Data scientific colour comparison among five ethnic townscapes in Singapore

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This study aims to analyse the colour characteristics of unique townscapes in Singapore, to create a colour palette that distinguishes each cultural difference, and to apply this palette to souvenirs production and public relations design for foreign tourism. Singapore is known as a multicultural country that comprises various ethnic groups, including Chinese, Malay, Tamil, Western and so on. Foreigners can experience the cultural atmosphere of certain ethnic groups in various places through the colours. In this research, we decided to particularly focus on five towns; Chinatown, Kampong Glam, Little India, Katong and Colonial District, to visualise the different regional characteristics of colours in Singapore. Firstly, many photos of the townscapes were collected in the five selected towns, five symbolic photos were chosen for each town. The characteristic nine colours for each region were extracted from those photos. The RGB data of the nine colours were picked and converted to the HSV data, and the characteristics for each town were observed on the colour space. Consequently, it was found that Chinatown exhibited warm colours, and Colonial District had low-saturation colours such as black and white as expected. Though Little India, Kampong Glam and Katong were hard to distinguish due to shared colour characteristics, they varied in saturation, with Little India having the highest saturation and Katong the lowest. After the analysis, we tried to produce the actual packaging of gifts and brochures by using the colour palettes to verify its practical effectiveness for people who have different cultural backgrounds in Singapore. We will be conducting further experiments investigating the effects of colours of products' packaging on their sales. This research could be applied for tourists to understand and enjoy colour townscape formed by Singapore's unique historical and cultural background. Additionally, these outcomes could be useful to add extra value to products created by Made with Passion [1], a national initiative jointly led by Singapore Tourism Board and Enterprise Singapore in the future.

Introduction

Currently, I live in Singapore which is known as a multicultural country that comprises various ethnic groups, including Chinese, Malay, Tamil, Western and so on. Foreigners can experience the cultural atmosphere of certain ethnic groups in various places through the colours. For example, red Chinese temples can be found in Chinatown, Kampong Glam is known as a colourful historical Malay enclave, and Little India has vivid Indian shops and temples. Additionally, Katong has pastel-coloured Peranakan houses, and white and black colonial-style buildings can be seen around the banks of the Singapore River. Urbanisation and tourism development have been carried out while complying with the conservation guidelines implemented by the Urban Redevelopment Authority [2].

The purpose of this study is to create a colour palette that identifies cultural differences based on an analysis of the colour characteristics of Singapore's symbolic townscape, and to apply this palette in the production of souvenirs and the design of public relations materials for foreign tourism. In this research, five famous towns for tourists in Singapore; Chinatown, Little India, Kampong Glam, Katong and Colonial District, were selected to showcase the different characteristics of colours. First, the methodology employed to investigate the colours of each townscape will be explained. Subsequently, the analysis results of colour characteristics will be compared and discussed. Finally, efforts will be made to connect these findings to propose colour designs for tea packaging.

Methodology

The symbolic colours of five cultural towns in Singapore; Chinatown, Little India, Kampong Glam, Katong and Colonial Distinct were visualised following the steps shown in Figure 1.
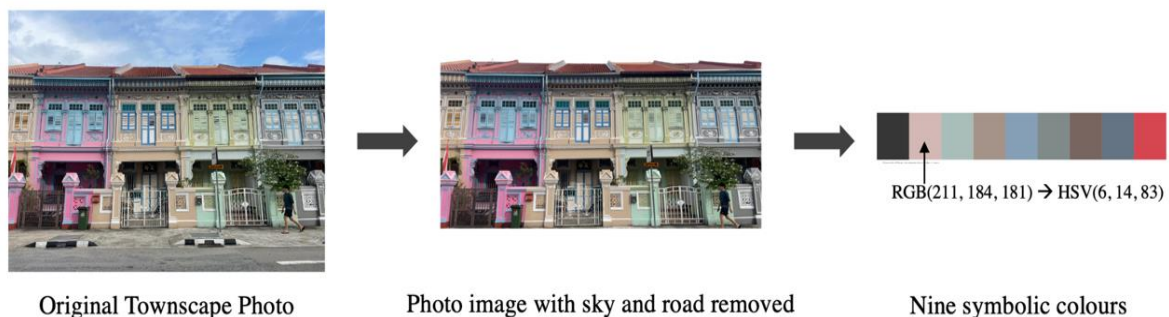

Original Townscape Photo   Photo image with sky and road removed   Nine symbolic colours

RGB(211, 184, 181) → HSV(6, 14, 83)

Figure 1: Procedure for deriving symbolic colours.

