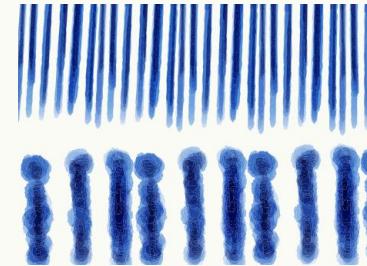
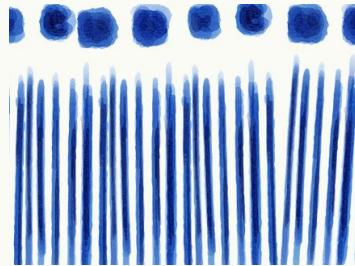
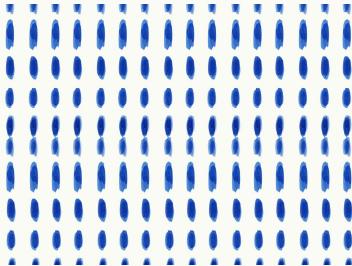


EfficientNet V2

•••Batik Motifs Classification•••

Christopher Mulya, Natalie Coutinho, Pranav Kumar

Agenda



01

02

03

04

Introduction

Objectives

**Results/
Analysis**

Conclusion

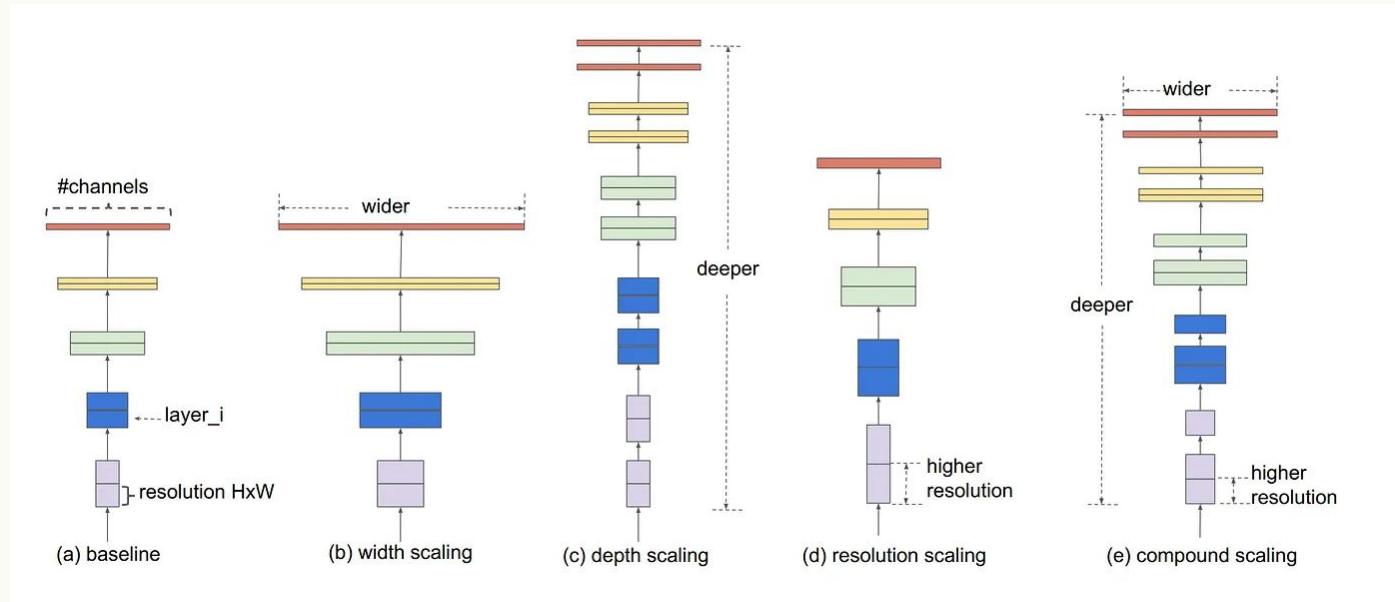
What is Batik?

