ภาพลักษณ์ของเอเชียตะวันออกเฉียงใต้: การค้นหาภาพลักษณ์ของภูมิภาคจากภาพถ่ายในสื่อสังคมออนไลน์ที่ผู้ใช้สร้างขึ้น

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บทคัดย่อ

การวิเคราะห์ภาพลักษณ์ของสถานที่เป็นหัวข้อที่มีการศึกษาอย่างแพร่หลาย แต่ในขณะเดียวกันการวิจัยในระดับภูมิภาค (Supranational) ยังมีอย่างจำกัด งานวิจัยนี้มีจุดประสงค์เพื่อนำเสนอวิธีการใหม่ในการระบุภาพลักษณ์ของภูมิภาคเอเชียตะวันออกเฉียงใต้ (SEA) ซึ่งเป็นพื้นที่ที่ได้รับความสนใจในการศึกษาค้นคว้าข้อมูลในด้านของความร่วมมือทางเศรษฐกิจและการเมือง โดยการนำเสนอ

ภาพลักษณ์ของภูมิภาคเอเชียตะวันออกเฉียงใต้จะนำไปสู่การพัฒนาธุรกิจการท่องเที่ยวในระดับภูมิภาค งานวิจัยนี้ใช้ Google Cloud Vision AI และอัลกอริทึมการในการสร้างแบบจำลองหัวข้อ (Latent Dirichlet Allocation) เพื่อวิเคราะห์ภาพถ่ายจาก Flickr จำนวน 50,000 รูป จากทั้ง 10 ประเทศซึ่งเป็นสมาชิกของสมาคมประชาชาติแห่งเอเชียตะวันออกเฉียงใต้ (อาเซียน) โดยผลจากการวิเคราะห์รูปภาพแสดงให้เห็นว่าภูมิภาคเอเชียตะวันออกเฉียงใต้มีความโดนเด่นใน 5 มิติ ประกอบไปด้วยภูมิทัศน์ที่สวยงามความหลากหลายธรรมชาติ สถาปัตยกรรมทางประวัติศาสตร์และศาสนา ความคึกคักของเมือง และกิจกรรมทางวัฒนธรรมและประเพณีต่าง ๆ โดยผลการวิจัยนี้สามารถช่วยให้ประเทศในภูมิภาคเอเชียตะวันออกเฉียงใต้สร้างภาพลักษณ์ที่ครอบคลุมและสอดคล้องกันได้มากขึ้น ประเทศต่าง ๆ ในภูมิภาคยังสามารถแลกเปลี่ยนและโอนถ่ายภาพลักษณ์เพื่อสร้างผลิตภัณฑ์และบริการเฉพาะภูมิภาค

คำสำคัญ: ภาพลักษณ์ภูมิภาค, การตลาดสำหรับแหล่งท่องเที่ยว, ภูมิภาคเอเชียตะวันออกเฉียงใต้, อาเซียน, การวิเคราะห์ภาพ, การสร้างแบรนด์สถานที่

Identifying a Supranational Image of Southeast Asia Using Machine Learning

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Abstract

The core of place marketing and branding is the concept of place image which can be defined as a group's or an individual's perception towards a particular place. Images represent a simplification of a large number of associations and pieces of information connected with the places. A level of place image that requires further investigation is supranational image – a level of a place image that is larger than a country. Therefore, the purpose of this research is to introduce a new method to

identify the supranational image of Southeast Asia (SEA). This new method can help identify a unified supranational image of SEA, to transfer image from stronger countries to weaker ones, and to create regional thematic products and services. This research uses a combination of Google Cloud Vision AI and a topic modelling algorithm, latent Dirichlet allocation (LDA) to analyse 50,000 Flickr photos of the 10 countries and to identify the image of SEA which comprises beautiful and diverse landscape, rich tropical nature, elegant historic and religious architecture, bustling city scenes, and cultural and recreational activities.

Keywords: Supranational image, Destination marketing, Southeast Asia, ASEAN, Image Analysis, Place Branding

1. Introduction

Interest in place marketing has grown substantially during the past decade among academics, policy makers and business practitioners (Elliot, Papadopoulos & Kim, 2011). The application of marketing strategies and methods to places can be considered as a powerful instrument to promote cultural distribution and economic development (Qu et al., 2011). One aspect of place marketing as place branding has recently attracted increased attention from both practitioners and academics. This refers to the application of brand strategies to develop cities, regions and countries through the identification and differentiation of "places" by positive image building (Cai, 2002). The core of place marketing and branding is the concept of place image, which can be defined as representing the sum of group or individual perceptions towards a particular place (Dinnie, 2004).Images represent a simplification of a large number of associations and pieces of information connected with places (Day, Skidmore & Koller, 2002).

