Advanced Image Analysis Methods for Character Recognition

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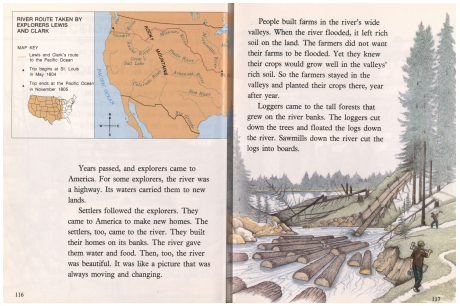
Background

The goal of our project is to use new methods in image analysis to understand how different types of people and actions are represented in printed content. Our focus will be on school materials, e.g., textbooks.
Below is an example of our "source material":



Midway resources used in this project

We are using **compute nodes, storage, and software, available on Midway supercomputer at Research Computer Center,** to analyse and store the scanned textbooks. Our primary focus is classifying the skin color, the age, the gender, and the actions portrayed in the textbook's images.

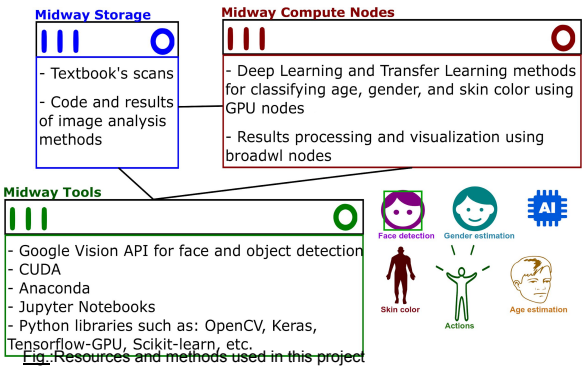
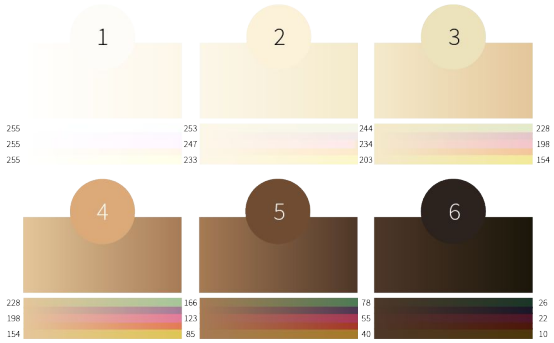


Fig. Resources and methods used in this project

Categorizing Skin Color in Textbook Images

To study how changes in the racial messages in these textbooks map onto changes in student outcomes, we first need a method of determining the race of the individuals pictures in these texts.

We began by using creating a skin color scale from 1-6 (Below) based off of the Fitzpatrick scale and the von Luschan scale.



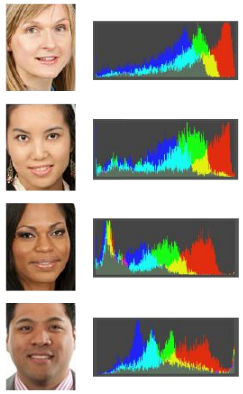
We can use this color scale to determine the density of particular skin tones within a textbook to determine whether the individuals shown in the textbook are representative of the children who are reading these texts.

By combining image analysis with text analysis, we hope to measure not just the quantity of representation but the quality and content as well.

By examining the amount of red, green, and blue in the skin tones of the pictured individuals (Left), we can observe that for skin color, the intensity of red is greater than the intensity of green, which is greater than the intensity of blue.

Red>Green>Blue

We can use these kinds of restrictions to help us accurately identify skin color within the texts we're analyzing.



Future work

Color Profiles
One of our next steps is to determine which color profile is best suited to working with skin tones. Below are some of the profiles we are considering:

- RBG - (red, blue, green),
- HSV - (Hue Saturation Value),
- YCbCr - (transformation from an RGB color space)

Illustrations vs Photographs
Since we are focusing on children's texts, many of the images are cartoons or drawings. We need to find a way to translate the way we analyze photographs into a method for analyzing illustrations as well.

Dark or Overexposed Images
One issue we have run in to is how to determine the skin color of an individual in a poorly lit photograph where their skin color appears darker or lighter than it would in a well lit photograph.

Detecting Skin Tone in Black & White Images
Many of the images in older textbooks are black and white. This makes it impossible to detect skin color, but we are working on ways to detect skin tone.

Acknowledgements

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