two main hypotheses. The first, the chromatic deficiency hypothesis, suggests that these challenges arise due to the immaturity or absence of different cone types. The second, the visual efficiency hypothesis, posits that although infants possess fully developed cones, their visual sensitivity is not yet sufficient to effectively utilize them.

Description of Implementation

To simulate the development of color perception with age, we use two thresholds: the chromatic threshold, which determines the ability to discriminate hues, and the luminance threshold, which governs brightness discrimination. According to the chromatic deficiency hypothesis, both thresholds improve as a child gets older. Based on experiments, the authors in [1] suggest that newborns have very limited ability to distinguish colors, and this ability develops over the first year of life.

In our implementation, we model the improvement of these thresholds as an exponential change over time. The chromatic threshold is applied to the saturation channel of the image, while the luminance threshold is applied as a Gaussian Blur. Since the acuity implementation also uses a Gaussian Blur, it is applied only once to avoid redundancy.

Description of Performance Evaluation

The performance evaluation was conducted on a subset of 100 images from the Places 365 dataset [2]. The execution time is compared with and without dataset transformation, using a 2-month setting and a batch size of 8. All images were in RGB format with dimensions of 256x256. On average, the execution time without transformation was 36.27 ms, while with transformation it increased to 140.56 ms.

References

[1] Philip J. Kellman and Martha E. Arterberry. Infant visual perception. 2007.

[2] Bolei Zhou, Agata Lapedriza, Aditya Khosla, Aude Oliva, and Antonio Torralba. Places: A 10 million image database for scene recognition. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2017.

Images for the Two Properties

Figure 1: Acuity simulation

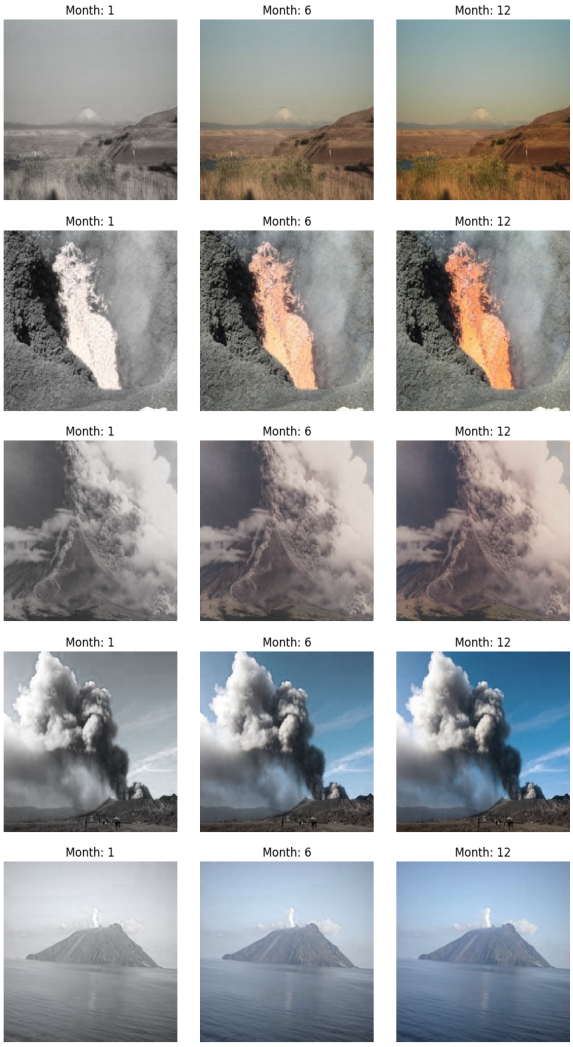

Figure 2: Color perception simulation

Performance Evaluation

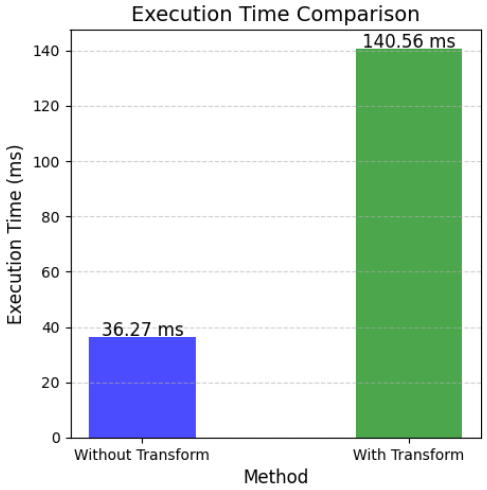

Figure 3: Performance Evaluation Plot with and without transformation