Researchers have agreed that place image is a multidimensional construct comprising two main elements as affective and cognitive (Hosany, Ekinci & Uysal, 2006). The multidimensional complexity of a place image is difficult to analyse because places are nested in multiple scalar and territorial levels (Therkelsen & Gram, 2010) such as neighbourhoods, districts, cities and countries (Taecharungroj, 2018). Despite extensive research and assessment of place image on various levels (Dolnicar & Grün, 2013; Gallarza, Saura & Garcıa, 2002), the supranational image of a place that transcends national boundaries, authority or interests (Dooley & Bowie, 2005; Therkelsen & Gram, 2010) has not been adequately explored.

Here, a supranational image of Southeast Asia (SEA) as a region that is fast emerging on the global stage was first identified and then examined. SEA is a sub-region of Asia comprising 10 sovereign states as Malaysia, Singapore, Indonesia, the Philippines, Brunei, Myanmar, Lao Peoples Democratic Republic (Lao PDR), Cambodia, Vietnam and Thailand that are members of the Association of Southeast Asian Nations (ASEAN). The region has become a major global tourism destination with significant economic growth (Ghimire, 2001). The tourism sector commands 11% of the gross domestic product (GDP) of ASEAN member countries (Wong, Mistilis & Dwyer, 2011).

One of the obstacles when studying a supranational image is the limited capability of traditional methods. Traditional quantitative and qualitative methods such as in-depth interviews, content analysis or surveys are mostly limited to one or a few places. However, the recent proliferation of digital data on the Internet, as so-called Big Data, has opened new study avenues to research places on a larger level. Digital data as photographs or photos can be used to effectively study place brand image (Van Dijck, 2011). Research has demonstrated that photos can create a better understanding of places. The social media platform Flickr is a photo repository website that allows photo sharing. Photos on Flickr have been used in many place-related studies (see Taecharungroj & Mathayomchan, 2020a).

2. Research Objective

User-generated photos on Flickr as Big Data were utilised to identify a supranational image of Southeast Asia. A comprehensive understanding of the supranational image of SEA can be used as an effective tool by researchers, national tourism organisations (NTOs)

and destination marketing organisations (DMOs) to promote the region and member countries. To accomplish this objective, machine learning techniques including Google Cloud Vision AI and the latent Dirichlet allocation (LDA) topic modelling algorithm were used to identify the dimensions of the SEA image.

3. Literature Review

3.1 Place branding and place image

Zenker and Braun (2010) defined place branding as "a network of associations in the mind of the consumer based on the visual, verbal and behavioural expression of a place, which is embodied through the aims, communication, values and general culture of the place's stakeholders and overall design". The process of place branding is regarded as a production of cultural meanings (Pedeliento & Kavaratzis, 2019). The main purpose of a place brand is an identifier and a differentiator of a place (Aitken & Campelo, 2011). Acting as an identifier and differentiator, a place brand is a powerful instrument in influencing customer perception and behaviour (Nathan et al., 2019).

Place image is a focal point of place branding (Kavaratzis, 2004); a strong and positive image is regarded as the most straightforward indicator of success in place branding (Acharya & Rahman, 2016; Braun, Eshuis & Klijn, 2014; Cai, 2002). Place image can be defined as the sum of beliefs, ideas, impressions and perceptions that people hold of events, objects and behaviours (Tasci & Gartner, 2007); it is an expression of knowledge, imagination, impression, prejudices and emotional thoughts of an individual towards a particular place (Song et al., 2019). A place image is important because it attracts both visitors and residents (Braun et al., 2014; Greaves & Skinner, 2010).

The projection of a unique image of a place can help to attract customers by presenting attributes that distinguish the visit from a normal experience (Kokosalakis, Bagnall, Selby & Burns, 2006). Thus, both NTOs and DMOs require a deeper understanding of the nature of the images held by both organisations and individuals. This will allow them to shape or influence a favourable image to enhance economic development and place attractiveness (Greaves & Skinner, 2010).

Researchers have agreed that place image is a multidimensional construct comprising two main elements as affective and cognitive (Hosany et al., 2006). The multidimensional complexity of a place image and brand is difficult to analyse because places are nested in multiple scalar and territorial levels (Therkelsen & Gram, 2010), which may possess both complementary and contradicting characteristics (Taecharungroj, 2018).

3.2 Destination image

A related concept to place image is destination image, which can be considered as the construction of an overall evaluation by a person towards a destination (Taecharungroj & Mathayomchan, 2020b). The association between the destination and a number of image objects such as events, culture, traditions, history, products, celebrities, famous people and businesses can lead to the creation of destination image (Chaulagain et al., 2019). Researchers explained the relationship between place image and destination image using three approaches. First, some studies claimed that destination image and place image are distinct constructs that have a causal relationship; an improved place image will also improve the image of a destination

(Chaulagain et al., 2019). Second, according to Taecharungroj & Mathayomchan (2020b), destination image is a spatial subset of place image. Destinations refers to locations where tourists visit e.g. a scenic mountain in a country or a market in a city. Third, destination image can be conceptualised as a functional subset of place image. Despite a similar spatial boundary, a destination image is the perception of visitors whereas a broader place image considers other constituents such as residents, businesses and customers. Nevertheless, destination image and place image are closely related. The approach of this research had the primary aim of inferring a destination image of SEA but the outcome can also be used to improve and strengthen place image. This is discussed in the final section.

