Educational on Detection Process of Phasatpung Pattern (Honeycomb) in Mudmee Silk of Thailand Local Weaving Community

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Abstract

This research aims to develop a process to detect Prasatpung pattern (honeycomb) in Mudmee Thai silk from the network of weaving community enterprise in northeastern region of Thailand. The process is using image processing by analyze histogram and using sliding window technique to segment and detect Prasatpung pattern. Data had been processed was traditional Phasatpung pattern of Mudmee silk, collected by capturing the pattern images with digital camera and phone camera in total of 885 images. Benchmarked results had showed that the accuracy of pattern segmentation was 43.73% and the accuracy of pattern detection was 68.99%. Due to complications of pattern of Mudmee silk, the segmenting and detecting process could represent only at moderate level of accuracy.

Keywords: Image segmentation, Image detection, Phasatpung pattern, Mudmee silk

Introduction

Thailand has one of the most booming textile industries in the world. As of 2020, the Thailand textile market was valued at $8085.0 billion, with estimations that by 2028 it will reach $11097.9 billion (Verified Market Research, 2021). To be where it is today, the Thai textile industry has endured many years marked by the advancement of skills for high-quality products. Regarding the historicity of the industry, archeological excavation has provided evidence that the prehistoric Thai people learned to use natural fiber to make clothing and other useful materials, an ability that advanced through the Sukothai and Ayudhaya periods to the modern time (Hayami, 1998). This growth was not smooth, as the industry experienced declines in the early nineteenth century due to the imposition of treaties which opened it to colonial interferences. Other compounding issues that stunted the industry were poor relevant experience and the use of simple technology that made Thailand unable to compete with other countries in the international textile trade (Intarakumnerd & Lecler, 2010). Later on, textile products from the Thai textile industry could be traded with other regions or neighboring countries such as Burma, China, England, and Laos as more relevant skills and methods of production were acquired (Hayami, 1998).

While the early periods of the Thai textile industry entailed the application of simple methods of production like throw-shuttle handlooms, it continued to experience expansion so that cloth weaving evolved to include production outside of the scope of the household. This growth was mostly enabled by the importation of modern tools of production such as textile machines, looms, and spindles from Germany, initially for textile to be used for military purposes (Suphachalasai, 1994). Later on, privately owned modern textile mills were established to respond to shortages of materials during the Second World War, in the process catapulting entrepreneurship in the industry. Since then, the Thai textile industry has had to fight through various setbacks such as the collapse of production as a result of competition from low-cost imported cotton textiles from Pakistan, while on the other hand policy measures such as the Investment Promotion Act introduced in 1960 helped to propel growth by encouraging investment in the Industry (Suphachalasai, 1994).

For the Thai textile industry, silk production has remarkably been one of its strongest abilities. Although the art of silk making is said to trace its origin to a Chinese legend that goes as far back as C.2696 BCE, evidence suggests that Thailand may have had a long history with silk (Martins, 2019). Nevertheless, modern silk production has likely been introduced in Thai by the Chinese through maritime trading routes, although it was not until 1861 CE when sericulture and silk production was encouraged by King Chulalongkorn by starting a silk production facility close to Bangkok (Martins, 2019). However, because of factors such as a lack of proper technical skills among silk farmers and cocoons of inferior quality, Thai silk production was affected as Chinese silk was considered more highly prized. In the 1950s and 1960s, the perception of Thai silk received a boost when the American architect Jim Thompson popularized the commodity in the international market, thereby causing the industry to boom (Diethelm Travel Group, n.d.). Today, Thai silk has found great appeal in the international market, characterized by many designs and styles.

Prasatpung pattern (honeycomb) is the unique pattern of Mudmee silk, originated from traditional ceremony called Boon Prasatpung (make merit to local spirits) which also called Boon Tondogpuang in northeastern region of Thailand. This ceremony had been inherited in many areas in Thailand, including among people in Ubon Ratchathani province. They believed that Prasatpung figure will allocate places for their loved ones in the afterlife. They have been inherited this tradition and other cultural heritages from one generation to another. The Prasatpung pattern is also called Sinmeeyai found in Mudmee silk which is the unique pattern that can only be found in this area. People from many villages had formed weaving community enterprise to produce outstanding products including glass bead pattern from ebony dye, Jokdao cloth, Homkid cloth and, the Prasatpung pattern in Mudmee silk which is the unique pattern created by natural dye. Since most of weavers in weaving community are elders, their production is intended to preserve the folk wisdom that had been inherited from the ancients. Until now, they don’t have neither equipment nor technique that can verify the authentication of Prasatpung pattern instead of their eyesight and experiences.

