ABSTRACT

The increasing volume of waste and the low level of waste-sorting practices in society The increasing volume of waste and the low practice of sorting in society demand technologies capable of automatically identifying waste types to make waste management more efficient. This study aims to develop a waste classification model using a combination of *Gray Level Co-occurrence Matrix (GLCM)* texture feature extraction and *Hue Saturation Value (HSV)* color features, along with the *Random Forest* algorithm. The dataset used consists of 4,650 images of six waste classes (*plastic, paper, metal, glass, battery, organic*) from *Kaggle*. The study stages include image preprocessing, GLCM feature extraction at four orientations (0°, 45°, 90°, 135°) and HSV feature extraction, splitting the data into 80% training and 20% testing sets, and classification using *Random Forest* with 200 decision trees. The results show that the combination of GLCM at 135° and HSV features achieves the best performance with an accuracy of 82%, higher than using GLCM alone (68%) or HSV alone (74%). *Permutation Feature Importance* analysis reveals that HSV color features, particularly the *Value* channel, contribute dominantly to most classes, while GLCM texture features play a significant role in classes with distinctive texture patterns. These findings confirm that combining texture and color information produces a more effective image representation for distinguishing waste types compared to using either feature separately.

Keywords : Waste Classification, GLCM, HSV, *Random Forest*