3.3 Supranational image

Place levels typically include neighbourhood, district, city and country (Taecharungroj, 2018). As well as prominent city and country brands, regional brand can be considered as an intermediate level (Zenker & Jacobsen, 2015). Regions could be within individual countries or occurring cross-nationally, referred to as cross-border regions (Witte & Braun, 2015). Interregional place branding is an approach that involves two or more regions jointly branding together (Zenker & Jacobsen, 2015). A level of place branding larger than country brands is referred to as a supranational brand (Dooley & Bowie, 2005; Therkelsen & Gram, 2010) and this concept is the focus of this study. Examples of supranational brands previously studied include the Nordic region (Magnus, 2016), Baltic Sea region (Andersson & Paajanen, 2012), Europe (Therkelsen & Gram, 2010) and Africa (Browning & Ferraz de Oliveira, 2017). A visual representation of these

different levels of place branding is shown in Figure 1.

Studies concerning supranational branding are limited but the concept is important for branding places on smaller scales. A supranational brand has three complementary characteristics. First, it has the capability to transfer images from places with a stronger image to weaker image areas (Andersson & Paajanen, 2012). For example, the Nordic region has a positive image that does not specifically or individually apply to Sweden, Denmark, Norway, Finland, Iceland or Greenland (Magnus, 2016). Therefore, countries in the Nordic region often exploit their supranational brand for their own benefits. Likewise, Slovenia was compartmentalised as part of "Former Yugoslavia" or "Eastern Europe" (Andéhn & Zenker, 2015); these supranational images influenced perceptions of Slovenia before its national brand gained strength on the global stage. Second, supranational brands allow countries to pool resources together for larger-scale and more efficient marketing and branding campaigns (Andersson & Paajanen, 2012). For example, with its limited funding, Therkelsen and Gram (2010) posited that Denmark could benefit from working with other countries to fund a region-wide marketing effort. Pooling of resources helps to generate the economy of scale, which is crucial to allow smaller nations and cities to compete on a global level. Third, a supranational brand facilitates the development of transnational products or services such as thematic tours which tap into the resources and strengths of member countries (Andersson & Paajanen, 2012).

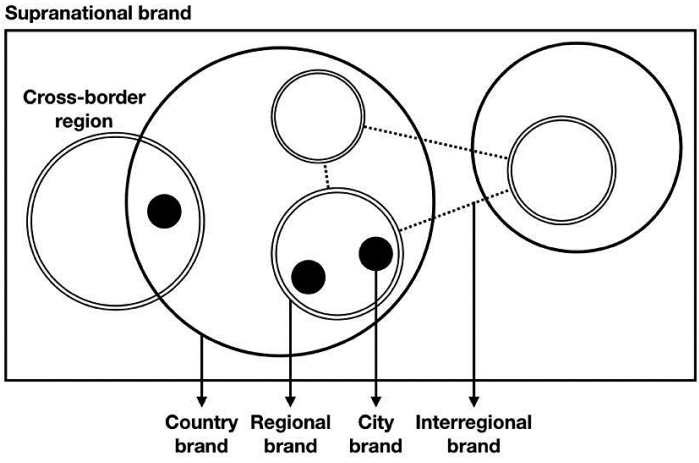


Figure 1 Visual representation of multiple levels of place brands

To reap the benefits of image transfer, pooling of resources and product development, it is important to understand and identify a unified image of the supranational brand. Such an image should be established from a unique and shared identity of constituent countries (Andersson & Paajanen, 2012). Nevertheless, establishing a unified supranational image is complex because of nesting hierarchies of place, multiple identities, diverting interests and rivalry (Therkelsen & Gram, 2010). Hence, a prevalent knowledge gap exists as the best method to identify the optimal supranational image. The lack of an effective method results in a blandness of the message portrayed in the "Brand Europe" strategy (Therkelsen & Gram, 2010) and contradicting discourse in the "Brand Africa" campaign (Browning & Ferraz de Oliveira, 2017).

To develop a new method capable of identifying the supranational image of SEA, a supranational image was regarded as the sum of its constituent countries (Magnus, 2016). This ensured the inclusion of any distinctiveness of smaller countries that might otherwise be subsumed or lost at a larger regional level (Browning & Ferraz de Oliveira, 2017).

In the past, it was challenging to identify a supranational image due to the limitation of traditional methods. Nevertheless, the recent development of social media platforms and the proliferation of user-generated content (UGC) have opened new possibilities to analyse massive amounts of data. This Big Data refers to a complex and large data volume emanating from autonomous and heterogeneous sources. Data agglomerate due to distribution and decentralisation without proper control (Taecharungroj & Mathayomchan, 2020a). Recent research on Big Data uses a combination of web mining, social media analysis, data mining, visualisation, machine learning and optimisation. A new analytical technique used to analyse such data is called machine learning. This has capabilities that far surpass traditional statistical methods. Recent research has incorporated machine learning to study the attributes of a particular area, including correlations between affective components and tourist activities through online images in travel reviews and travel blogs (Liu, Tseng & Tseng, 2018). These studies demonstrate that machine learning has the potential to analyse a massive amount of UGC.

