A Study of Batik Style Transfer using Neural Network

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Introduction

- Convolutional Neural Networks (CNN) has many applications, including the generative ones
- Texture synthesis is a CNN task that reconstructs the abstract style of an image using a trained CNN
- Applying texture synthesis to another image enables creation of synthetic artworks given a pair of content and style images. The process is called style transfer.
- As one of the traditional fabrics that have a unique style, color, and texture, Batik recently has become a subject of some studies of neural network.
- Style transfer unfortunately has never been studied in the Batik case.

Methodology

Content Loss:

$$L_c = \sum_l [\beta(F_l(I_s) - F_l(I_c))^2]$$

Style Loss:

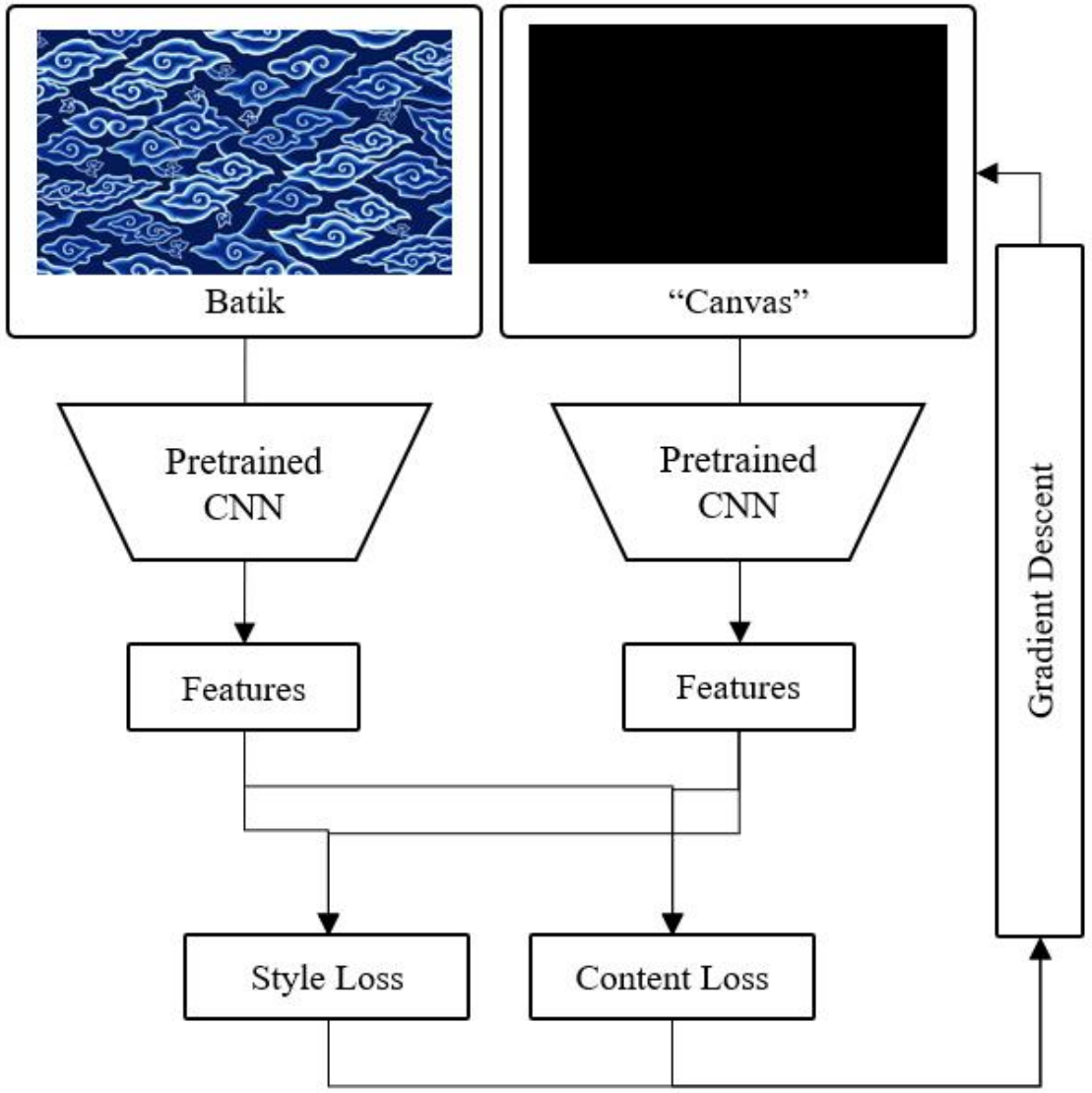
$$L_s = \sum_l [\beta(G_l(I_s) - G_l(I_c))^2]$$

