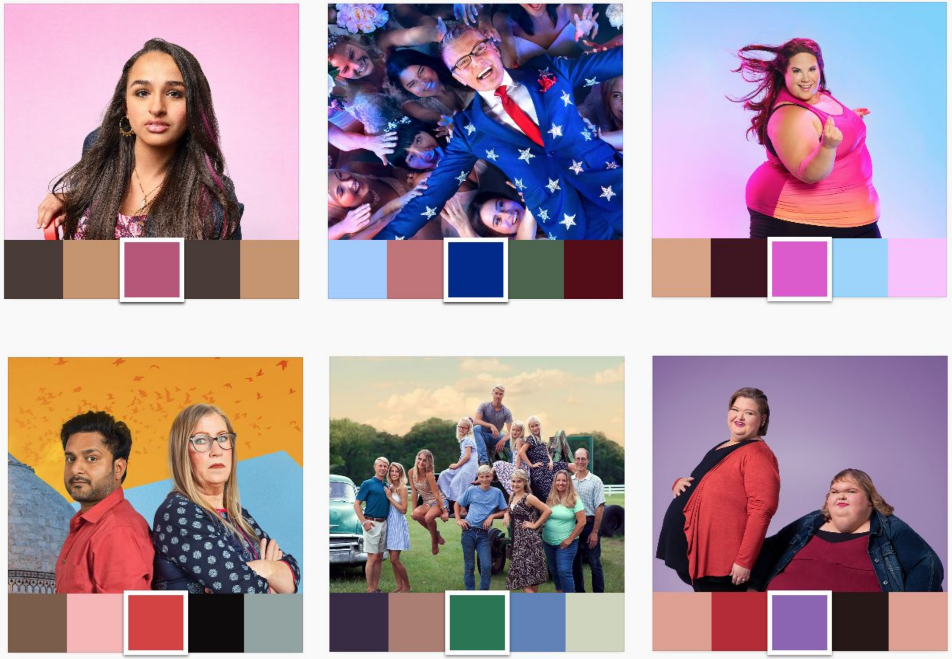
Dynamic Color System Using K-means clustering

Last Updated: Dec. 27, 2021

Extract dominant colors of an image using Python



K-mean Clustering is one of the most common data analysis techniques.

*Any image consists of pixels, each pixel represents a dot in an image. A pixel contains three values and each value ranges between **0 to 255**, representing the amount of **red**, **green** and **blue** components. The combination of these forms an actual color of the pixel.*

To find the dominant colors, the concept of the k-means clustering is used.

*Various colors will belong to different RGB values, k-means clustering can be used to cluster them into groups which can be identified into **5 dominant colors**.*

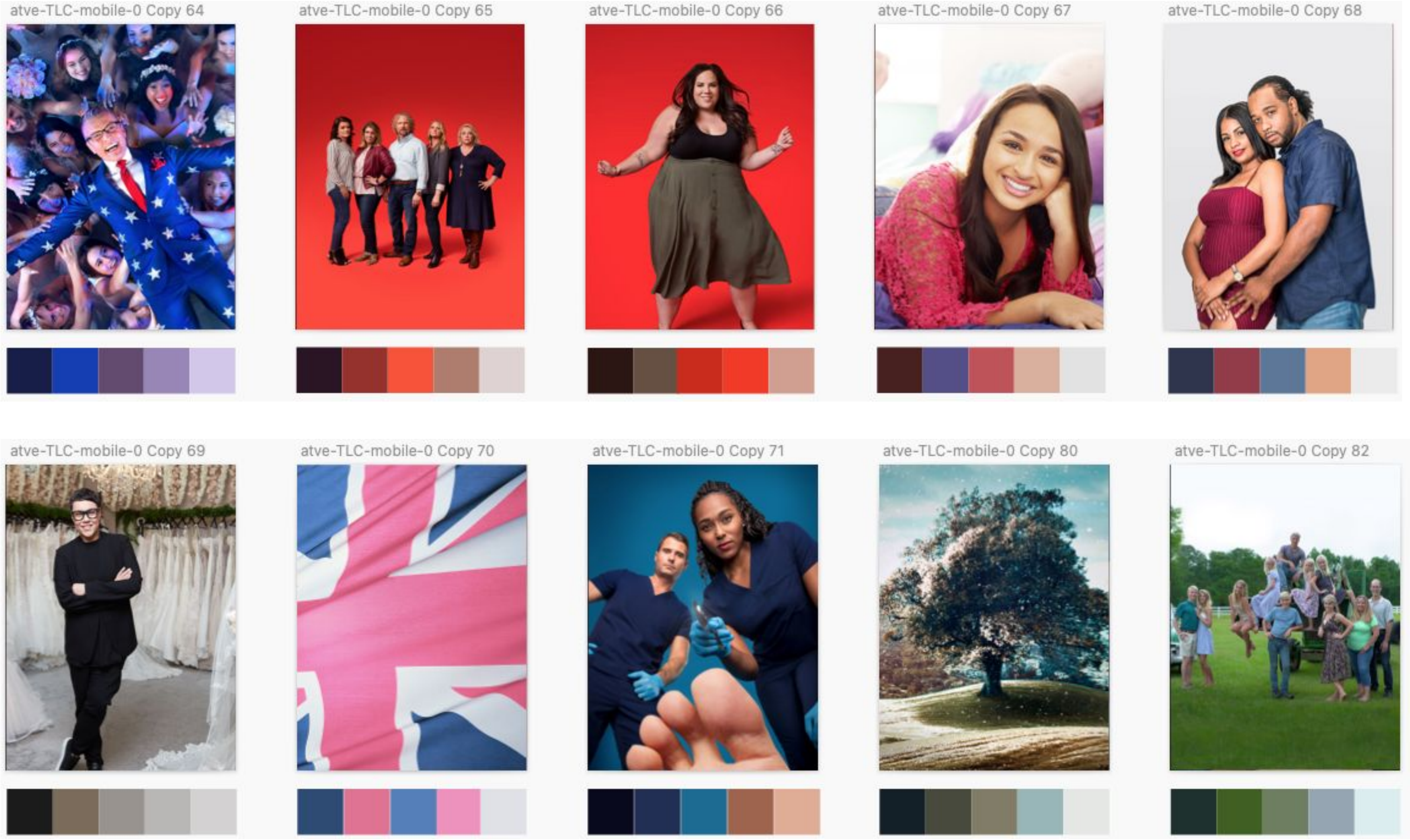
Color Analysis
Part 1

dominant colors

Extract an image’s dominant colors using the K-Means algorithm

Find optimal number of clusters of given image using the elbow plot approach.