UGC is digital information in the form of texts, images, videos or any combination of such media that people create to broadcast and communicate their experiences. Despite its diversity and quantity, UGC has become a valuable source for studying place brands

(Taecharungroj, 2019). Images, in particular, are good sources for studying place brands as they show features of a place generated through the user's imagined, perceived or real exposure to the destination (Hunter, 2012). These user-generated images possess both accidental and intentional messages from users who experience the place vicariously or in person (Hunter, 2012). Detailed research on place image and place branding has been conducted by analysing images, such as studies of New York (Deng & Li, 2018), metropolitan areas in Bangkok (Taecharungroj, 2019) and Seoul (Hunter, 2012). Images used for this type of research are retrieved from Flickr, one of the most popular social media platforms, which acts as a specialised photograph repository for photo sharing. Flickr allows users to upload photos to express themselves and to show how they view the world through their photos (Van Dijck, 2011).

3.4 Research context: Southeast Asia

Southeast Asia (SEA) comprises a group of states between the Pacific and Indian Oceans. Countries in the region have rich cultural heritage, influenced by Chinese and Indian cultures. The region has diverse religious beliefs such as Islam, Buddhism and Christianity. SEA has long been one of the favourite destinations for global travellers. The region consists of 11 countries which are Brunei, Cambodia, East Timor, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam (Ramit-Medrano, 2017). The scope of countries in this study was limited to the 10 members of The Association of Southeast Asian Nations (ASEAN).

SEA is an important region and the ASEAN economy has recently attracted significant global attention. Economists have

projected a 5.3% increase in the gross domestic product (GDP) of the region from 2016-2020 (Petri, Plummer & Zhai, 2010). Main industries that drive regional economies are fuel, minerals and goods manufacture (Timothy, 2003), while the tourism industry has recently grown in importance. The total number of international tourists that visited countries in SEA was 129.2 million in 2018 (Salikha, 2019).

Despite the importance of Southeast Asia, there is no existing study on the supranational image of SEA. Image identification could benefit countries in the region in several ways, including the transfer of a supranational image from SEA to lesser known countries, as a common denominator to facilitate pooling of resources and development of new products and services. Therefore, the research question of this study is "what is the supranational image of SEA according to the analysis of user-generated photos?"

4. Research Methodology

To answer the research question, the method adopted here followed the three steps performed by Taecharungroj and Mathayomchan (2020a) as (1) photo retrieval, (2) label detection and (3) latent Dirichlet allocation (LDA).

In the first step, photos were searched by country name, with results sorted by relevance to the search term. To ensure a sufficient number of photos for analysis, the cut-off point was set at 5,000 photos for each country. However, more than 5,000 photos of each country were collected for further screening after label detection. The Flickr API was used to collect photo metadata of each country.

Google Cloud Vision was used to detect the features and objects in every photo. This is a recent technology that collects,

analyses and extracts information from visual images (Hosseini, Xiao & Poovendran, 2017). The Google Cloud Vision API offers "powerful pre-trained machine learning models through REST and RPC APIs. Assign labels to images and quickly classify them into millions of predefined categories" (Mulfari, Celesti, Fazio, Villari & Puliafito, 2016). The Google Cloud Vision API was used in this study because of its "label detection" capability that can detect and indicate features and objects within photos. Consequently, these labels can be used to rapidly infer the images of places on a large scale (Taecharungroj & Mathayomchan, 2020a, 2020b). All photos of the 10 countries were processed to detect their labels. The maximum number of labels produced by Google Cloud Vision was set at 10. Photos with the fewest labels were removed to reduce the number of photos to 5,000 per country. In total, 50,000 photos of the 10 ASEAN member countries were used to identify the supranational image.

LDA modelling, as the most common feature extraction or topic modelling algorithm in machine learning, was conducted to answer the research question (Guo et al., 2017). LDA is a "generative probabilistic model of a corpus" considered to be highly efficient in Big Data management (Anandkumar, Foster, Hsu, Kakade & Liu, 2012). The general concept of LDA assumes the existence of a hidden structure consisting of a set of topics in the whole corpus of photos. This model helps to identify a mixture of topics from a large number of photos using the co-occurrence of photo labels (Maskeri, Sarkar & Heafield, 2008). The LDA modelling algorithm demands that the required number of topics is specified a priori. The elbow method was used to indicate the optimal number of topics by running the k-means clustering algorithm for a specified number of clusters.

Results indicated that five was a suitable number of topics. The identified topics from LDA were used to infer the supranational image dimensions (see Taecharungroj & Mathayomchan, 2020a). The LDA modelling algorithm produced a distribution of probability within different topics (dimensions) for each photo. Each photo was then allocated into the respective categories based on its highest dimension. For example, Khuek Khak Temple in Thailand (Figure 2) had distribution of probabilities as 0.001 (activities), 0.001 (nature), 0.994 (architecture), 0.002 (landscape) and 0.001 (city). Thus, the photo was categorised as an architecture photo. Distribution of probabilities of a photo of a paddy field in Laos (Figure 3) gave 0.001 (activities), 0.994 (nature), 0.001 (architecture), 0.002 (landscape) and 0.001 (city). Thus, this photo was categorised as a nature photo. An activities photo showing an opera performance in Vietnam (Figure 4) had distribution of probabilities as 0.994 (activities), 0.001 (nature), 0.001 (architecture), 0.002 (landscape) and 0.002 (city).

