

## Generating Ulos Pattern by Using L-System

<sup>1</sup>Arlinta C. Barus, <sup>2</sup>Dimas Y. Danurwenda, <sup>1</sup>Ovryenni Pandiangan,

<sup>1</sup>Surya Simangunsong and <sup>1</sup>Fitri Juliana Manurung

<sup>1</sup>Del Institute of Technology, Jl. Singamangaraja, Laguboti, 22381 North Sumatra, Indonesia

<sup>2</sup>PT. Pikel Indonesia, Jl. Jakarta No. 20-22 Kav. 30 H, 40272 Bandung, Indonesia

**Abstract:** Ulos is a traditional woven from the tribe of Batak in the form of scarves. It is commonly used in the Batak traditional ceremonies. Ulos such as other Indonesian traditional woven, yet rapidly developed in the industry because the production is still traditional and manual. Besides, the design of their motifs is still particularly aimed for ceremonial purpose only. Accordingly, we conduct a study to develop software called jTenun that is able to generate new motifs of Ulos but still have specific characteristics of Ulos. The development is based on existing software called jBatik that has been successfully developed and widely used to generate a new motif of Batiks. jBatik was developed using L-System, a programming language which is able to create a pattern by making use of the iteration concept. Due to the same repetition characteristics of Batik and Ulos, L-System is also applicable to generate new pattern of Ulos. Hence, it is also used in this study. The result shows that jTenun is able to generate new patterns of Ulos as confirmed by some Ulo's experts in the evaluation phase of this study.

**Key words:** Pattern, Ulos, L-System, repetition, ceremonial

---

### INTRODUCTION

Weaving is a heritage of skills handed down from generation to generation in many tribes of Indonesia (Hengky, 2015). The motifs of woven in Indonesia are very diverse. However, they have not been rapidly developed in the industry because the production is still traditional and manual. Besides, the design of their motifs is mostly still particularly aimed for ceremonial purpose only.

This research is expected to develop new and more attractive motifs of woven particularly Ulos as a case study. Ulos is a traditional woven from the tribe of Batak in the form of scarves and commonly used in the Batak traditional ceremonies (Panggabean, 2009). Similar research has been conducted by PT Pikel Indonesia on Batik cloth and produce software called jBatik that has been popular and widely used by Batik craft-men.

Batik is developed by applying the theory of fractals to identify the relationship between fractals and Batik and using L-System programming language (Nancy, 2014; Hariadi *et al.*, 2013).

L-System is a programming language which creates a pattern by making use of the looping concept. Therefore, L-System is also used in this study to generate new

patterns of Ulos as Ulos is proven to have repetition on its motifs. Despite their similarities, Ulos and Batik also have some differences.

Accordingly, Batik cannot be used directly to generate new pattern of Ulos. For that, in this study, we develop jTenun, a customization of jBatik that is able to generate new motifs of Ulos.

### Literature review

**L-System:** L-System is a simple programming language that works on repeated substitution, used to produce an image of a pattern (Grzegorz Rozenberg). The programming language used is easy to learn and understand. L-System consists of several parts, namely an initiator or axiom, generator or detail, variable and symbols.

Axiom or initiator is a string containing symbols or variable is used as an opening initials. Variable is a compilation of some of the symbols to which the symbol contains elements can be replaced by other variables. The symbol has a constant nature that cannot be replaced with another variable. Production rules explains the rules used in changing the variables and symbols.

For example, there are two symbols A and F. A is set as an axiom with A = FA. As mentioned, L-System is a

programming language that works with the substitution of repetition. Given the iteration number is 3 in the iteration-0, a will be the first initial. In the iteration-1, the first initial will be substituted so that the result will be FA. In the next iteration, a is also replaced, so that the result of the second iteration is FFA. Similarly, the result of the third iteration will be FFFA.

## MATERIALS AND METHODS

**Ulos:** Ulos is a traditional Batak woven scarf with certain dimensions of length and width. The dimension is adjusted to its placement in the body: wrapped in the head laid on the shoulder or wrapped in the waist. He classified Ulos as Batak traditional symbol in the form of artefacts (concrete).