As the first step, many photo images of the townscapes of the five selected towns were captured in real life by an author using an iPhone 12 mini camera. All the photos were taken on sunny days to minimise the effect of shadows. Afterwards, five photos of road scenery that show the characteristics and incorporate symbols were selected for each town, resulting in 25 photo images used for our investigation in total. These photos were chosen to distinguish the colour characteristics of five towns. All photos mainly focused on architectural elements but included trees, streetlights, roads and sky as well.

 As the second step, to isolate the essential colours in each townscape, post-processing of the photo images was conducted. Specifically, the colours of roads and sky were transformed to transparency since those are not typically considered memorable colours and not recognised as symbolic elements of each townscape by the human eye.

As the third step, nine symbolic colours were identified for each photo image using a software called Pick Color From Image [3]. A total of ten options ranging from five to ten colours were considered, and it was found that nine colours were better to showcase the uniqueness of each townscape. Subsequently, the RGB values data of the nine colours were picked and converted to the HSV values. This conversion was carried out to enable a more intuitive understanding of the colour differences, aligning with human perception.

Results and discussion

The derived symbolic nine-colours bands are placed below 25 original townscape photos in Figure 2. The colourful characteristics of the historic buildings can be seen expressed in the colour bars. It is observed that there are many reddish colour chips in Chinatown, Little India, and Kampong Glam, and that there are many monotone colour chips in Colonial District.
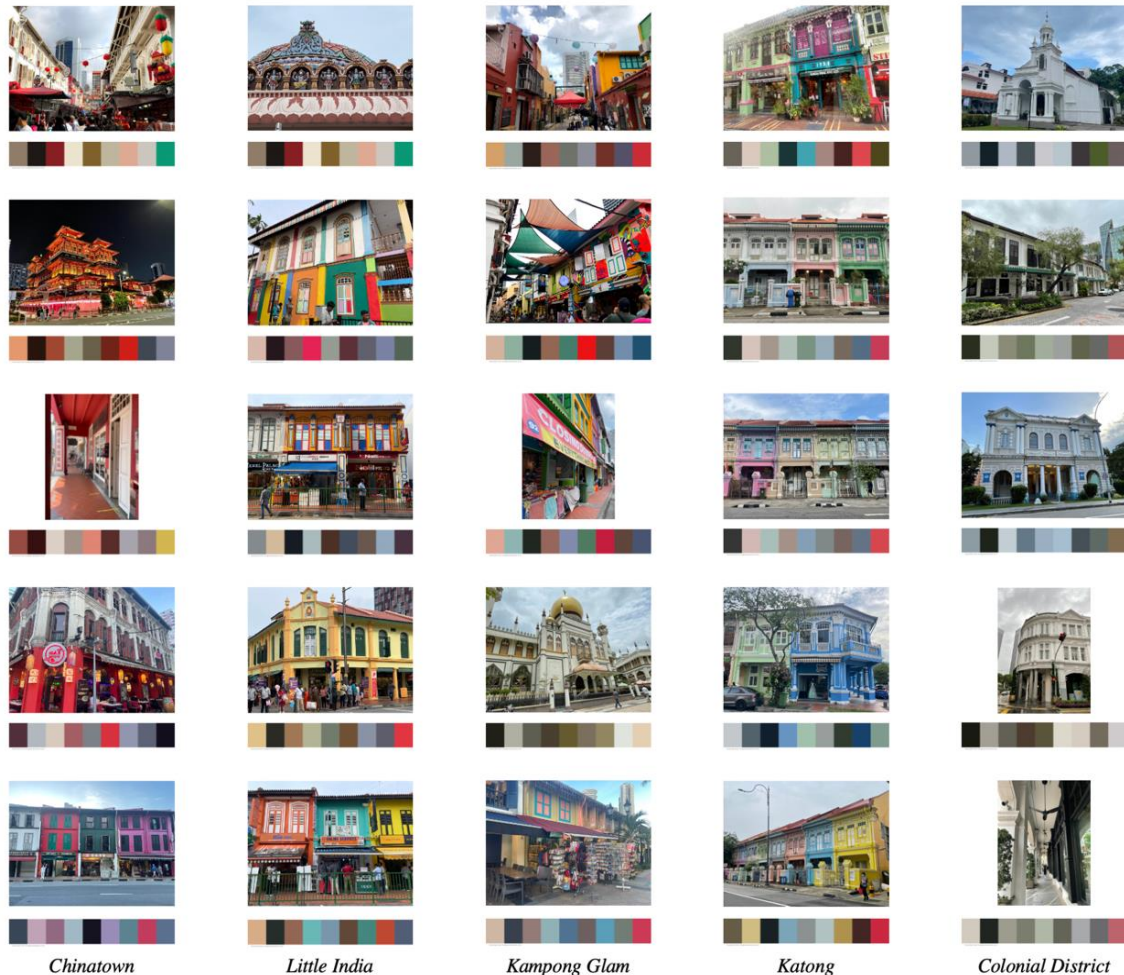

