

# Color Quantization Analysis Using Mascots of Public Institutions of Higher Education in the United States

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## Introduction

- Colors play an important role in our lives and being able to recognize colors is extremely helpful in performing daily tasks. However, there are scenarios where people cannot easily identify colors, and automatic color recognition in such cases proves to be very beneficial.
- In this project, we use K-means clustering, a popular unsupervised machine learning algorithm, to initialize the image quantization process and perform color recognition on them.
- Furthermore, we aggregate the colors in the images by their proportions and provide the color blend visualization. Our method is applied to investigate the colors present in selected mascots of different public higher-educational institutions across the United States.
- The usefulness of our project can contribute to the research efforts that can help visually impaired people to better quantize and recognize colors. Further applications may prove useful in branding and marketing sectors who rely heavily on colors to attract viewers.

## Methods

The main steps of our analysis are as below:

- Preprocessing the image: The first step in working with downloaded images of university mascots is to convert them into numerical representation that can be used by the K-means clustering algorithm. K-means clustering divides a colorful image into regions with pixels of similar hexadecimal color code values using the RGB (red, blue, green) color model and detects the colors based on identified clusters.
- Selecting the number of clusters: Determine the number of clusters (k) that is most appropriate for the analysis, namely for each mascot image.
- Initializing the centroids: Define the initial centroids for each cluster based on neighboring values of the RGB codes.
- Running the algorithm until convergence: Iterate the k-means algorithm until convergence is obtained by examining the negligible changes in the centroids.
- Evaluating the results: Validate results by visualizing the clusters and determining if they make sense based on the original image.

## Results

The results for the Wichita State University (WSU) WuShock mascot are as follows:



Figure 1: The Wichita State University WuShock mascot. WuShock is a big, bad, muscle-bound bundle of wheat. He has been WSU's mascot since 1948, a friend to every Shocker fan and the No. 1 supporter of all things Wichita and Wichita State.

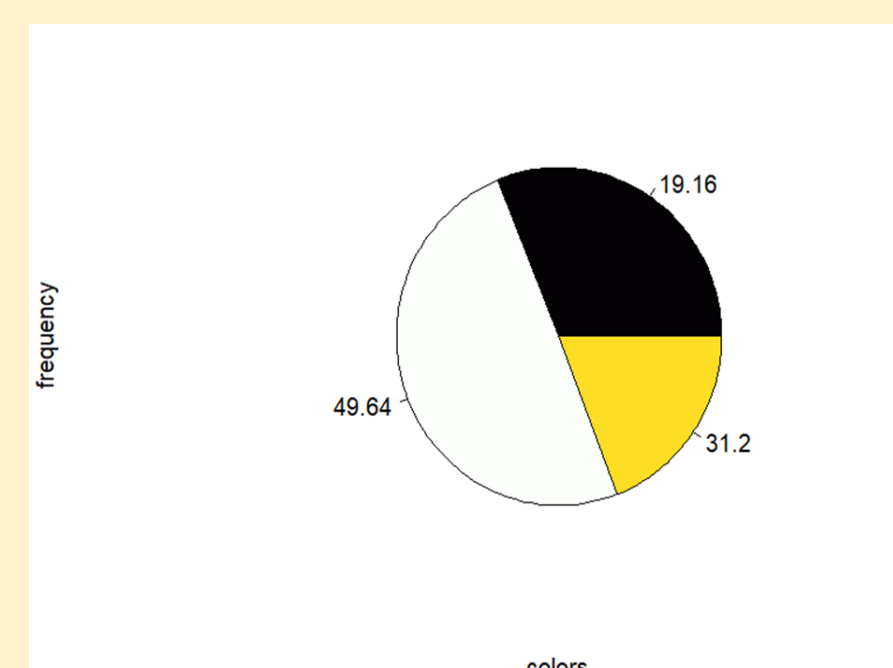


Figure 2: The Wichita State University WuShock mascot's main colors and their proportions. Note: the surprisingly higher white proportion is due to the white background unintentionally picked up by the K-means clustering algorithm.

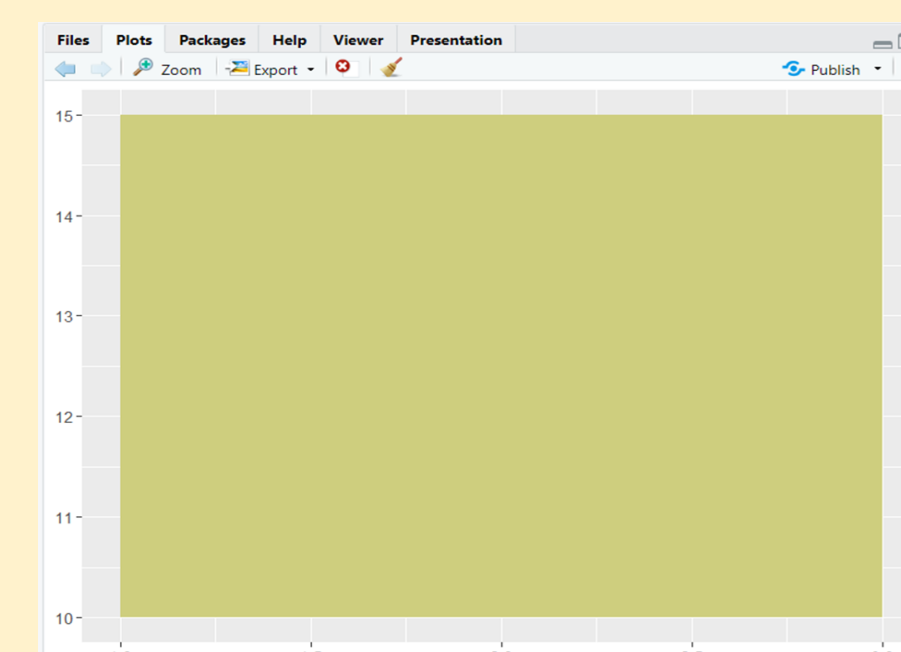


Figure 3: The Wichita State University WuShock mascot's color blend using the main colors and their proportions identified in Figure 2. This provides an "average" color of the WSU mascot, which helps to simplify and identify trends.