Jhonson Pardos defines Ulos as religious cloth with a mystical value. Hence, there exists some requirements and restrictions that are advised to be followed in the process of weaving. Details such as length and width have to be adjusted accordingly to bring peace and blessings; otherwise it might bring to death or bad luck. Sihombing also explains that Ulos contains religious values. Weaving process are begun with prayers, hope, imagination, knowledge, skills and patience, so that Ulos can be used as a medium to deliver prayers and wishes to God.

Most of the time, beside in Batak traditional ceremony, Ulos has also been used as gift to special people or guest to show the feelings of respect, care or love, not restricted to Batak people only but for other ethics in Indonesia and also

foreigners. Esthetic values are reflected from the beauty of Ulos patterns. Furthermore, now a days, Ulos has also been initiated to be used in fashion in the form of dresses, shirts and accessories.

In Fig. 1, the structure of Ulos is presented. It consists of sides, center, border between sides and center, weft border and warp border. According to Niessen, there are two main concepts of Ulo's layout which are symmetric and tri-partition. Symmetric can be identified through vertical or horizontal layout of Ulos. Tri-partition can be identified through three different areas of Ulos which are: right side, center and left side as shown in Fig. 2. Figure 3 shows the example of the application of both principals in Ulos. These principals contribute in designing the work-area of new pattern generation of Ulos.

**jBatik:** jBatik is a generative art software, aiming to generate new pattern of Batik. jBatik is an innovation and addition to assist Batik craft-men to create various patterns of Batik. It is developed based on the Batic Fractal algorithm, proposed by Hariadi *et al.* (2013). In their study, they apply Fourier Transformation and prove that Batik has fractal characteristic with dimension between 1 and 2. Fractal in Batik shows the presence of complexity in traditional art. The presence of fractal in Batik becomes the foundation for them to create a new algorithm to generate new patterns which is called Batik Fractal.

The method used for creating the pattern is L-System (Grzegorz Rozenberg) and Fractal Dimension (Heurteaux and Jaffard, 2007). L-System is used to create pattern,

