ABSTRACT

Central Javanese batik motifs exhibit a high degree of diversity as each region possesses distinctive motifs reflecting local cultural identity. However, manual identification requires specialized expertise and is prone to errors due to high visual similarities between motifs from different regions. This study develops a classification model for Central Javanese batik motif images covering all 35 regions, comprising 29 regencies and 6 cities, using InceptionV3-based transfer learning. The dataset consists of 2,801 images collected independently and divided using stratified split into 70% training, 20% validation, and 10% test sets. Class distribution imbalance was addressed through a combination of offline augmentation, online augmentation, and class weighting. Training was conducted in two sequential phases: Phase 1 (feature extraction) with all InceptionV3 layers frozen and a custom classification head trained, and Phase 2 (fine-tuning) with the last 16 non-Batch Normalization layers unfrozen using a cosine annealing learning rate scheduler with a maximum value of 2×10^{-6}. Evaluation on the test set yielded a test accuracy of 90.60%, test loss of 0.4898, macro precision of 91.21%, macro recall of 90.62%, and macro F1-score of 90.45%. Top-3 accuracy reached 95.97%, Top-5 accuracy 96.64%, and mean Average Precision (mAP) of 95.25%. A train-val gap of 0.0130 indicates good generalization capability without significant overfitting. Pearson correlation analysis across image pairs per class showed that all 35 classes have low mean intra-class correlation values averaging 0.0599. Testing the relationship between intra-class visual uniformity and classification performance yielded $r = 0.2254$ with p-value = 0.1929, which is not statistically significant. Conversely, testing the relationship between inter-class feature similarity and classification performance yielded $r = -0.4075$ with p-value = 0.0151, which is statistically significant, proving that inter-class feature similarity is the dominant factor affecting model performance. Overall, the transfer learning method with a two-phase fine-tuning strategy proved effective for batik image classification despite the relatively limited number of images per class.

Keywords : Central Javanese batik, image classification, transfer learning, InceptionV3, *fine-tuning*, convolutional neural network