Step 1: Extract dominant 5 colors



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Color Analysis Part 2

accessibility

Using algorithm can maintain color darkness consistent across color hues

Take the dominant color and standardize the value based on HSL (or HSV)

Step 2: Consistent color contrast for each value

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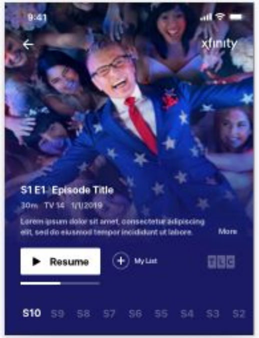
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TLC
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K11 #191964

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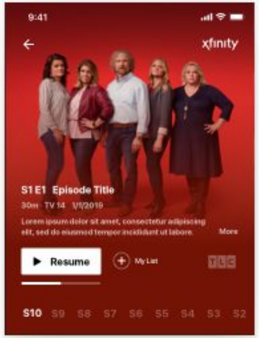
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K7 #721305

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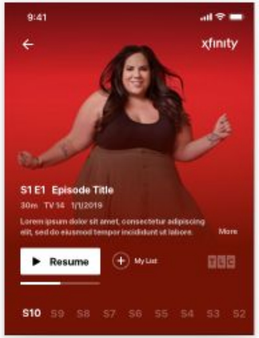
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K7 #721305

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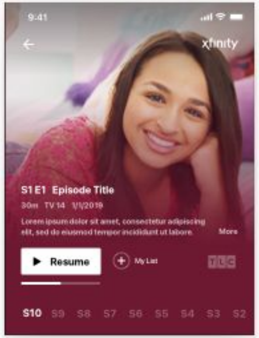
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K8 #6d1932

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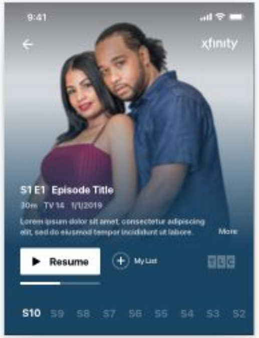
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K15 #184c62

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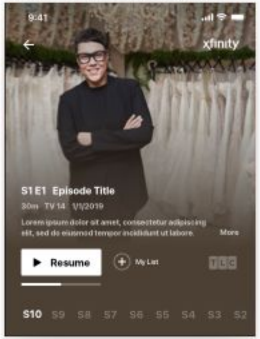
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K5 #4c3f33

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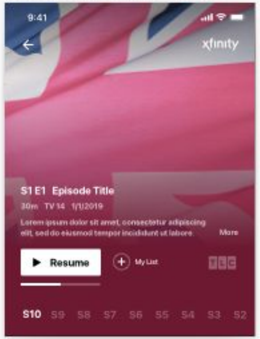
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K8 #6d1932

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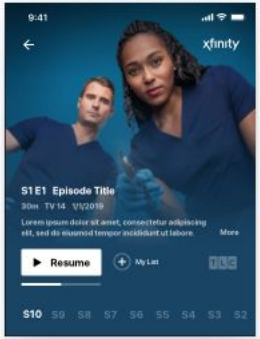
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K14 #191964

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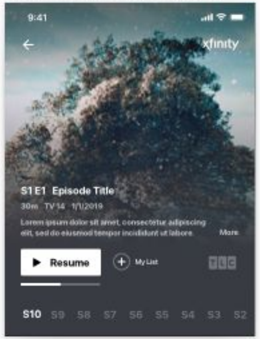
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K0 #393b42

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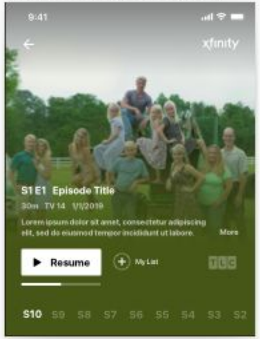
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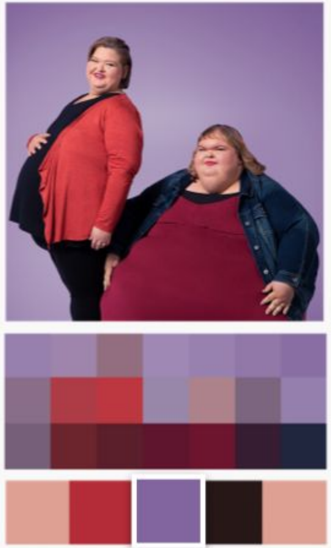
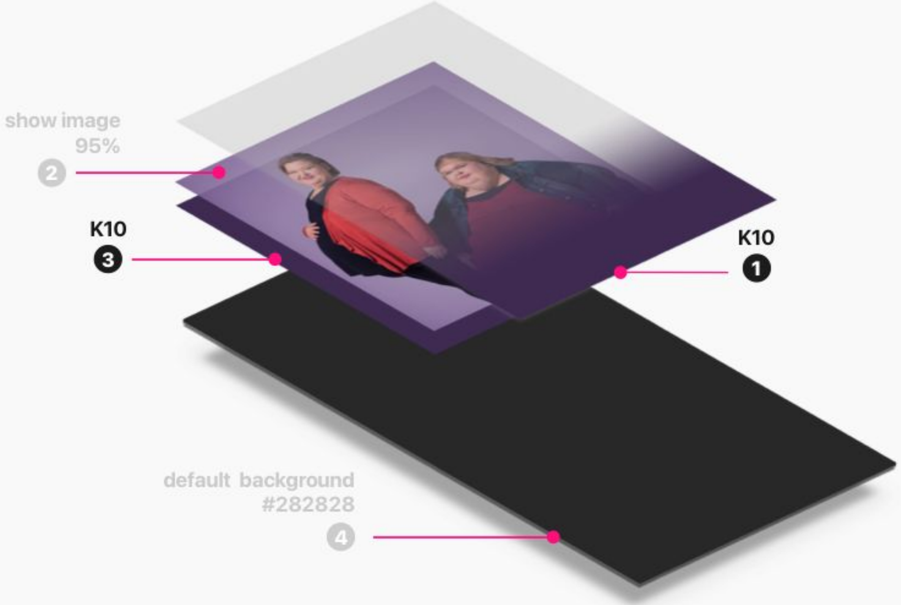
K1 #465616