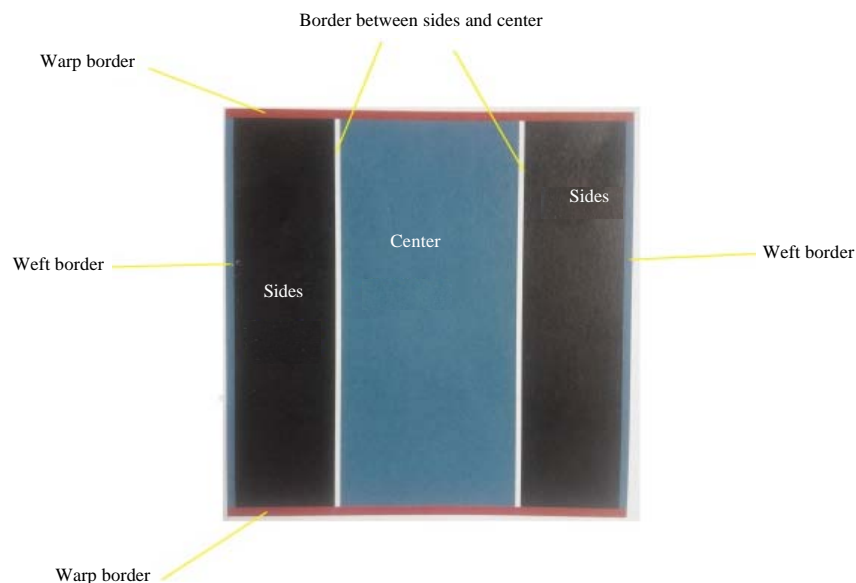


Fig. 1: Structure of Ulos

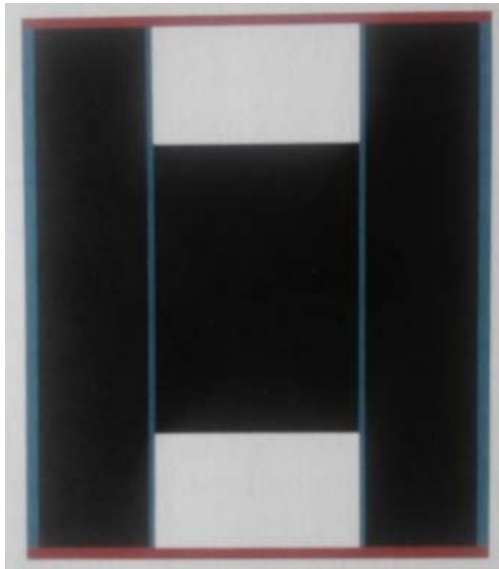


Fig. 2: Layout of Ulos

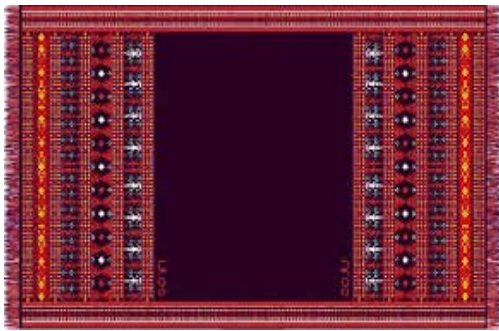


Fig. 3: Example of Ulos with symmetric and tri-partition layout

while Fractal Dimension is used as a measurement tool for Batik Fractal to compare with traditional Batik.

### Analysis, design and implementation

**Comparison of Batik and Ulos:** Both Batik and Ulos are traditional clothes of Indonesia heritage. Both of them have various beautiful patterns that contain repetition concept. From this perspective, they can be considered similar. However, the production approaches are totally different. The patterns of Batik are drawn or printed on a piece of plain cloth. The printing can be implemented by a special traditional Batik drawing tool, called canting, or can be printed either using Batik stamp or machine printing. However, Ulos is a woven cloth. It is woven by a weaving tool. Weaving is a method in which two distinct sets of yarns or threads are interlaced at right angles to form a fabric or cloth. The longitudinal threads

are called the warp and the lateral threads are the weft or filling. Ulos, like other woven cloth is usually woven on a loom, a device that holds the warp threads in place while filling threads are woven through them.

**Customizing jBatik into jTenun:** As mentioned, Batik and Ulos share similar characteristics which is having repetitive patterns. Intuitively, jBatik is expected to be able to generate new patterns of Ulos. However, Ulos is produced differently to Batik. This leads to the customization of jBatik to be jTenun. The output of jTenun should be able to be translated on a loom as set of yarns or threads interlaced at right angles as warp and weft or filling as explained there. Therefore, jTenun is expected to be able to generate new motifs of not only Ulos but other Indonesian traditional cloth. Accordingly, jBatik is modified to be jTenun by customizing following features.

**Work-area:** This part works as a screen to place the newly created motif. In jBatik, work-area is an empty/blank area. In jTenun, work-area is modified to have three rows and columns according to the tri-partition concept that has been explained there. The layout of work-area can be seen in Fig. 4.

**Property sheet:** This feature aims to receive parameters from users or display the default parameters to create the new pattern. In property sheet, field text of iteration and angle are changed into combo box. The values of the iteration parameter are restricted to 1 up to 10. This is due to the result of pre-observation that Ulos patterns can only be created up to 10 iterations only. The angle values are restricted to special and regular angle values such as 30, 45, 60, 90, 120, 150, 180, etc. This is due to the nature of how Ulos is woven so that the angle cannot be randomly and irregularly chosen. The layout of property sheet can be seen in Fig. 5. Similar to jBatik, jTenun accepts parameters as inputs from users as:

- Iteration: this determines the number of iteration to generate the new pattern. As mentioned, the possible values for this parameter are 1-10
- Angle: angle is a parameter to determine the angel of squares that will be filled with the patterns
- Length: this parameter determines the distance between the squares
- Width: this determines the width of the squares
- Axioma: Axioma is the first symbol that will be used by the jTenun
- Detail: detail is used to replace the initial symbol (Axioma)