Batik is a traditional Indonesian **textile art** form that involves using wax to create **intricate patterns** on fabric. The process typically involves applying wax to the cloth in specific areas to resist dye, then dyeing the fabric, and finally removing the wax to reveal the desired pattern.



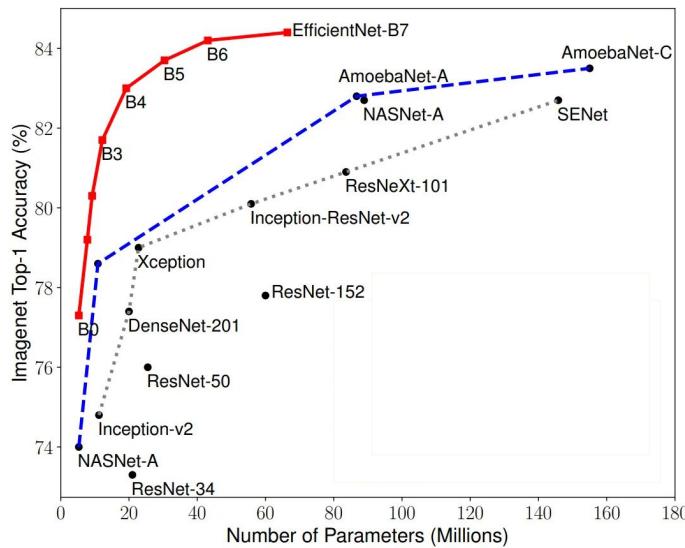
What is EfficientNet?

- EfficientNet is a convolutional neural network built upon a concept called "compound scaling."



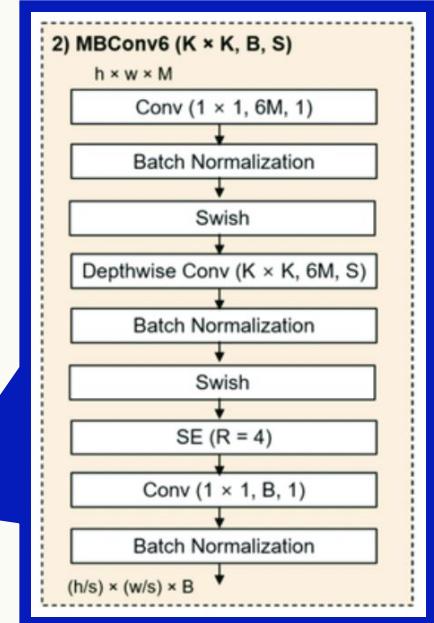
What is EfficientNet?

- The EfficientNet model obtained **state-of-the-art performance** on the ImageNet and the CIFAR-100 datasets, compared to previous CNN models (Tan & Le, 2019).