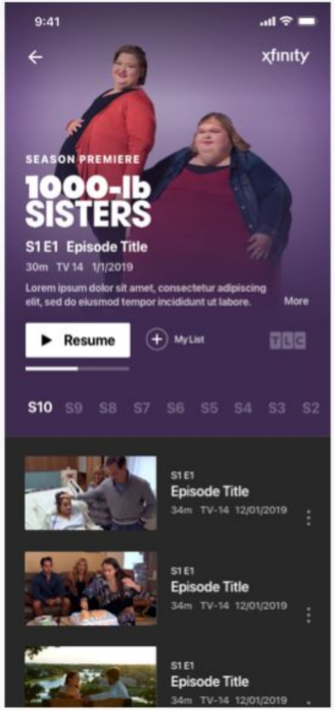
How does the dynamic color theming work?



dominant color

K10 #3F2A53





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⊕ My List

TLC

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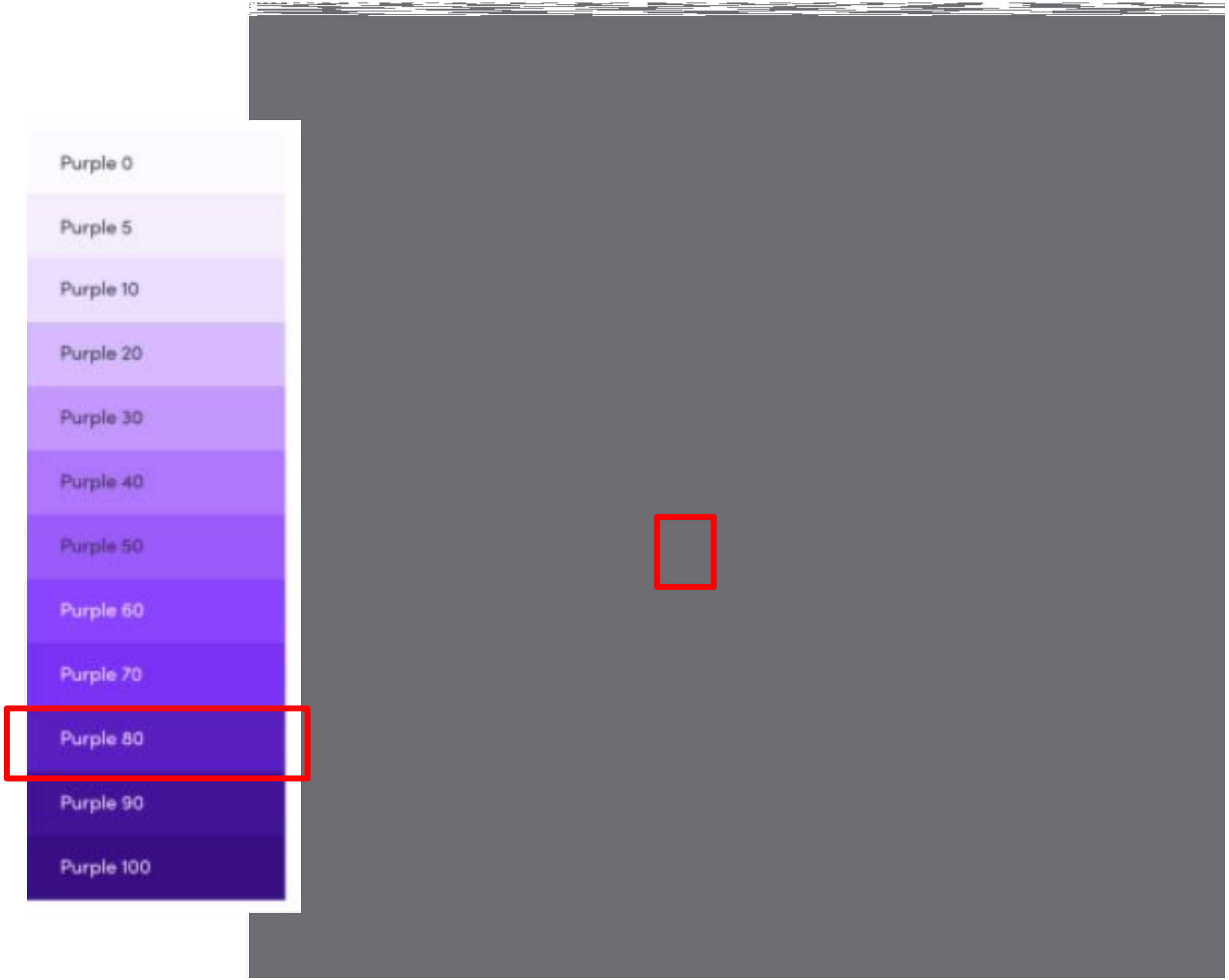
S1 E1
Episode Title
34m TV-14 12/01/2019