where

F_l: Feature vector mapped in layer l,

$G_l = F_l \cdot F_l'$: Gram Matrix,

α_l and β_l: parameters



Case Study

Architectures Used

Name	Year	Depth	Characteristic
VGG-19	2014	19	Sequential
Inception-V3	2015	159	Inception Block
ResNet-50	2016	50	Residual connection
DenseNet-121	2017	121	Cross-layer flow

Case Study

Batik Used





Name	Pattern		
	Structured	Repeating	Size
Megamendung	No	Yes	Small
Bali	No	No	Large
Parang	Yes	Yes	Medium
Kawung	Yes	Yes	Small
Sidomukti	Yes	Yes	Large

Results

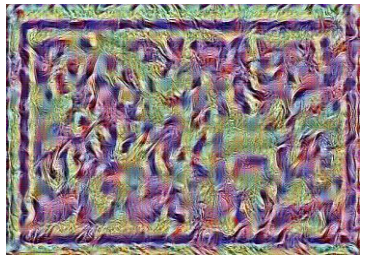
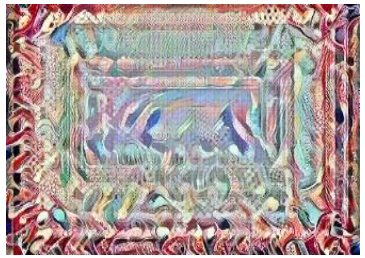
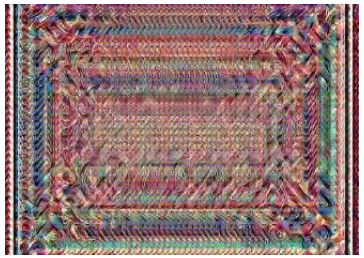
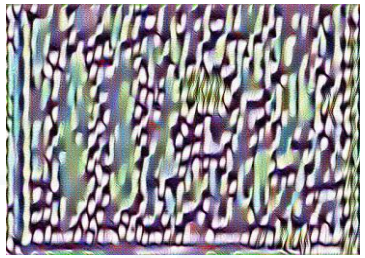
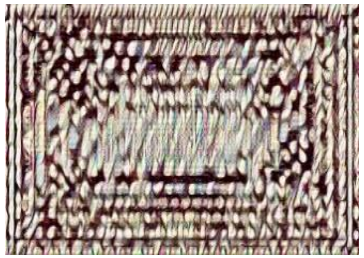
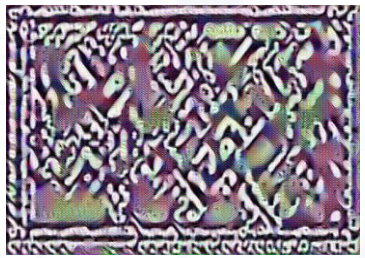
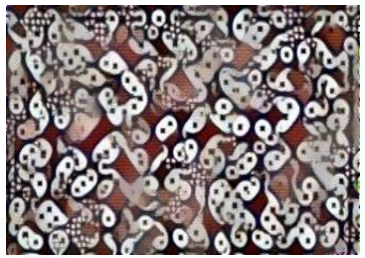
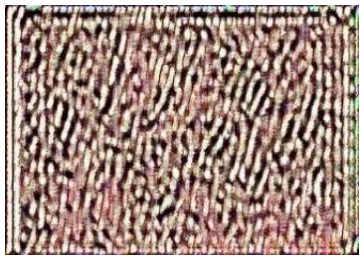
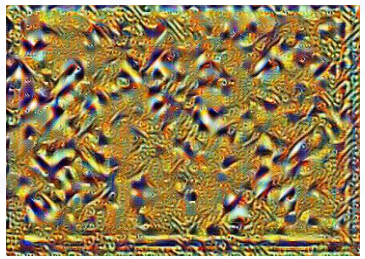
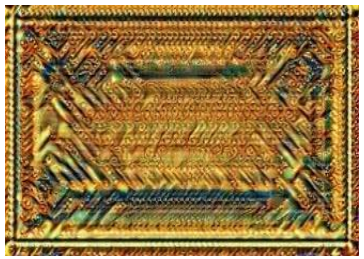
DenseNet-121