Figure 2 Khuek Khak Temple in Thailand

Source: https://www.flickr.com/photos/52741348@N02/44412810054

Figure 3 A paddy field in Laos

Source: https://www.flickr.com/photos/7155605@N03/25337628427

Figure 4 Tuong Singing (classical opera) in Vietnam

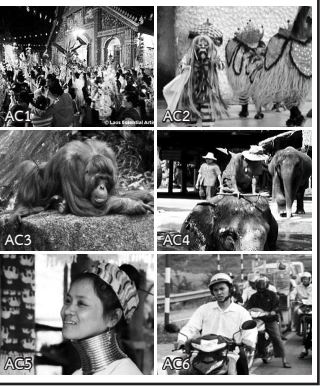
Source: https://www.flickr.com/photos/57693424@N05/9305559442

5. Results

The LDA results are displayed in Table 1. The five dimensions of the supranational image of SEA according to the labels of 50,000 photos included activities, architecture, nature, city and landscape. Each dimension was named according to the interpretation of its

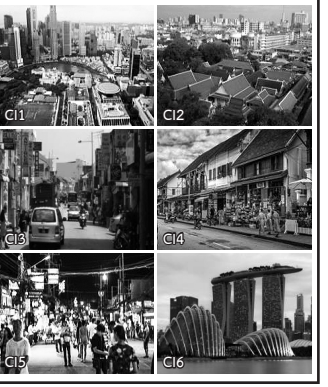
highly weighted labels. LDA assigned the most probable dimensions which were then used to categorise all 50,000 photos. The result gave landscape (12,649) as the most frequently found category followed by activities (10,627), city (10,101), architecture (9,026) and nature (7,597). Table 1 displays the LDA results and photo examples in each category of supranational image.

Table 1: LDA results and photo examples of SEA in each category

SEA image category	Count	Labels	Photo examples (links in Appendix)
Activities	10,672	vehicle, transport, people, adapt, smile, child, fun, car, sport, event, wildlife, human, organism, vacation, animal	

SEA image category	Count	Labels	Photo examples (links in Appendix)
Architecture	9026	temple, architecture, place, build, site, worship, history, landmark, history, sky, carving, wat, ancient, sculpture, art	

SEA image category	Count	Labels	Photo examples (links in Appendix)
Nature	7597	plant, tree, nature, food, flower, grass, vegetation, botanical, forest, landscape, art, environment, jungle, green, field	

SEA image category	Count	Labels	Photo examples (links in Appendix)
City	10101	area, city, architecture, build, urban, metropolitan, light, sky, night, landmark, metropolis, human, settlement, house, cityscape	

SEA image category	Count	Labels	Photo examples (links in Appendix)
Landscape	12649	water, sky, nature, sea, cloud, river, ocean, mountain, boat, atmosphere, phenomenon, landscape, transport, tree, vehicle	

Activities refers to photos that represent human leisure and enjoyment at the destination. Photos of activities include the following themes: (1) ceremonial, professional, sport and social events, (2) wildlife, (3) locals and (4) transport. Activities indicate things that visitors could participate in and do in SEA. The first theme of activities is events, which refer to public assembly for the purpose of socialisation, education, celebration, reunion or business. This supranational image category characterises SEA's vibrant festive events across all seasons. For example, the Kathin Ceremony in Wat Simuang, Laos (Figure AC1, Table 1) is a traditional Buddhist ritual that brings together people from various places. Ponorogo Dance in Indonesia (Figure AC2) is a traditional Indonesian dance in an open arena that displays folk entertainment and Indonesian culture in forms of magical elements. Tourists can also interact with wildlife and local people. Wildlife refers to photos of an animal-related activity such as having breakfast with orangutans in the Singapore Zoo (Figure AC3) and a famous ecotourism activity, elephant bathing in Thailand (Figure AC4). Locals refers to photos of local people such as a photo of the Karen long neck tribe in Chiang Mai, Thailand (Figure AC5) who wear heavy brass rings around their necks. Transport is also part of this category of photos and includes vehicles such as planes, cars, trains and motorcycles. Motorcycles (Figure AC6), in particular, are a popular means of transport in many SEA countries such as Vietnam, Thailand, Indonesia and Malaysia.