S1 E1
Episode Title
34m TV-14 12/01/2019

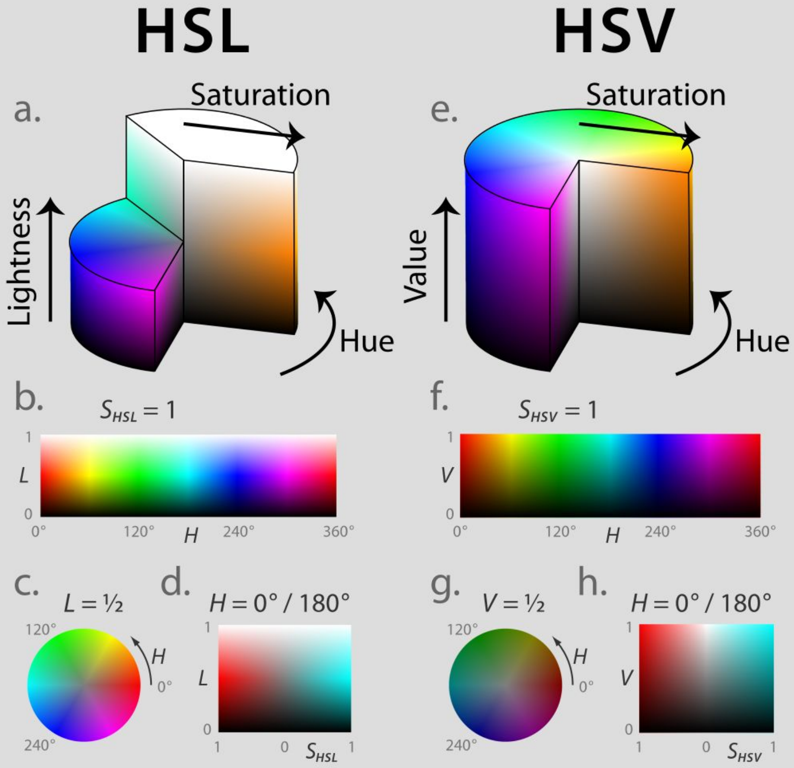
Colors Variance in Space

Using algorithm can maintain color darkness consistent across color hues

Two fundamental elements in color value:
*one is the **hue** of the color, which pointed to a space on the color wheel, and the other is the **modifier** that pointed to the degree of lightness or darkness of that color.*



RGB color model - HSL and HSV



HSL: fully saturated colors are placed around a circle at a lightness value of ½, with a lightness value of 0 or 1 corresponding to fully black or white, respectively.

(e.g. to create "light red", a red pigment can be mixed with white paint; this white paint corresponds to a high "lightness" value in the HSL representation)

HSV: the HSV representation models how colors appear under light

(e.g. shining a bright white light on a red object causes the object to still appear red, just brighter and more intense, while shining a dim light on a red object causes the object to appear darker and less bright)

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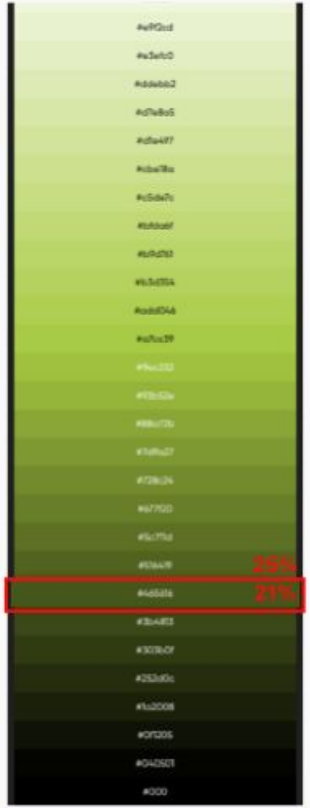
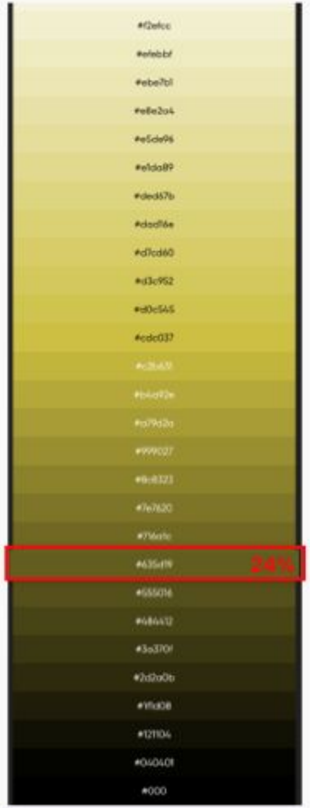
The difference between HSL and HSV is that a color with maximum lightness in HSL is pure white, but a color with maximum value/brightness in HSV is analogous to shining a white light on a colored object

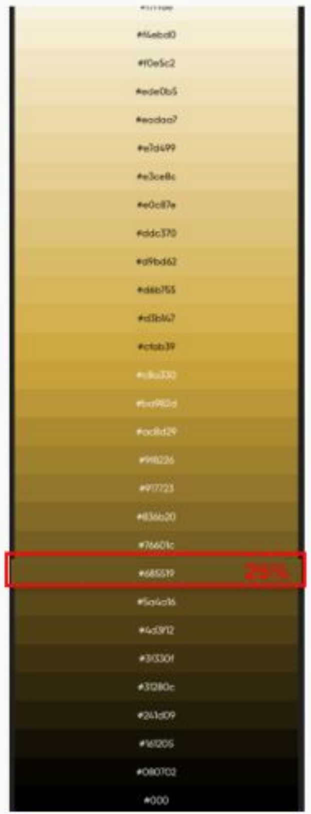
Standardized color K values (1-5)