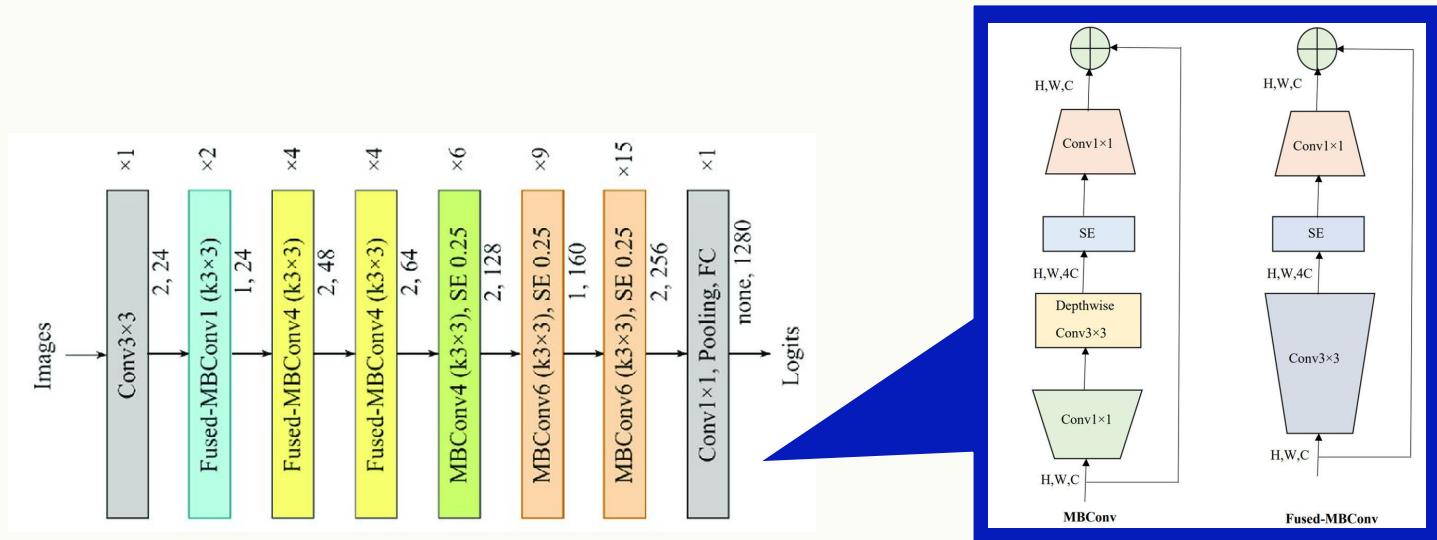
What is EfficientNet?

- The Mobile Inverted Bottleneck (MBConv) layer is a fundamental building block of the EfficientNet architecture.



EfficientNet V2

- In the early layers of EfficientNet architecture, depthwise convolutional layers (MBConv) are slow.
- EfficientNetV2 uses a combination of MBConv and **Fused MBConv** to make the training faster



Reference Paper

- Anastasya, Fahri, & Situmorang (2024) utilized **EfficientNetV1** and obtained the following:



Max Train Accuracy:
79.62 %

Max Validation Accuracy:
73.33 %

Batik Bali Predictions --> 11/20 correct
Batik Betawi Predictions --> 13/20 correct
Batik Cendrawasih Predictions --> 12/20 correct
Batik Dayak Predictions --> 15/20 correct
Batik Geblek Renteng Predictions --> 11/20 correct
Batik Ikat Celup Predictions --> 17/20 correct
Batik Insang Predictions --> 18/20 correct
Batik Kawung Predictions --> 16/20 correct
Batik Lasem Predictions --> 13/20 correct
Batik Megamendung Predictions --> 19/20 correct
Batik Pala Predictions --> 10/20 correct
Batik Parang Predictions --> 17/20 correct
Batik Poleng Predictions --> 19/20 correct
Batik Sekar Jagad Predictions --> 12/20 correct
Batik Tambal Predictions --> 17/20 correct



Objectives

1. **Reproduce the results** reported in the reference paper by employing the **EfficientNetV1** architecture for batik recognition, aiming to achieve comparable performance metrics.
 2. **Adapt and fine-tune** the **EfficientNetV2** architecture for batik recognition, focusing on optimizing accuracy, speed, and memory efficiency for real-world deployment.
 3. Iteratively **refine the model's design and training process** based on rigorous testing and validation, aiming to achieve superior performance compared to baseline models and state-of-the-art approaches.
- 

Methodology

1. Data Augmentation

- Utilized diverse **data transformation techniques** including random resized cropping, horizontal flipping, resizing, and center cropping.



2. Model Training Setup

- Configured **data loaders** with specified batch size, shuffling, and parallel processing for efficient model training.
- Validation methodologies ensured model reliability, with emphasis on **holdout validation** and testing accuracy for model selection.



