

ABSTRAK

Kemajuan teknologi kecerdasan buatan telah mendorong perkembangan *Deep Learning*, khususnya dalam bidang klasifikasi citra. Dalam klasifikasi jenis daging, teknologi ini berpotensi membantu mengatasi praktik manipulasi daging oleh oknum yang tidak bertanggung jawab, sehingga meningkatkan keamanan pangan dan kepercayaan konsumen. Tujuan penelitian ini adalah untuk membedakan jenis daging sapi, daging kambing, dan daging babi menggunakan *Ensemble Hard Voting*. Data yang digunakan merupakan data primer yang diambil langsung dari beberapa pasar di daerah Surabaya, terdiri atas tiga kelas, yaitu daging sapi, daging kambing, dan daging babi, masing-masing sebanyak 216 gambar, dengan total 648 gambar. Penelitian ini menggunakan teknik augmentasi data dan menerapkan model pra-latih ResNet-50V2, MobileNetV2, dan InceptionV3 sebagai *feature extractor* tanpa *fine-tuning* untuk meningkatkan akurasi klasifikasi. Masing-masing model dilatih menggunakan *hyperparameter* yang ditetapkan, seperti *learning rate* awal sebesar 0,001, *batch size* 32, optimizer Adam, dan jumlah *epoch* sebanyak 50. Setelah pelatihan, prediksi dari ketiga model digabungkan menggunakan metode *hard voting*. Evaluasi dilakukan menggunakan metrik akurasi, presisi, *recall*, dan *F1-score*. Hasil penelitian menunjukkan bahwa pendekatan *ensemble hard voting* mampu meningkatkan performa klasifikasi hingga 100% pada data uji.

Kata kunci: *Deep Learning*, Klasifikasi Citra, *Ensemble Learning*, *Hard Voting*, ResNet50V2, MobileNetV2, InceptionV3

ABSTRACT

Advances in artificial intelligence technology have driven the development of Deep Learning, particularly in the field of image classification. In the classification of meat types, this technology has the potential to help overcome the practice of manipulating meat by irresponsible people, thereby increasing food safety and consumer confidence. The purpose of this research is to distinguish between beef, mutton, and pork using Ensemble Hard Voting. The data used is primary data taken directly from several markets in the Surabaya area, consisting of three classes, namely beef, mutton, and pork, each with 216 images, for a total of 648 images. This research uses data augmentation techniques and applies the pre-trained models ResNet-50V2, MobileNetV2, and InceptionV3 as feature extractors without fine-tuning to improve classification accuracy. Each model was trained using predefined hyperparameters, such as an initial learning rate of 0.001, batch size of 32, Adam optimizer, and number of epochs of 50. After training, the predictions of the three models were combined using the hard voting method. Evaluation was conducted using accuracy, precision, recall, and F1-score metrics. The results showed that the ensemble hard voting approach was able to improve classification performance by 100% on the test data.

Keywords: *Deep Learning, Image Classification, Ensemble Learning, Hard Voting, ResNet50V2, MobileNetV2, InceptionV3*