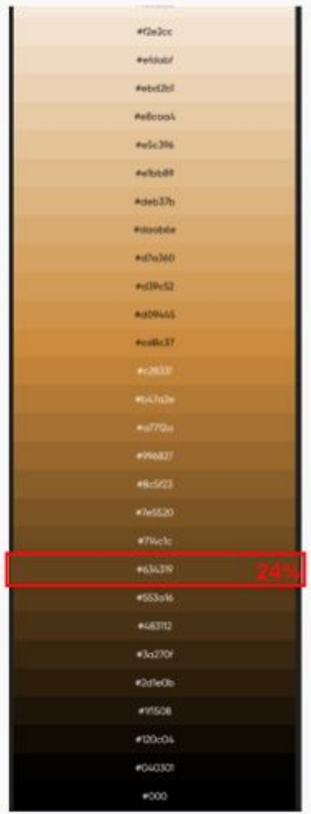
K1 #465616



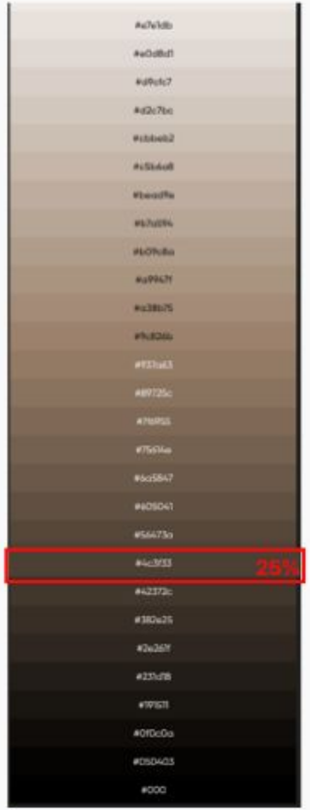
K2 #635D19



K3 #685519

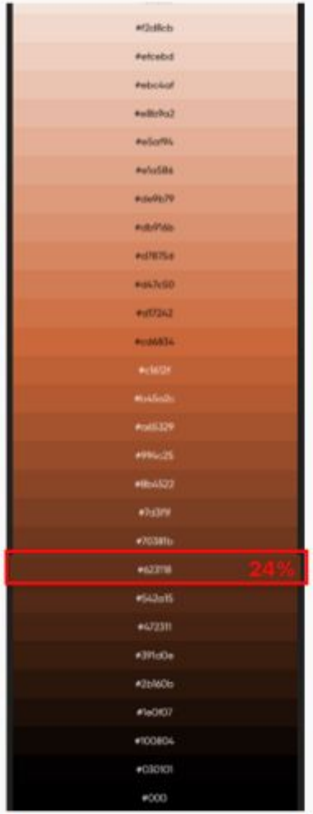


K4 #634319

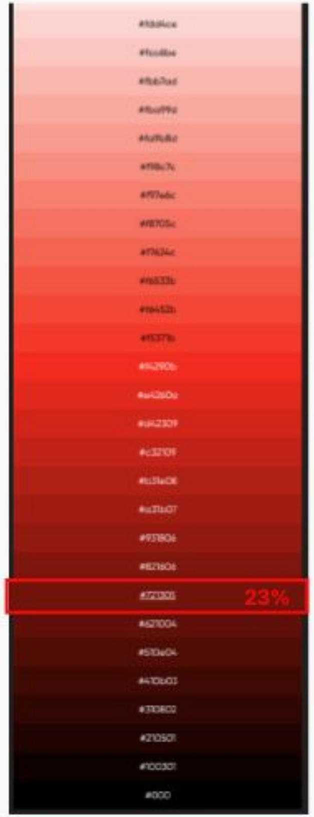


K5 #4c3f33

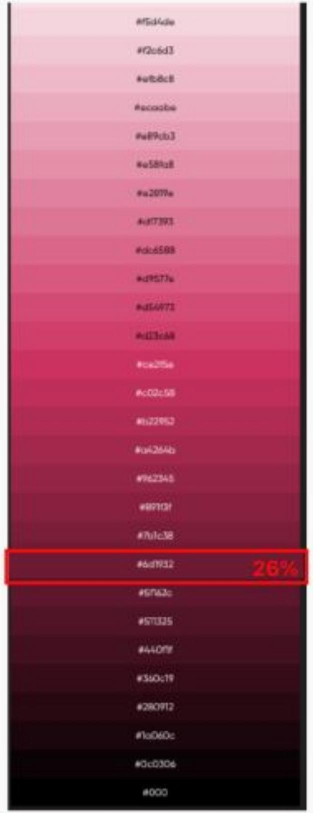
Standardized color K values (6-10)