Methodology

3. Training Process and Performance Monitoring

- Model chosen is EfficientNet V2-S, pre-trained on ImageNet based on its efficiency and effectiveness of image classification tasks.
- Implemented a structured training loop encompassing training and testing phases over multiple epochs.
- Monitored key performance metrics such as loss and accuracy to gauge model convergence and generalization.

4. Model Evaluation and Benchmarking

- Evaluated model performance on the test data and visualized the predictions on test images.

Results - Classification

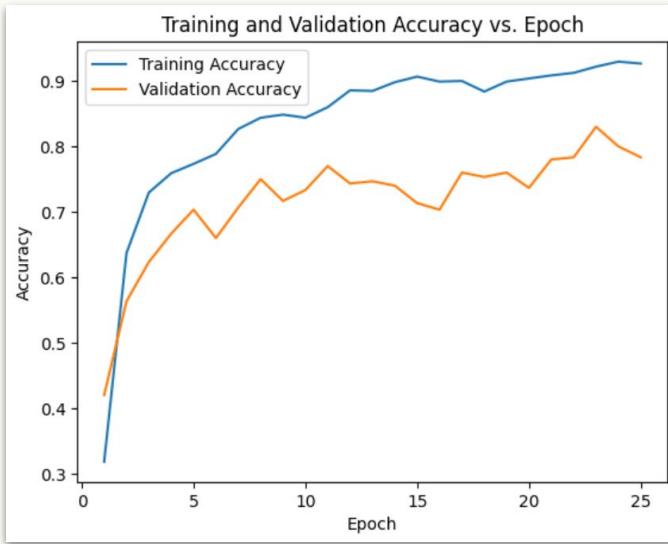
Batik Bali Predictions --> 8/20 correct
Batik Betawi Predictions --> 13/20 correct
Batik Cendrawasih Predictions --> 15/20 correct
Batik Dayak Predictions --> 18/20 correct
Batik Geblek Renteng Predictions --> 16/20 correct
Batik Ikat Celup Predictions --> 17/20 correct
Batik Insang Predictions --> 20/20 correct
Batik Kawung Predictions --> 15/20 correct
Batik Lasem Predictions --> 8/20 correct
Batik Megamendung Predictions --> 20/20 correct
Batik Pala Predictions --> 14/20 correct
Batik Parang Predictions --> 15/20 correct
Batik Poleng Predictions --> 19/20 correct
Batik Sekar Jagad Predictions --> 16/20 correct
Batik Tambal Predictions --> 20/20 correct

Version 1

Batik Bali Predictions --> 7/20 correct
Batik Betawi Predictions --> 9/20 correct
Batik Cendrawasih Predictions --> 16/20 correct
Batik Dayak Predictions --> 19/20 correct
Batik Geblek Renteng Predictions --> 14/20 correct
Batik Ikat Celup Predictions --> 17/20 correct
Batik Insang Predictions --> 14/20 correct
Batik Kawung Predictions --> 17/20 correct
Batik Lasem Predictions --> 13/20 correct
Batik Megamendung Predictions --> 20/20 correct
Batik Pala Predictions --> 15/20 correct
Batik Parang Predictions --> 18/20 correct
Batik Poleng Predictions --> 19/20 correct
Batik Sekar Jagad Predictions --> 15/20 correct
Batik Tambal Predictions --> 19/20 correct