## United States Public Institution Mascots

After analyzing the WSU mascot, we are interested in seeing those of other public universities and colleges around the United States.

- We downloaded and studied mascots of public institutions in all 50 states.
  - For each state, we analyzed 3 – 4 different mascots of the largest schools.
  - The image quantization and color separation process is repeated for each mascot.
  - After the main colors are specified, we weighed and blended them.
  - Putting together the average colors of mascots, we obtained the average state colors.
- The average mascot colors for each state is presented in Figure 4, where we demonstrated them on the United States map. We found that shades of red are among the most popular.

## Map of the states colored according to the blended color.

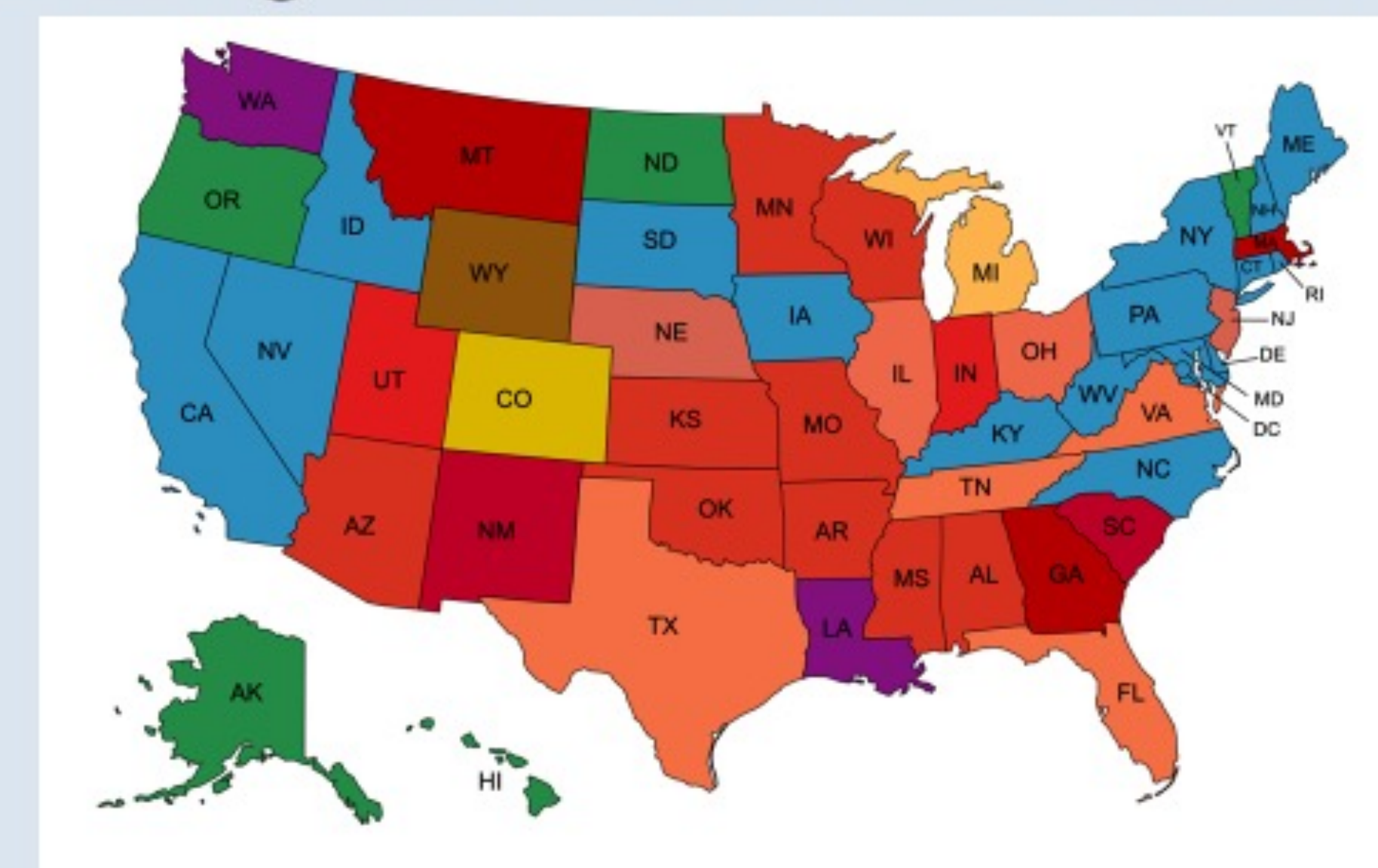


Figure 4: The map of the United States with distinct colors that represent the average blended colors based on the 3 or 4 largest public higher education institutions in that state.

## Conclusions

- In this project, we used the K-means clustering algorithm to automate the color recognition in images of mascots of higher-ed public institutions in the United States.
- K-means clustering divides the image into regions with similar color codes and detect colors based on identified clusters. Upon color quantization, the associating proportions are aggregated, and a color blend visualization is provided.
- The project has the potentials to aid visually impaired individuals in color recognition. We implemented the analysis using the open-source software R.

## References

<https://search.r-project.org/CRAN/refmans/colordistance/html/removeBackground.html>

Github