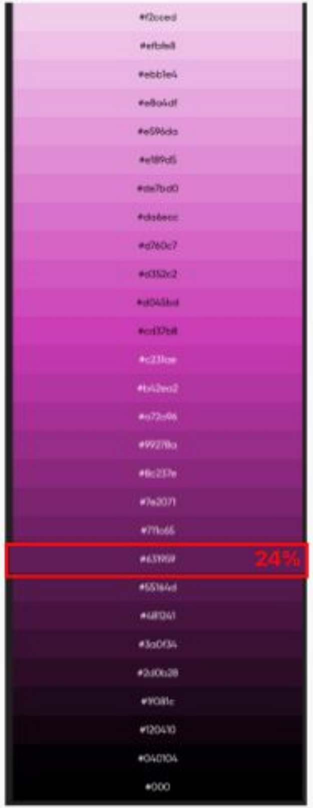
K6 #623118



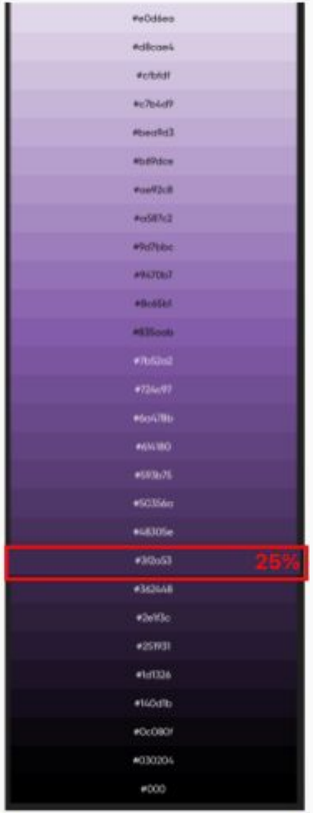
K7 #721305



K8 #6d1932

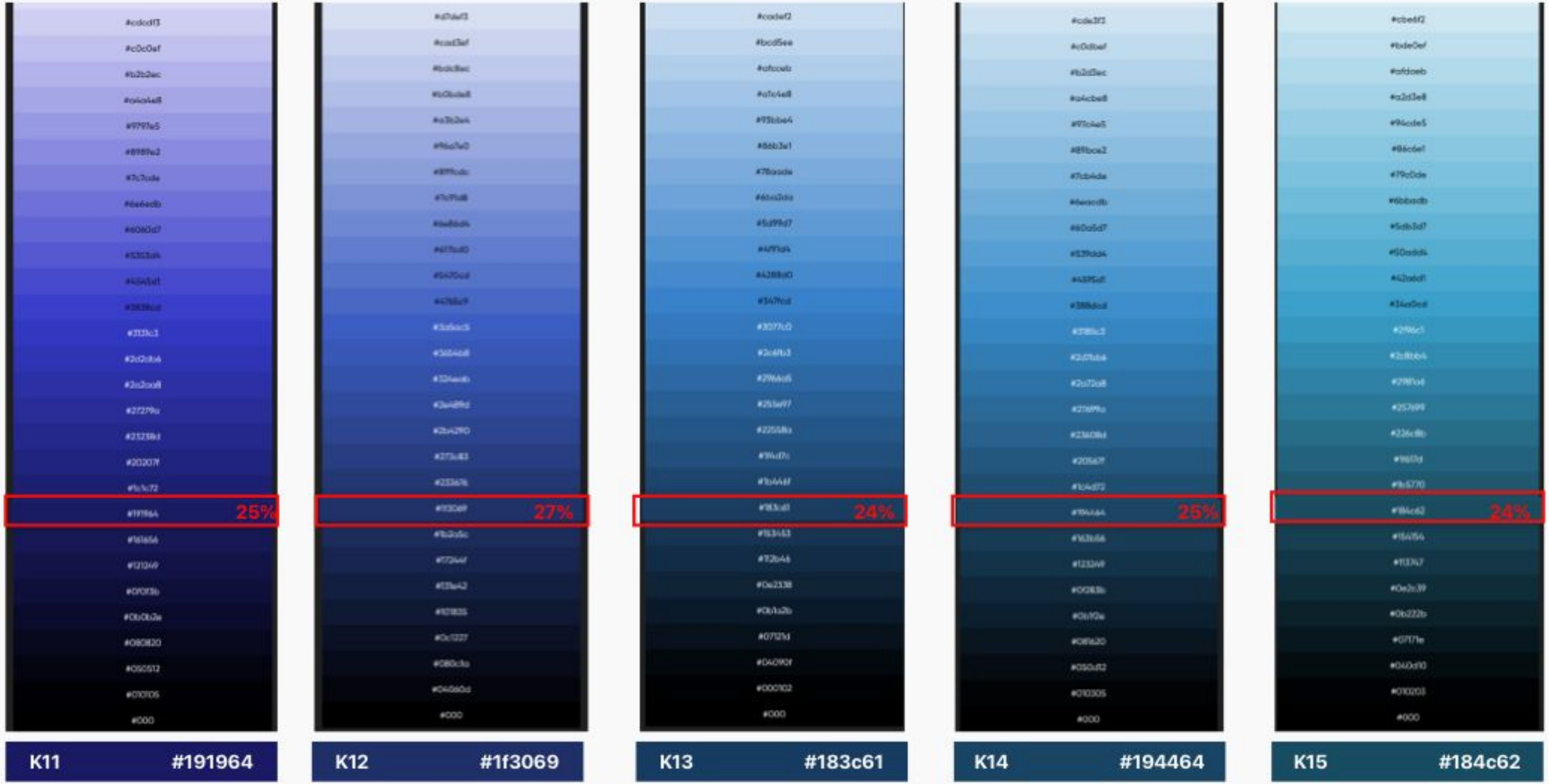


K9 #631959



K10 #3F2A53

Standardized color K values (11-15)