Therefore, researchers had a concept of developing process to detect Prasatpung pattern in Mudmee silk. This concept can be used to create guideline utilizing information technology system to detect Prasatpung pattern and to preserve cultural heritage that inherited from generation to generation.

Objective

This research intended to develop method to detect Prasatpung pattern in Mudmee silk from network of weaving community enterprise in northeastern region of Thailand.

Research Methodology

This research was combined with 2 parts: testing data and detecting Prasatpung pattern from presented principle as per following details. Data that had been used for this research was original Prasatpung pattern data. Collecting by capturing still images with digital camera and mobile camera with assistance from people in Nong Bo Subdistrict. Total images were 885 images as shown in figure 1.



Figure 1: Collecting data by capturing still images with digital camera and phone camera

Detecting Prasatpung Pattern: There were 5 major processes, preprocessing, binary image conversion, histogram calculation, segmentation, and detection. As shown in figure 2.

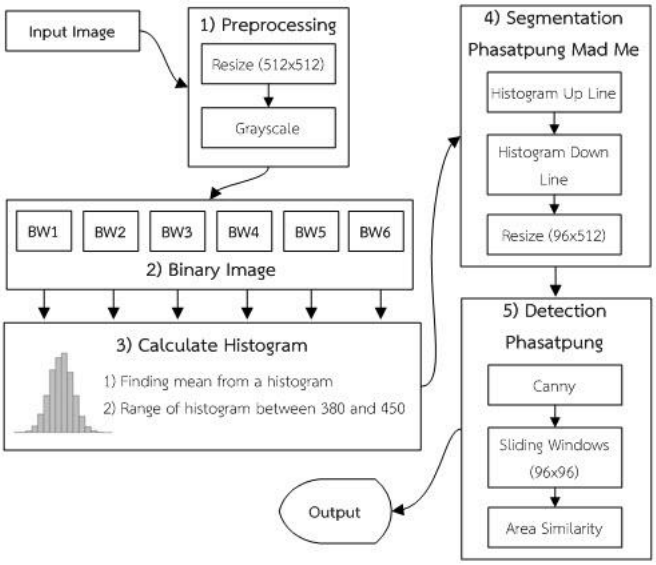


Figure 2: Prasatpung pattern detecting process

1. Preprocessing, this is primary process that preparing images to be the most suitable for utilization and to have enough performance before detecting process as per these following steps: 1) Resize images to have suitable size and ease to process. Researchers had set image size to 512 by 512 pixels. 2) Converting to greyscale. This process will convert images from RGB color mode to greyscale within range 0-255 as per equation (1)

$$Y = 0.3R + 0.59G + 0.11B \quad (1)$$

Therefore Y represented grey value at determined pixel
R represented red value at determined pixel
G represented green value at determined pixel
B represented blue value at determined pixel

2. Binary image conversion since exposure values can affect performance of pattern detection, researchers invented method to convert greyscale image to binary image with many values, total of 6 values. To determine the most effective binary value. As shown figure 3:

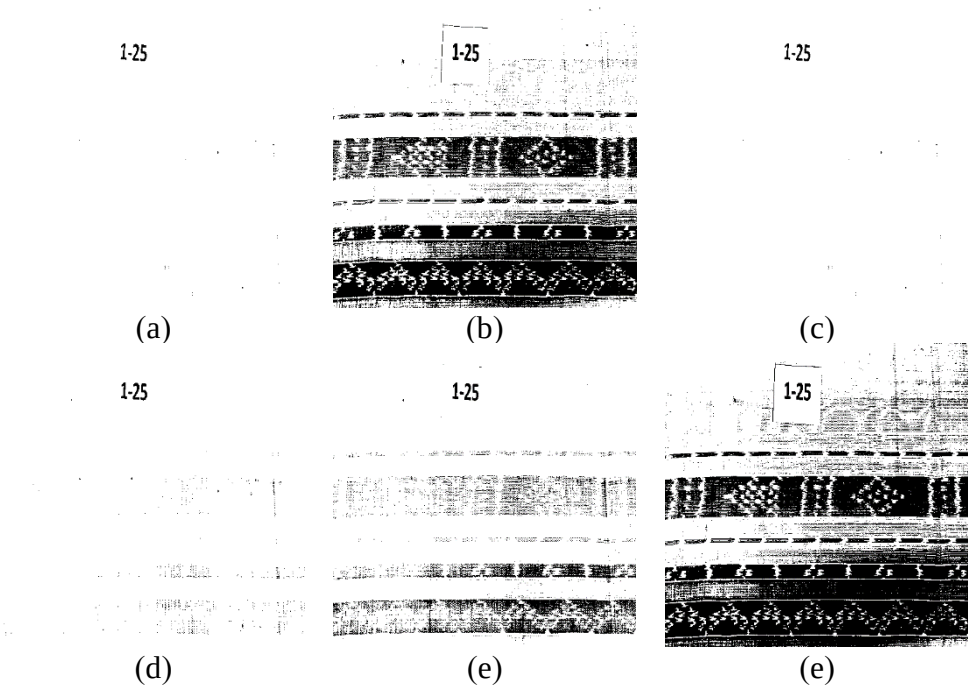
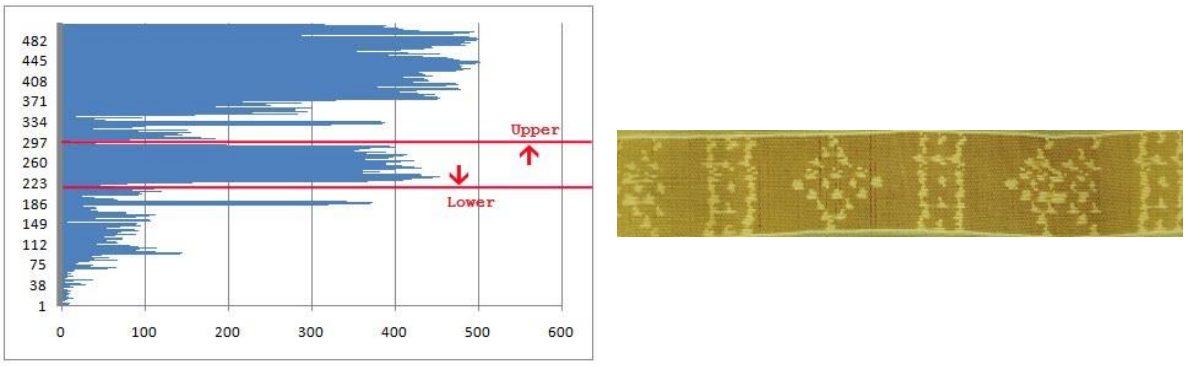


Figure 3: Binary image conversion

Figure 3 showed binary image conversion with command im2bw from Matlab 2015b application. Image (c) and (d) had been added command imadjust to adjust image intensity by setting parameter low_in to 0.5, 0.6, 0.7 and parameter high_in to 0.6, 0.7, 0.8, accordingly

3. Histogram calculation was process that converting binary image in each brightness to histogram. A histogram is a graph shows brightness by representing the frequency, a horizontal axis had value of 1-512 and a vertical axis had frequency of pixels. The appropriated average value for image should be 380-450 pixels. Image with low average value was too dark and image with high average value was too bright.

4. Prasatpung pattern segmentation was process separated part with pattern from without pattern.1) Defining upper line of Prasatpung pattern by considering the histogram. Comparing the cumulative frequency values for each horizontal axis row by row, starting from the core of the image (row 256 to row 1) and compare the lowest cumulative frequencies. Then stop searching when the lowest cumulative frequency was achieved. 2) Defining lower line of Prasatpung pattern. This process was similar to define upper line but comparing from row 256 to row 512 instead. 3) Adjusting image size. After defined upper ling and lower line of the image, researchers will crop only interesting area and resize it ro 96 by 512 pixel as in figure 4.



(a) (b)

Figure 4: (a) Histogram. Upper line and lower line. (b) Prasatpung pattern segmentation.

5. Detecting Prasatpung pattern, this process was to detect area as followed: 1) Finding edge of image with Canny method (Canny, 1986), this method used Gaussian filter to find so it can control image resolution and image denoiser. This process will be applied to template of pattern and image from segmentation process as shown in (a) and (b). 2) Sliding window technique was process that shifting image from the first pixel in horizontal axis by one pixel at a time. As shown in figure 5. 3) Area similarity. Images will be evaluated while shifting window to compare area similarity value with the template. The most value will be considered Prasatpung pattern. As shown in equation 2.

$$S_{area} = \frac{2n(A_1 \wedge A_2)}{n(A_1) + n(A_2)} \quad (2)$$

While A_1 is template, A_2 is window
$n(A)$ is pixel equal to 1 (white)