Architecture represents the physical architectural identity of the destination as the manifestation of the unique heritage, identity and culture of SEA. Many photos show the religious architecture of Hinduism, Buddhism and Islam. Hinduism and Buddhism are very common

beliefs in SEA. For example, Angkor Wat in Cambodia (Figure AR1, Table 1), a World Heritage Site built in 1650, is the largest religious site in the world. Another example is Pura Ulun Danu Bratan Temple in Bali, Indonesia (Figure AR2), a Hindu temple built in the middle of Lake Bratan to worship the Hindu god of water. Other examples are My Son Cham Ruins (Figure AR3) in Vietnam and Sulamani Temple in Myanmar (Figure AR4). Islamic architecture is another prominent theme in this category. In SEA, Islamic architecture often co-exists with local traditions. For example, Masjid Omar Ali Saifuddien in Brunei (Figure AR5) is an Islamic mosque, considered by many as one of the most beautiful mosques in the Asia Pacific region. Another example is Putra Mosque in Putrajaya, Malaysia (Figure AR6). These examples are sacred places of worship for the Muslim community, historical sites and famous tourist attractions.

Nature refers to photos of plants, trees, vegetation, forests and green natural areas in SEA. The photos of nature include (1) plants such as flowers and trees, (2) natural areas such as rainforests, grasslands and woods, (3) man-made green areas such as agricultural and paddy fields and (4) food. The first theme of nature is plants. SEA is well known for its biodiversity with abundant species of flowers such as the flamingo flower in Indonesia (Figure NA1, Table 1) and bougainvillea in Singapore (Figure NA2). Besides the various species of plants and flowers, tourists can enjoy natural areas in SEA. The region accounts for 15% of global tropical rainforests such as The Mulu National Park (Figure NA3), a UNESCO World Heritage Site in Sarawak. The park is famous for its caves and the available expeditions. Other examples include Kalimantan Forest (Figure NA4) and Mount Agung (Figure NA5) in Indonesia. Lastly, food is a theme in this category because it is

closely related with plants, such as a photo of bananas (Figure NA6).

City represents urban areas and human settlements in SEA; symbolising the economic and social development of the destination through buildings and skyscrapers. The themes of the city photos include (1) aerial-view cityscape, (2) street-view urban scenes, (3) night scenes in the city and (4) buildings such as tall skyscrapers and residential units. Aerial views are picturesque birds-eye representations of the city, such as a view of highly developed Singapore City (Figure CI1, Table 1) and culturally and economically diverse Bangkok in Thailand (Figure CI2). By contrast, street-views are ground-level photos of places, urban landscapes and human settlements such as a busy street in Penang, Malaysia (Figure CI3) and a peaceful residential area in Luang Prabang, Laos (Figure CI4). The third theme is the night scene of destinations such as Bangla Walking Street, the notorious heart of Phuket's nightlife (Figure CI5). The last theme of city is buildings. This includes tall skyscrapers and residential units. For example, the Marina Bay Sands building in Singapore (Figure CI6), the world's longest public cantilever with a structure 38m wide and 340m long, is an integrated resort that comprises three 55 storey towers including extravagant hotel rooms, restaurants, casinos and luxury shops.

Landscape shows the beautiful, peaceful and serene aspect of SEA. Common themes are water-related (e.g. sea and coastal areas, canals, lakes, rivers, reservoirs and waterfalls), mountains and sky photos. Water-related themes are a prominent part of this category. These photos often show the beautiful horizon on a body of water such as a fishing village and a coastal resort in Jimbaran, Indonesia (Figure LA1, Table 1). Other examples include a photo of a canal in

Hoi-An, Vietnam (Figure LA2) and a coastline in Malaysia (Figure LA3). Mountains are another common theme e.g. Mount Pinatubo (Figure LA4), a dormant volcano in the north of the Philippines that has an emerald colour lake in its crater. Tourists can hike to experience the beautiful views. Other examples of landscape photos are Halong Bay in Vietnam (Figure LA5) and Bromo Volcano in Indonesia (Figure LA6).

5.1 Correspondence analysis

Although countries in the same region may share a common supranational image, the quality and quantity of photos within each category are distinct. Correspondence analysis is a graphical technique that displays the ten countries and five identified supranational image categories as points on a two-dimensional map (Figure 5). The two dimensions correspond with the singular value decomposition (SVD). This was calculated from the standardised residuals of the relationship between countries and supranational image categories. Each dimension expresses the variance in the data. From the analysis, Dimension 1 (Figure 5) explains 67.9%, whereas Dimension 2 explains 28.4% of the variance. The analysis shows that increasing distance from the origin of the supranational image category suggests a greater association with a particular country. A country is more associated with a supranational image category if the lines connecting them to the origin form small angles. By contrast, angles near 180 demonstrate a negative association. The correspondence analysis helps to visualise and evaluate the associations (Greenacre, 1992) and also compares and contrasts countries based on their images.

Singapore, Malaysia and Brunei are located on the right side of

the correspondence analysis. These countries are highly associated with the city photos and are negatively related to landscape, activities and nature. Singapore, in particular, has the strongest association with city because the country is considered the most economically developed country in SEA. The mix of old colonial buildings and new cutting-edge skyscrapers along the canal and near the Marina Bay in Singapore is a common feature of photos of Singapore.