Figure 2: Original townscape photos and symbolic nine colours.

Next, the HSV data was presented through two different 2D diagrams as shown in Figure 3. The upper diagram describes the polar coordinates, which corresponds to the Munsell hue circle. The angle from the positive of the horizontal axis means H (hue), and the distance from the origin demonstrates S (saturation). In the lower diagram, the horizontal axis shows S (saturation), and the vertical axis indicates V (value). There are nine symbolic colours for each photo image, and every town has five photo images, so a total of 45 points are plotted within a single diagram. Figure 4 shows the mean and the standard deviation of each town. In the left graph, the vertical axis represents S (saturation), while in the right graph, it represents V (value).

The upper diagram of Chinatown in Figure 3 shows a concentration of points near warm colours, indicating that warm hues such as red and orange are unique colours of its townscape. Conversely, in the upper diagram representing Colonial Distinct, most of the points are situated close to the origin, showing low saturation. The lower diagram of Colonial Distinct further illustrates that the majority of

points have saturations lower than 50%. Moreover, as demonstrated in the left graph of Colonial Distinct in Figure 4, the mean of S is notably low as approximately half of that of others. This demonstrates that low-saturation colours such as black and white are more dominant compared to highly saturated vivid colours within Colonial Distinct. In terms of V, Colonial Distinct significantly differs from other towns, with the lowest mean of V at 52%, meaning that colours of Colonial Distinct are relatively darker compared to other towns. On the other hand, the upper diagrams of Little India, Kampong Glam and Katong are similar in a way that points are generally scattered and clustered predominantly around two directions; the red colour zone and the blue colour zone. This means that these three towns are hard to distinguish colours since they exhibit similar characteristics. However, Figure 4 reveals characteristic differences among these three townscapes. The left graph in Figure 4 shows that Little India has the higher mean of S at 38%, while Katong has the lower mean of S at 31% among these three towns. This implies that the symbolic colours of Little India tend to be more vivid and those of Katong are paler in comparison. Unlike the left graph, the right graph in Figure 4 shows no significant difference among the five towns in the right graph, although they all exhibit wide diversions, showing that road sceneries in these towns encompass both dark and bright elements.
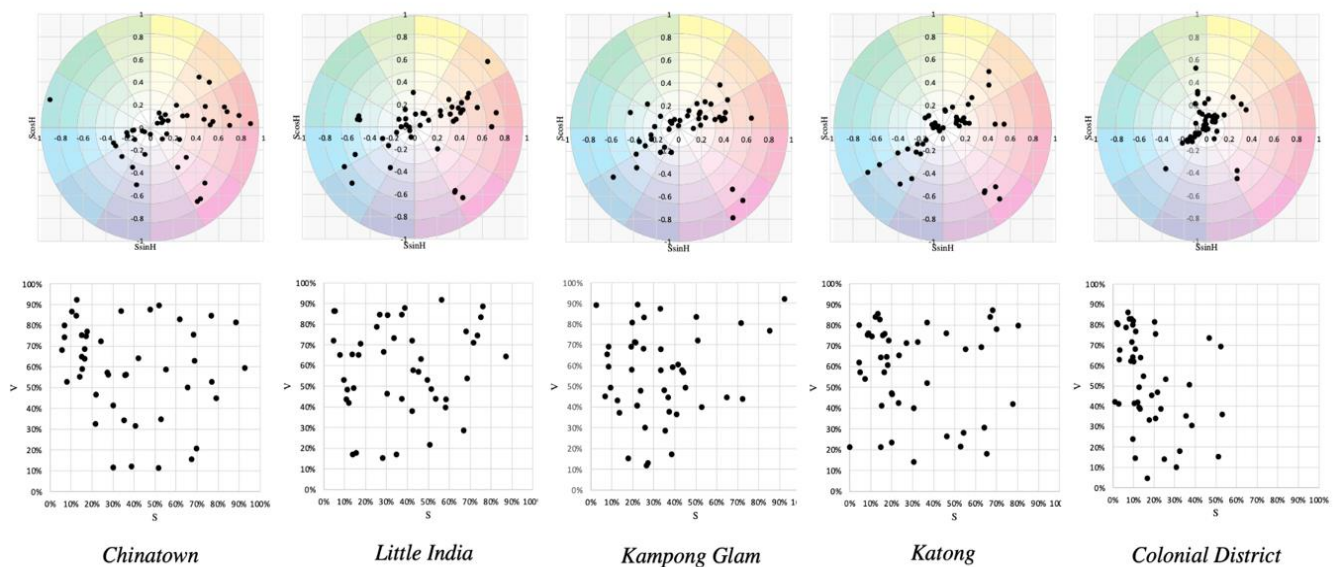