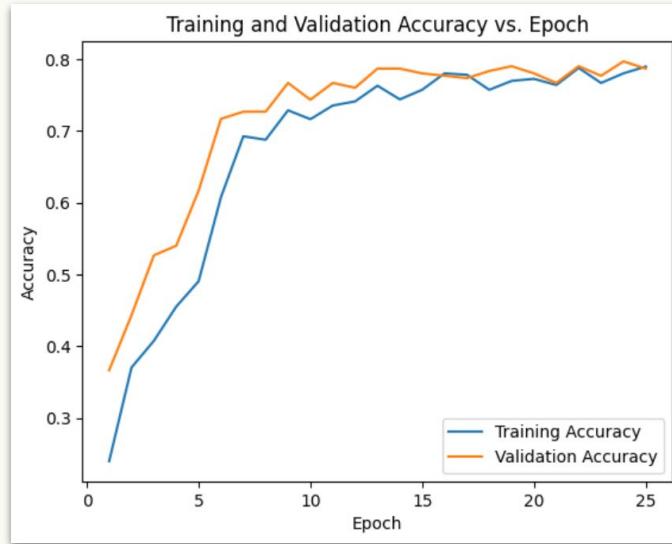
Version 2

Results - Accuracy



Train Accuracy: 90%
Test Accuracy: 80%

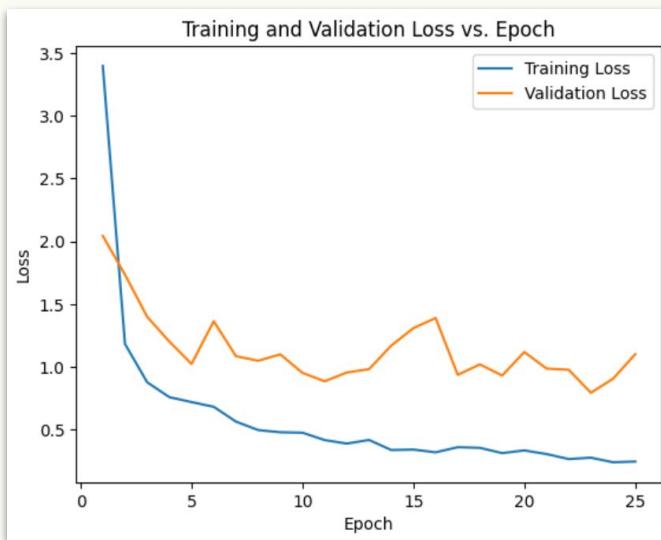
Version 1



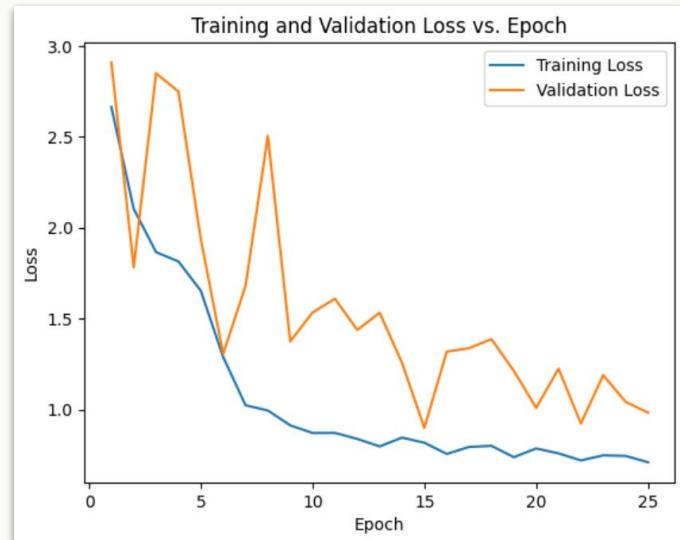
Train Accuracy: 74%
Test Accuracy: 77%

Version 2

Results - Loss



Version 1



Version 2



Future Works

- Further refine model architectures for improved accuracy, speed, and memory efficiency.
- Enhance domain adaptation through transfer learning techniques from related tasks to improve model generalization with limited labeled data.

Conclusion

- EfficientNet, offers a tailored balance between model size and computational efficiency, achieving state-of-the-art performance with fewer parameters.
- The refined EfficientNet model surpasses traditional CNNs in real-world batik pattern recognition tasks, demonstrating superior accuracy, efficiency, and robust generalization.



Thanks!

..... *Do you have any questions?*