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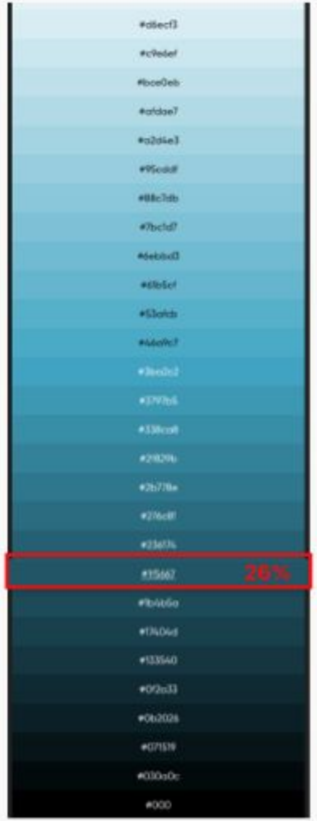
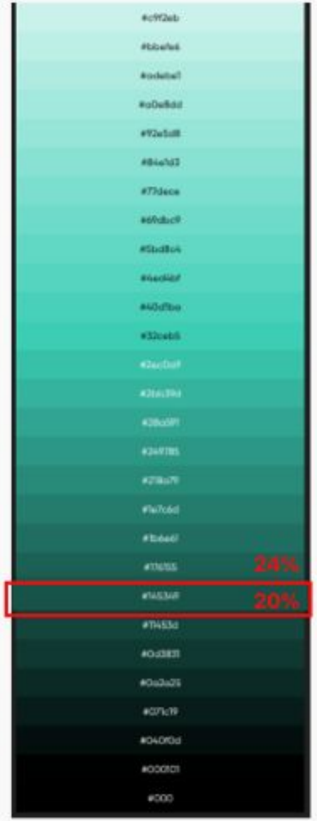
#a4a4e8	#b0bde8	#a1c4e8	#a4cbe8	#a2d3e8
#9797e5	#a3b2e4	#93bbe4	#97c4e5	#94cde5
#8989e2	#96a7e0	#86b3e1	#89bce2	#86c6e1
#7c7cde	#899cdc	#78aade	#7cb4de	#79c0de
#6e6edb	#7c91d8	#6ba2da	#6eacdb	#6bbadb
#6060d7	#6e86d4	#5d99d7	#60a5d7	#5db3d7
#5353d4	#617bd0	#4f91d4	#539dd4	#50add4
#4545d1	#5470cd	#4288d0	#4595d1	#42a6d1
#3838cd	#4766c9	#347fcd	#388dcd	#34a0cd
#3131c3	#3a5ac5	#3077c0	#3785c3	#2996c1
#2c2cb4	#3654c8	#2c6fb3	#2d7bb4	#2c8bb4
#2a2aa8	#324eab	#2966a6	#2a72a8	#2981a8
#27279a	#2e489d	#255e97	#27699a	#257699
#23238d	#2b4290	#22558a	#23608d	#226c8b
#20207f	#273c83	#1e4d7c	#20567f	#1f617d
#1c1c72	#233676	#1b446f	#1c4d72	#1b5770
#19196A 25%	#1f3069 27%	#183c61 24%	#194464 25%	#184c62 24%
#161656	#1b2a5c	#153453	#163b56	#154154
#121249	#17244f	#122b46	#123249	#113747
#0f0f3b	#131e42	#0e2338	#0f283b	#0e2c39
#0b0b2e	#101835	#0b1a2b	#0b1f2e	#0b222b
#080820	#0c1227	#07121d	#081620	#07171e
#050512	#080c1a	#04090f	#050d12	#040d10
#010105	#04060d	#000102	#010305	#010203
#000	#000	#000	#000	#000
K11 #191964	K12 #1f3069	K13 #183c61	K14 #194464	K15 #184c62

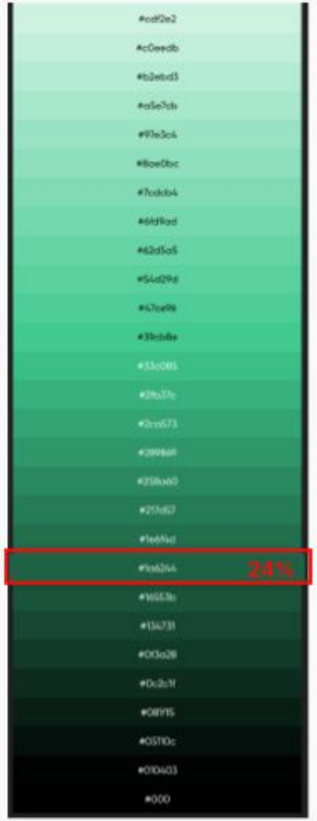
Standardized color K values (16-20)