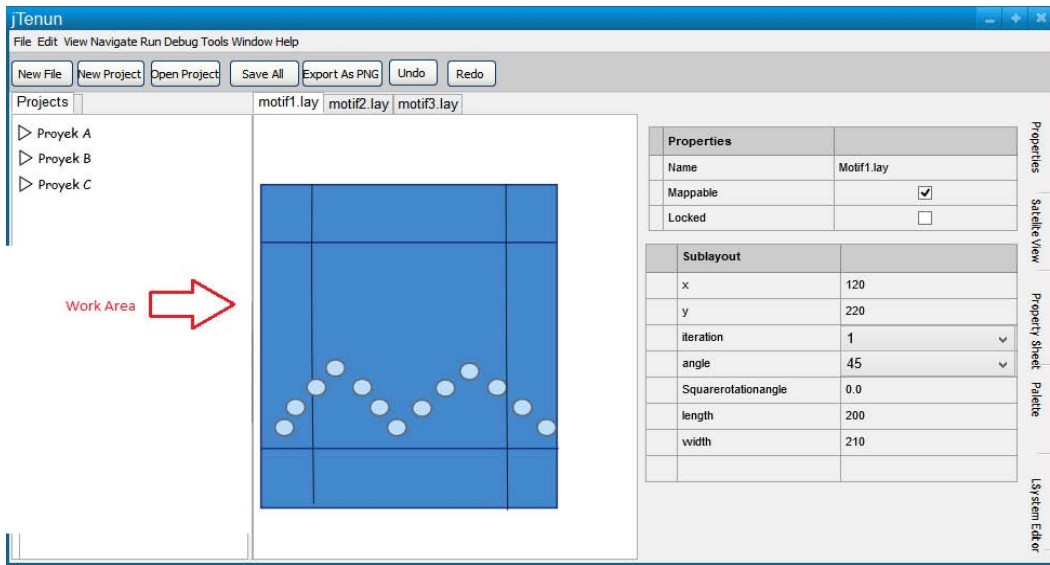


Fig. 4: Work-area of jTenun

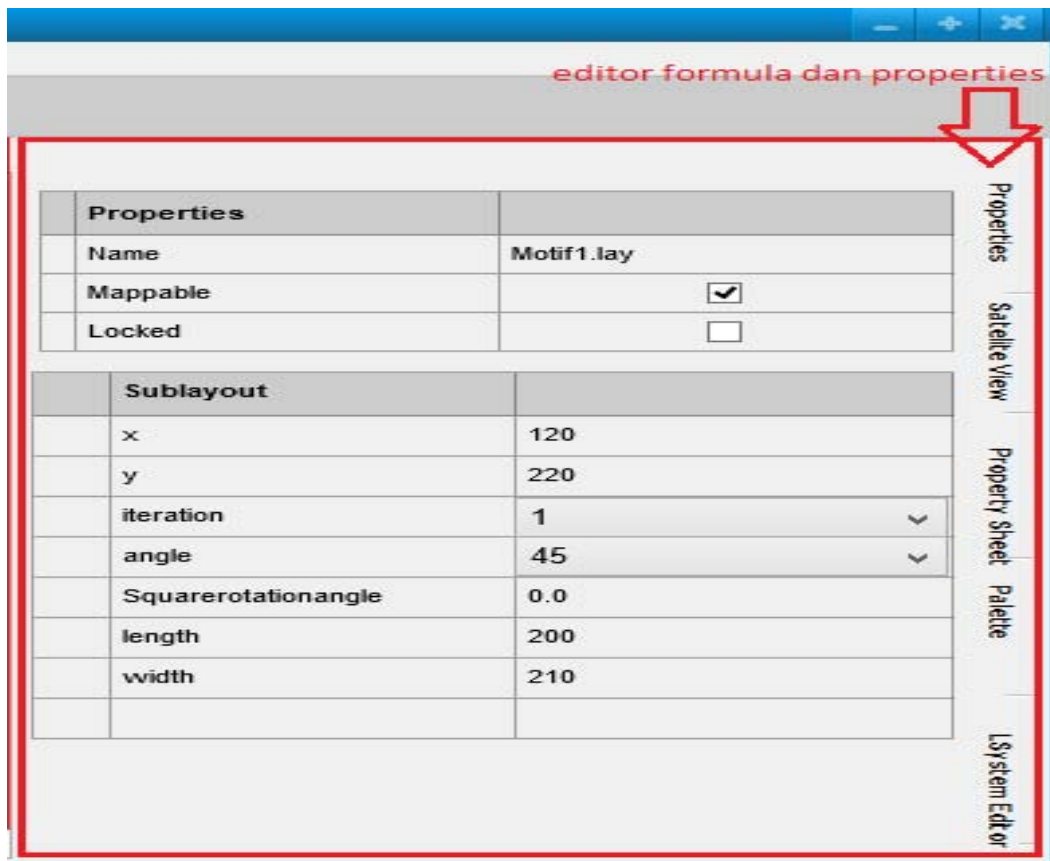











Fig. 5: Property sheet of jTenun

The generation of new pattern starts with the initialization of the parameters mentioned before. The formula of L-System is implemented in L-System editor. jTenun creates new pattern based on the formula

Table 1: Sample of patterns created by jTenun

Image	Axiom	Detail	Angle	Iteration	Length	Width
	A	$A = F-AF$	2	8	330	330
	A	$A = FA+FFFFFF+FA$	12	5	100	100
	A	$A = FA+FFFFFFFFFFFF$	117	10	300	200
	A	$A = FA+F++FFFF-FFFF$	70	5	350	300
	$+(90)F$	$F = FF$	90	2	100	100
	S	$S = 30F+F+F+F+F+F$	30	1	100	100
	AXA	$A = F[\alpha B]+A$	30	10	100	100
	XW	$W = F+(30)FXF$	90			
		$X = F+(30)FXF$	45	9	100	100
	$+F$	$F = FF$	90	1	100	100

of L-System. jTenun is designed simple so that the user can freely enter the parameters and formulas. This allows the variation of new pattern generated. However, as mentioned, not all new pattern can be implemented as a woven cloth motif. Therefore, we give restriction to the parameters as explained earlier. Table 1 shows some patterns generated by jTenun with various combinations Axioms, details, angles, number of iterations, length and width.

## RESULTS AND DISCUSSION

Based on the implemented patterns, the result can be combined in the work-area to be a whole cloth of Ulos. There are many patterns of Ulos as presented in Arlinta however motifs that can be generated by jTenun at this tage are Ulos Sadum, Ulos Bintang Maratur and Ulos Ragidup. Followings explain several of our experiment results.

**Ulos sadum:** Figure 6 shows one example of the newly generated of Ulos Sadum. Followings shown by Fig. 7 are evaluation result of new Ulos Sadum by some Ulos experts. Higher level reflects higher similarity. From Fig. 7, we can see that most of experts value the results in the level of 7.

**Ulos Bintang Maratur:** Figure 8 shows one example of the newly generated of Ulos Bintang Maratur. Followings are evaluation result of new Ulos Bintang Maratur by some Ulos experts. From Fig. 9, we can see that most of experts value the results in the level of 7.

**Ulos Ragidup:** Figure 10 newly generated Ulos Ragidup. Followings are evaluation result of new Ulos Ragidup by some Ulos experts. From Fig 11, we can see that most of experts value the results in the scale of 6. From the three groups of evaluation, we can see that most of experts give the value of 6-7 to the newly created