Cambodia, Myanmar and Thailand are located at the bottom left of the map, indicating a strong and positive relationship with the architecture photos. These countries have long and rich cultures and history represented through various Buddhist architectures. Many photos of temples and architectural wonders in Thailand, Myanmar and Angkor Wat in Cambodia make the architecture photos of these three countries more prevalent than other countries in SEA.

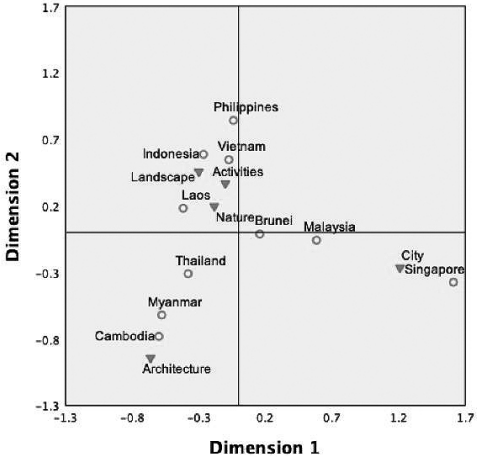


Figure 5 Correspondence analysis of countries in Southeast Asia

The remaining four countries, comprising Indonesia Vietnam, Laos and the Philippines, are located on the top left of the correspondence analysis. These countries are strongly associated with the three categories of supranational image as landscape, activities and nature that are clustered together. Rich in rivers, mountains and natural areas, Indonesia is strongly associated with landscape and nature. Laos is also distinctively associated with nature; the country is very negatively related to city, representing its less developed economy. By contrast, a large proportion of photos of Vietnam and the Philippines are activities and these two countries are strongly associated with activities photos on the correspondence analysis.

6. Discussion and Conclusions

The combination of Google Cloud Vision, AI label detection and LDA identified the supranational image of Southeast Asia from 50,000 user-generated photos of the 10 ASEAN member countries. This method included all the distinct images of the 10 member countries and identified the five dimensions and subsequent categories of the supranational image. A summary of the SEA brand image is depicted in the brand management map in Figure 6. According to this map, the salient images of the highly diverse SEA are the beautiful and diverse landscape, rich tropical nature, elegant historic and religious architecture, bustling city scenes and cultural and recreational activities.

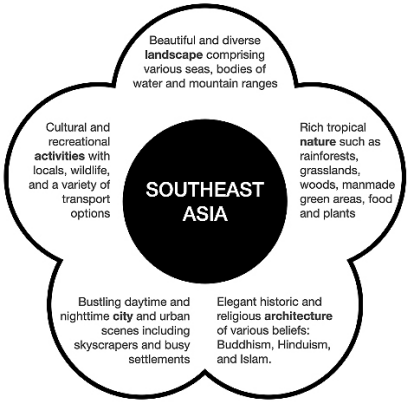


Figure 6 Southeast Asia brand image

The proposed method offered a rapid approach to investigate and understand the underlying image of a supranational brand that can be difficult to capture using traditional methods. This paper demonstrated that the analysis of user-generated photos can help identify and infer the supranational image of SEA. The cognitive image dimensions extracted from 50,000 photos of the 10 ASEAN member countries were inclusive and less subjective, requiring minimal human intervention during the process. Despite the contribution, some limitations were identified with this proposed method. Although the method could effectively capture the cognitive image of SEA, it did not readily indicate affective images. Nevertheless, Google Cloud Vision AI produced various labels for each photo which opened new possibilities to study contexts and emotions.

Despite increased regional collaboration in economic affairs, ASEAN member countries have not formulated a collaborative policy for tourism and service businesses. The SEA image identified in this

research could be used by both the public and private sectors to strengthen coordinated activities and foster intra-regional collaboration. The next section highlights possible strategies for countries in SEA.

6.1 Practical implications

- **The brand of Southeast Asia:** A unified brand image of SEA would allow countries to pool resources such as capital investment and skilled labour to promote regional goods and services. For example, with the limited amount of available funding, countries within the region could benefit from working with others to finance an effective large-scale regional destination marketing and branding campaign. Furthermore, smaller countries and cities in the region would benefit from pooling resources to facilitate the initiation of impactful strategies to compete on a global scale.
- **Image transfer to destinations with weaker image:** The supra-national image can be regarded as the central element of a region and country branding strategy. Destination management organisations (DMOs) of each country can use this method to transfer the image from destinations with a stronger image to weaker image areas. A clear understanding of SEA could help to develop better brand images. For example, the supranational image of SEA, which is rich in natural (nature and landscape) and cultural (activities and architecture) resources could enhance the image of Singapore that lacks in nature and culture despite being a high-income country. Likewise, the bustling economy and urban liveliness of SEA could help augment the images of Laos, Cambodia and Myanmar that are less developed

economically compared with their neighbours.

- **Thematic products and services:** A comprehensive understanding of the supranational brand image and its dimensions can help to facilitate the development of transnational services or products such as thematic tours that can tap into the strengths and resources of countries within the region. DMOs in SEA can collaborate and develop relevant themes such as a nature lover tour, trips for experience seekers and tours focusing on cultural aspects.