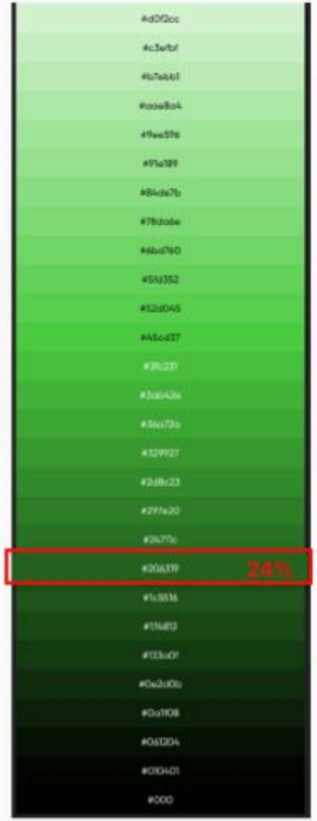
K16 #1f5667



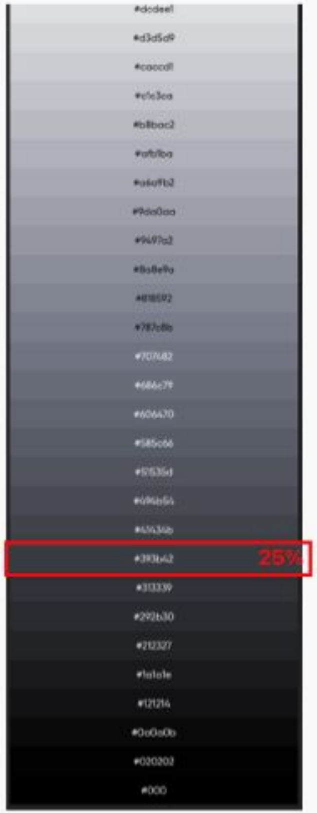
K17 #145344



K18 #1a6251

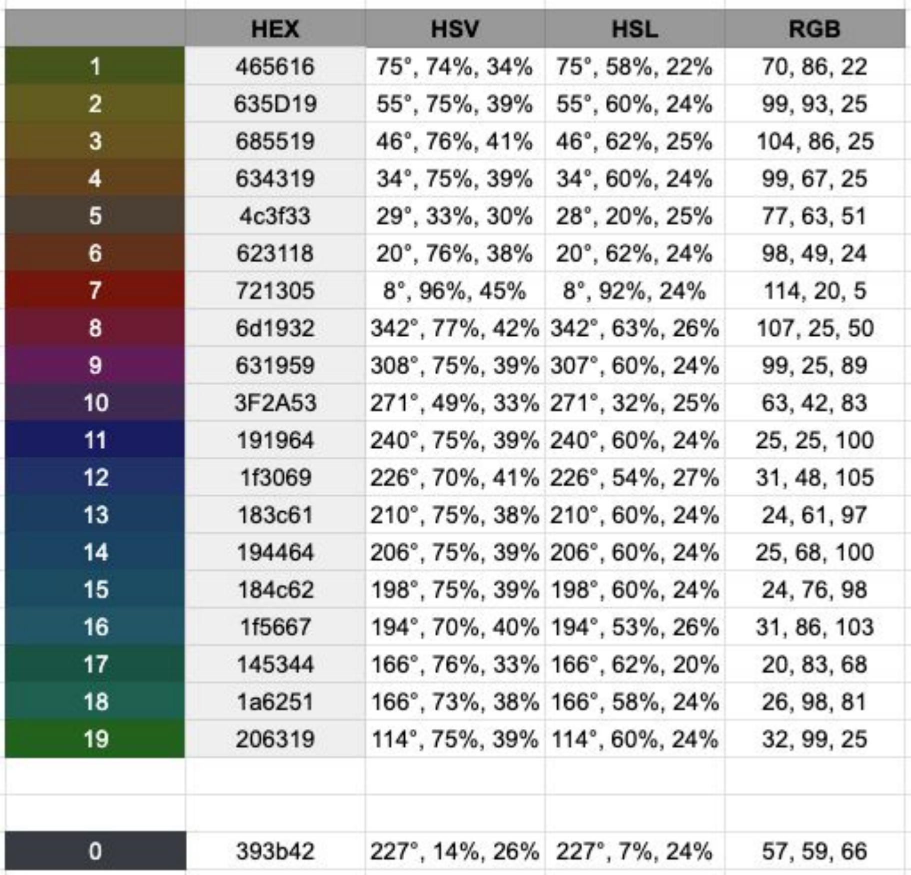


K19 #206319



K0 #393b42

Standardized color values



	HEX	HSV	HSL	RGB
1	465616	75°, 74%, 34%	75°, 58%, 22%	70, 86, 22
2	635D19	55°, 75%, 39%	55°, 60%, 24%	99, 93, 25
3	685519	46°, 76%, 41%	46°, 62%, 25%	104, 86, 25
4	634319	34°, 75%, 39%	34°, 60%, 24%	99, 67, 25
5	4c3f33	29°, 33%, 30%	28°, 20%, 25%	77, 63, 51
6	623118	20°, 76%, 38%	20°, 62%, 24%	98, 49, 24
7	721305	8°, 96%, 45%	8°, 92%, 24%	114, 20, 5
8	6d1932	342°, 77%, 42%	342°, 63%, 26%	107, 25, 50
9	631959	308°, 75%, 39%	307°, 60%, 24%	99, 25, 89
10	3F2A53	271°, 49%, 33%	271°, 32%, 25%	63, 42, 83
11	191964	240°, 75%, 39%	240°, 60%, 24%	25, 25, 100
12	1f3069	226°, 70%, 41%	226°, 54%, 27%	31, 48, 105
13	183c61	210°, 75%, 38%	210°, 60%, 24%	24, 61, 97
14	194464	206°, 75%, 39%	206°, 60%, 24%	25, 68, 100
15	184c62	198°, 75%, 39%	198°, 60%, 24%	24, 76, 98
16	1f5667	194°, 70%, 40%	194°, 53%, 26%	31, 86, 103
17	145344	166°, 76%, 33%	166°, 62%, 20%	20, 83, 68
18	1a6251	166°, 73%, 38%	166°, 58%, 24%	26, 98, 81
19	206319	114°, 75%, 39%	114°, 60%, 24%	32, 99, 25
0	393b42	227°, 14%, 26%	227°, 7%, 24%	57, 59, 66

PROCESSING

(Color Analysis Part 2)

Take the dominant color and standardize the value based on **HSL (or HSV)**

- *Compare the color value of distance/depth HSL (or HSV)*

- *Assign data point to the best match in range **1 - 19***

- *If the value is not specified, assign to the default value **0** (grey)*

https://docs.google.com/spreadsheets/d/1rcp4w10d1D24Htfck5SgU9141sziwSplbMm4WecFKN8/edit?usp=sharing

Color Analysis Resources

Color palette

https://www.0to255.com/

Color models and color spaces*

https://programmingdesignsystems.com/color/color-models-and-color-spaces/index.html

Building color systems for accessible UIs that scale

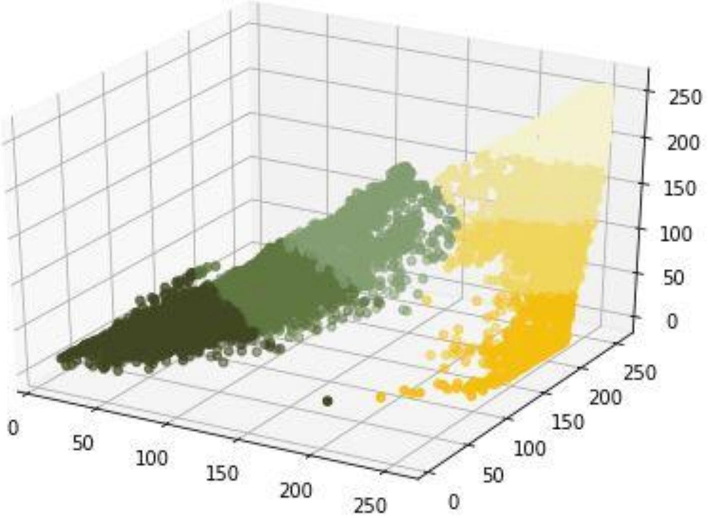
https://design.lyft.com/re-approaching-color-9e604ba22c88

Extract Dominant Colors from an existing Image — K-Means Clustering Algorithm

https://medium.com/swlh/extract-dominant-colors-f mage-k-means-clustering-algorithm-e9acb36a9c45

https://github.com/nandinib1999/DominantColors

https://www.reddit.com/r/Python/comments/dmzs6s/i_created_a_python_script_to_generate_color/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