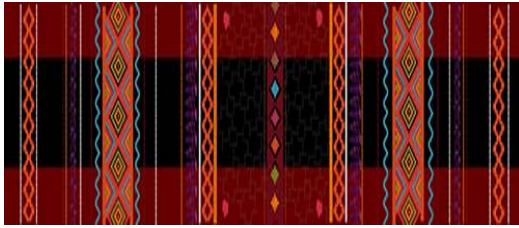


Fig. 6: Newly generated Ulos Sadum

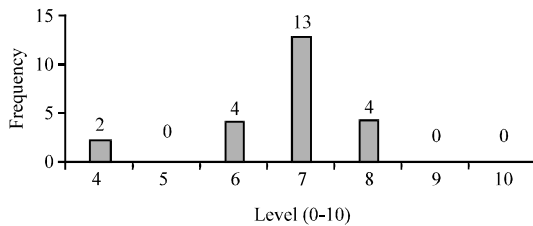


Fig. 7: Evaluation result of Ulos Sadum

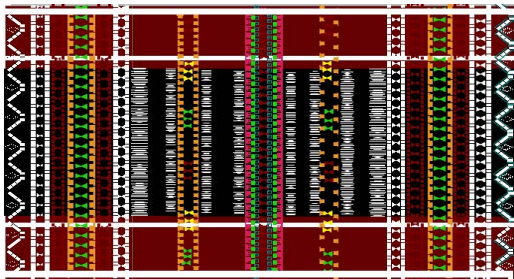


Fig. 8: Newly generated Ulos Bintang Maratur

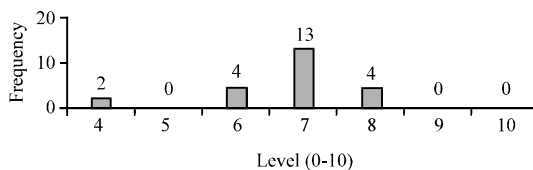


Fig. 9: Evaluation result of Ulos Bintang Maratur

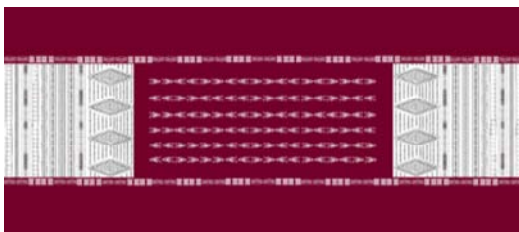


Fig. 10: One example of the newly generated of Ulos

motif of Ulos. We consider that as a good initial result of Jtenun with Ulos has a pilot case study.

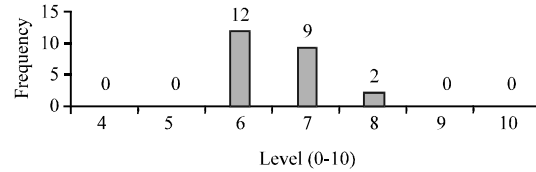


Fig. 11: Evaluation result of Ulos Ragidup

## CONCLUSION

In this study, we have customized jBatik to be jTenun to generate new patterns of woven clothes with Ulos as a case study. The modifications have been made by:

- Restricting parameters angels and iterations to control the newly patterns to shape new patterns of Ulos
- Changing the layout of work-area using the tri-partition concept so that the new pattern can be translated in loom to be woven as Ulos

## RECOMMENDATIONS

As future work, it is worth to do more investigation on different combination of parameters to generate new patterns with higher similarity with the original pattern of Ulos. Further, study and improvement of jTenun are also definitely necessary to expand the scope of jTenun's input to other Indonesian traditional woven clothes as other case studies.

## ACKNOWLEDGEMENT

This study is supported by LPDP's productive and innovative commercial research grant (RISPRO Komersial) No. PRJ-2285/LPDP/2015.

## REFERENCES

- Hariadi, Y., M. Lukman and A.H. Destiarmand, 2013. Batik fractal: Marriage of art and science. *J. Visual Art Des.*, 4: 84-93.
- Hengky, S.H., 2015. Image analysis: Textile industry in Indonesia. *World J. Bus. Manage.*, 1: 42-56.
- Heurteaux, Y. and S. Jaffard, 2007. Multifractal Analysis of Images: New Connexions Between Analysis and Geometry. In: *Imaging for Detection and Identification*, Jim, B. (Ed.). Springer, Netherlands, Europe, ISBN:978-1-4020-5618-5, pp: 169-194.
- Nancy, M., 2014. Batik fractal community creative engagement through technology. Bandung Institute of Technology, Bandung, Indonesia.
- Panggabean, R., 2009. Sadum: Traditional and contemporary. *J. Visual Art Des.*, 3: 167-174.