Chinatown   Little India   Kampong Glam   Katong   Colonial District

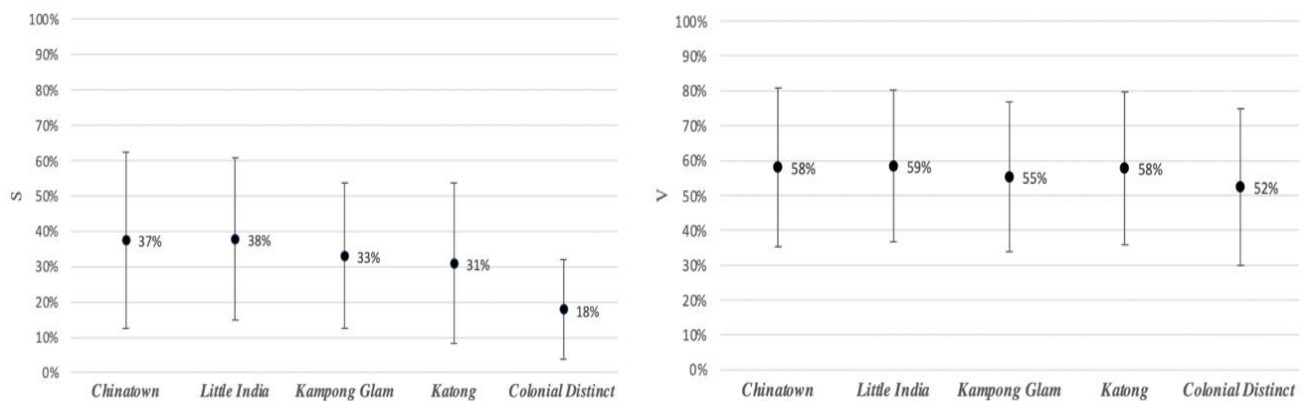*Figure 3: Comparison of HSV data for five townscapes.*

Figure 4: Comparison of S (saturation) and V (value) for five townscapes.

Conclusions

The colours characteristics of distinct five towns in Singapore were compared and discussed using data science. However, several limitations were encountered in this research. Firstly, the selection of nine symbolic colours for each town relied on existing software where the process of selection is unknown. Using scientific methods such as k-means clustering could potentially enhance the accuracy of colour extraction. Secondly, colours can be easily influenced by various factors beyond cultural difference among towns, including lighting conditions and camera angles. Moreover, it was found that the dominant area of a colour may not directly correlate with its psychological impact. It was challenging to capture the contextual nuances of the original photos in the colours extraction process since memorable colours do not exactly match scientifically measured physical colours. Additionally, even if memorable colours were scientifically measurable, they could vary depending on an individual's cultural background, past experiences, and changes in visual sensitivity due to ageing.

In the future, it is recommended to employ k-means clustering carried out to select four symbolic colours for each town to create tea packaging design, as shown in Figure 5. Further investigations on the effects of colours of products' packaging on their sales should also be conducted. This would enable a more comprehensive understanding of how colours of towns affect individuals' behaviours and preferences.

Figure 5: Examples of colour package design for five townscapes.

References

1. Singapore Tourism Board. *Passion Made Possible.* [https://www.visitsingapore.com/madewithpassion/ – last accessed 12 September 2023]

2. Urban Redevelopment Authority. *Urban Design.* [https://www.ura.gov.sg/Corporate/Guidelines/Urban-Design – last accessed 14 September 2023]

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