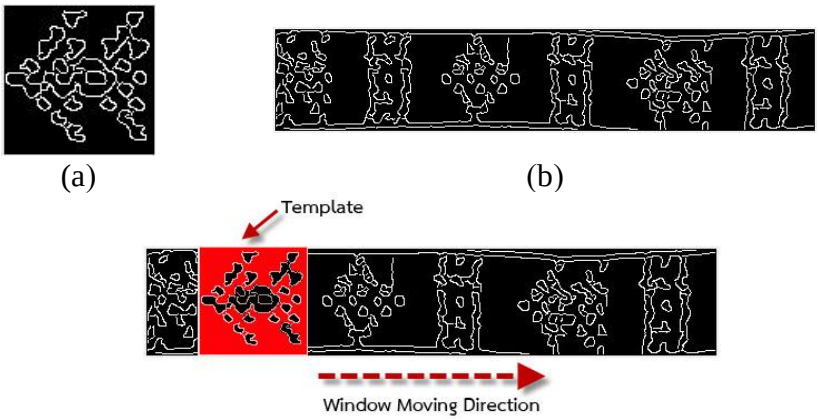


Figure 5: (a) Template, (b) Border line, (c) Sliding Window technique

Research Findings

This development of detecting Prasatpung pattern in Mudmee silk was developed by Matlab 2015b application. Research result showed in 2 parts containing segmentation and detection. Accuracy rate can be evaluated from equation 3. Accuracy rate of pattern segmentation was at 43.73%. Accuracy rate of pattern detection was at 68.99%. The accuracy rate of pattern segmentation was negligible due to unclear pattern which cannot be distinguished between fabric color and pattern. Distorted fabric pattern had caused incorrect definition of upper line and lower line. While brightness falling on Mudmee silk was still an uncontrollable factor.

$$Accuracy = \frac{No.\ of\ \ Correctness}{No.\ of\ \ Test\ \ Data} x\ 100 \quad (3)$$

While $No.\ of\ \ Test\ \ Data$ is data of Mudmee silk image
$No.\ of\ \ Correctness$ is amount of verified data



(a) (b)

Figure 6: (a) Result of segmentation (b) Result of detection

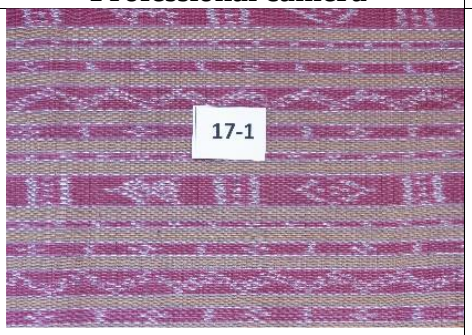
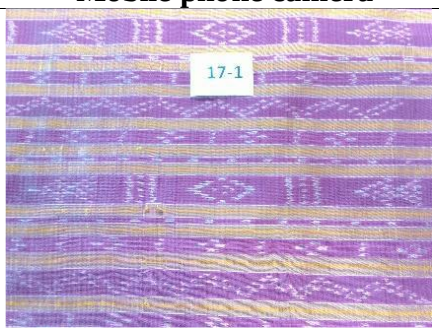


(a) (b)

(c) (d) (e) (f)

Figure 7: (a)-(b) Error in segmentation (c)-(f) Error in detection

Table 1 Photography format with all components of Mudmee silk, Prasartpung pattern. Compositing with Prasartpung pattern, Eeih pattern, Compkao pattern, Koh pattern, and Krajup pattern. Specified on image quality, image exposure, and type of camera.

Image specification	**Type of camera**	
	Professional camera	**Mobile phone camera**
1. Image with all components. Image quality set at the highest resolution. Image exposure set to very bright.		

2. Image with all components. Image quality set at the highest resolution. Image exposure set to moderate brightness.		
3. Image with all components. Image quality set at the highest resolution. Image exposure set to dark.		
4. Image with all components. Image quality set at medium resolution. Image exposure set to very bright.		
5. Image with all components. Image quality set at medium resolution. Image exposure set to moderate brightness.		
6. Image with all components. Image quality set at medium resolution. Image exposure set to dark.		

7. Image with all components. Image quality set at the lowest resolution. Image exposure set to very bright.		
8. Image with all components. Image quality set at the lowest resolution. Image exposure set to moderate brightness.		
9. Image with all components. Image quality set at the lowest resolution. Image exposure set to dark.		

Discussion/Conclusion

Recognition of Phasatpung pattern has made significant strides in recent years and attracted a lot of interest. The two main kinds of weave pattern recognition techniques are texture-based statistical approaches and database/model-based techniques. From research result of detecting Prasatpung pattern in Mudmee silk showed that images are recognized through a series of image enhancement techniques, such as the color-encoding algorithm by Martins 2019 application model. It can be applied to recognize pattern of fabric images but this process had faced many challenges due to handmade coloring of pattern. The suggested model has potential for the textile and fashion industries because it can be trained with fewer parameters at a lower computational cost. Therefore, researchers hope this research will be useful and inherit preserve cultural heritage from generation to generation.

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