VGG-19

ResNet-50

Inception-V3

MODEL DEPTH

	DenseNet-121	VGG-19	ResNet-50	Inception-V3
Bali 				
Parang 				
Kawung 				
Sidomukti 				

Batik-textured image

Original

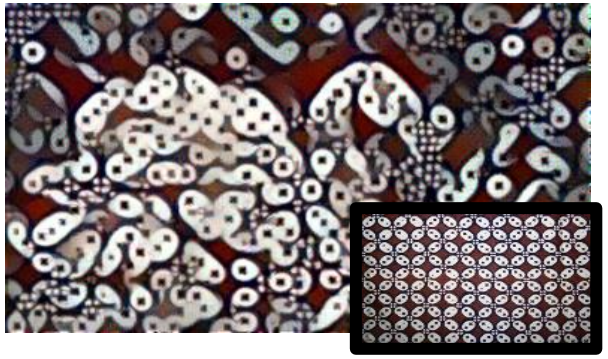
Preprocessed

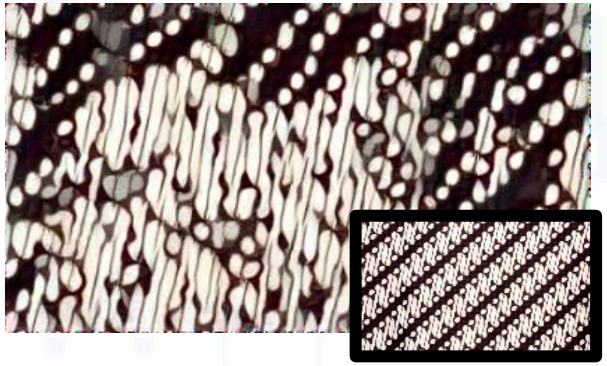
Stylized

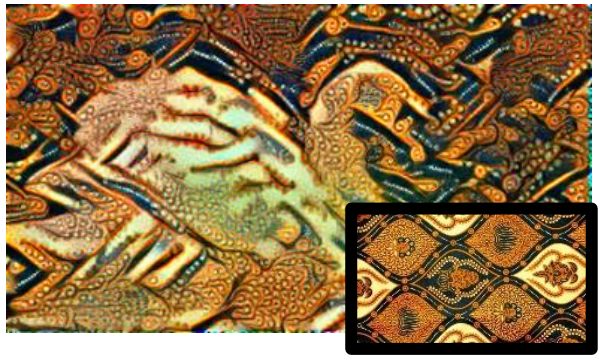
Color-restored

Batik-textured image

Original image







Conclusion

- Deeper layer of neural networks maps more abstract pattern
- Because batik has a concrete style structure, a shallower layer was proven gives a better result
- Some batik motifs were not transferable without losing some of its regular structure pattern
- Only motifs that have an unstructured localized pattern, such as batik Megamendung, was stylized in a good adaptive result
- A technique to regenerate a new motif-preserved batik image with some embedded shapes has been developed