  For example, DMOs can cooperate to develop a packaged tour emphasising natural routes. Nature tourism is a trend that is expected to increase in popularity during and after the COVID-19 pandemic (Taecharungroj & Mathayomchan, 2020b). Southeast Asia has a tropical climate with island chains of volcanoes. The region is also rich in diverse natural landscapes. Tourists can relax on a beach or enjoy hiking in a tropical forest. A coastal area in Jimbaran, Indonesia, a dormant volcano, Mount Pinatubo, in the north of the Philippines and a UNESCO World Heritage Site, Mulu National Park in Sarawak, Malaysia can be promoted together as regional natural scenes.

  The second possible theme is cultural trips. DMOs can collaborate and promote the exploration of cultural and architectural wonders in the region such as Angkor Wat in Cambodia, Pura Ulun Danu Bratan Temple, Indonesia, a temple built in the middle of Lake Bratan and various other Buddhist temples in Thailand and Myanmar.

  Lastly, city dwelling trips can incorporate Southeast Asia's vibrant festive events across all seasons to attract experience

seekers. Tourists can enjoy various types of activities such as the Kathin Ceremony in Wat Simuang, Laos or experience a Ponorogo Dance in Indonesia. Tourists can also interact with wildlife and local people through an elephant bathing activity in Thailand or a visit to the Karen long neck tribe at Chiang Mai in the north of the country.

6.2 Limitations and future research

A novel method was introduced to identify a supranational brand image using machine learning techniques based on 50,000 photos of the 10 Southeast Asian countries sourced from Flickr.com. However, despite its contributions, this research had some limitations. First, the analysis was conducted with user-generated photos on Flickr. Thus, the results may contain a platform bias because despite its relevance, Flickr is not the only platform that collects images. Arguably, significantly more images and photos exist on other popular social media platforms such as Twitter, Facebook and Instagram. Future research should study photos and images from other platforms. Second, an analysis of photos cannot capture many intangible and inherent dimensions of countries such as governance, safety and education. Although many supranational brand images identified in this research implied such inherent qualities, this method is not the only available option to thoroughly and deeply analyse brand image. Future research should compare the results of this new method with traditional approaches. The correspondence analysis displays the association between countries and supranational image. Future research can further explore the association between such image and other variables such as time or the characteristics of photographers.

Third, LDA modelling requires the user to indicate the desired number of dimensions (topics). The elbow method was used to set the number of topics at five. However, there are other techniques that could be used in future research, such as the four algorithms by Arun (2010), Griffiths and Steyvers (2004) and Cao Juan (2009). To further strengthen the validity of this method, future research should adapt the aforementioned techniques to compare and contrast the outcomes.

7. References

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Appendix

Activities photos

AC1:

https://www.flickr.com/photos/15368831@N00/3976204032

AC2:
https://www.flickr.com/photos/88192491@N08/8797297908
AC3:
https://www.flickr.com/photos/34534185@N00/6605022485
AC4:
https://www.flickr.com/photos/53836467@N07/9032638107
AC5:
https://www.flickr.com/photos/65548818@N00/16301625821
AC6:
https://www.flickr.com/photos/54238729@N07/14346024054
Architecture photos
AR1:
https://www.flickr.com/photos/17291033@N00/4839832214
AR2:
https://www.flickr.com/photos/71048973@N00/12842517294
AR3:
https://www.flickr.com/photos/88151946@N00/33773761641
AR4:
https://www.flickr.com/photos/31190896@N08/6499612057
AR5:
https://www.flickr.com/photos/126971360@N02/24725835765
AR6:
https://www.flickr.com/photos/69862881@N00/8883443568
Nature photos
NA1:
https://www.flickr.com/photos/22451301@N00/10639019666
NA2:
https://www.flickr.com/photos/89604217@N04/8159117102

NA3:
https://www.flickr.com/photos/46133228@N02/34039009110
NA4:
https://www.flickr.com/photos/58989164@N02/6283123074
NA5:
https://www.flickr.com/photos/106254613@N05/10492959275
NA6:
https://www.flickr.com/photos/39415470@N02/8087489499
City photos
CI1:
https://www.flickr.com/photos/44124447497@N01/400140019
CI2:
https://www.flickr.com/photos/25725480@N00/4825899210
CI3:
https://www.flickr.com/photos/26781577@N07/11512501443
CI4:
https://www.flickr.com/photos/75212875@N02/36019310096
CI5:
https://www.flickr.com/photos/52741348@N02/30197582287
CI6:
https://www.flickr.com/photos/45928922@N03/8509721095
Landscape photos
LA1:
https://www.flickr.com/photos/88192491@N08/8786656659
LA2:
https://www.flickr.com/photos/75212875@N02/35823805414
LA3:
https://www.flickr.com/photos/147711984@N08/27841515309

LA4:
https://www.flickr.com/photos/100635695@N04/23029314679
LA5:
https://www.flickr.com/photos/112649395@N05/40295658672
LA6:
https://www.flickr.com/photos/31366043@N03/14862374415