ABSTRAK

Indonesia memiliki kekayaan budaya yang sangat beragam, salah satunya adalah Gamelan Jawa yang telah diakui oleh UNESCO sebagai Warisan Budaya Takbenda Dunia. Namun, eksistensi instrumen tradisional ini menghadapi tantangan serius akibat arus globalisasi yang menyebabkan keterasingan generasi muda terhadap detail bentuk dan nama-nama instrumen gamelan. Penelitian ini bertujuan untuk mengatasi masalah tersebut melalui digitalisasi budaya dengan mengimplementasikan teknologi pengolahan citra berbasis kecerdasan buatan untuk mengklasifikasikan sembilan jenis instrumen gamelan Jawa, yaitu bonang, demung, gambang, gender, gong, kendang, kenong, saron, dan slenthem. Pendekatan yang digunakan adalah metode kuantitatif eksperimental dengan arsitektur *Convolutional Neural Network* (CNN) ResNet-50 melalui teknik *transfer learning* untuk mengekstraksi fitur visual secara otomatis dan mendalam.

Proses penelitian dimulai dengan pengumpulan dataset yang terdiri dari 540 citra, mencakup data primer dari pengambilan gambar langsung dan data sekunder dari platform Roboflow. Sebelum memasuki tahap pelatihan, seluruh data melalui fase *preprocessing* yang ketat meliputi pengubahan ukuran citra (*resize*) menjadi 224x224 piksel, normalisasi nilai piksel ke rentang 0-1, serta penerapan teknik augmentasi seperti rotasi, *shear*, *zoom*, dan *flip* untuk memperkaya variasi pola dan mencegah terjadinya *overfitting*. Eksperimen pelatihan model dilakukan dengan membandingkan tiga jenis algoritma optimasi, yaitu Adam, SGD, dan RMSProp, serta variasi jumlah iterasi (*epoch*) sebanyak 20, 30, dan 50.

Hasil penelitian menunjukkan bahwa pemilihan *hyperparameter* berpengaruh signifikan terhadap akurasi model. Konfigurasi terbaik diperoleh menggunakan *optimizer* Adam dengan 50 *epoch*, yang berhasil mencapai tingkat akurasi sebesar 95,37% dan *macro average F1-score* sebesar 95,53%. Selain pengujian standar, penelitian ini melakukan pengujian ketahanan (*robustness test*) untuk mengevaluasi kinerja sistem pada kondisi lingkungan yang tidak ideal. Hasilnya, model terbukti tetap tangguh pada kondisi minim cahaya dengan akurasi 96,29%, namun mengalami penurunan performa signifikan pada pengambilan citra jarak jauh (3 meter) dengan akurasi merosot hingga 70,37% akibat hilangnya detail tekstur dan konteks skala ukuran objek. Temuan ini diharapkan dapat memberikan kontribusi nyata dalam bidang informatika serta mendukung pelestarian budaya melalui pengembangan sistem edukasi berbasis kecerdasan buatan.

Kata Kunci: Gamelan Jawa, CNN, ResNet-50, Transfer Learning, Klasifikasi Citra.

ABSTRACT

Indonesia possesses a vast and diverse cultural wealth, including the Javanese Gamelan, which has been officially recognized by UNESCO as an Intangible Cultural Heritage of Humanity. However, the existence of these traditional instruments faces serious challenges due to globalization, which has led to a growing estrangement among the younger generation regarding the specific forms and names of Javanese Gamelan instruments. This research aims to address this issue through cultural digitalization by implementing artificial intelligence-based image processing technology to classify nine types of Javanese Gamelan instruments: bonang, demung, gambang, gender, gong, kendang, kenong, saron, and slenthem. The approach utilized is an experimental quantitative method employing the Convolutional Neural Network (CNN) architecture, specifically ResNet-50, integrated with a transfer learning technique to extract visual features automatically and deeply.

The research process began with the collection of a dataset consisting of 540 images, which included primary data acquired through direct photography and secondary data sourced from the Roboflow platform. Prior to the training phase, all data underwent rigorous preprocessing, including image resizing to 224x224 pixels, normalization of pixel values to a range of 0–1, and the application of augmentation techniques such as rotation, shear, zoom, and flip to enhance pattern variety and prevent overfitting. The model training experiments were conducted by comparing three types of optimization algorithms—Adam, SGD, and RMSProp—across variations in the number of training iterations or epochs, specifically 20, 30, and 50 epochs.

The research results demonstrate that hyperparameter selection significantly influences model accuracy. The optimal configuration was achieved using the Adam optimizer with 50 epochs, which successfully reached an accuracy rate of 95.37% and a macro average F1-score of 95.53%. In addition to standard testing, this study performed a robustness test to evaluate the system's performance under non-ideal environmental conditions. The results showed that the model remained resilient in low-light conditions with an accuracy of 96.29%, but experienced a significant performance decline in long-distance image capture (3 meters), where accuracy dropped to 70.37% due to the loss of texture details and object scale context. These findings are expected to provide a tangible contribution to the field of informatics and support cultural preservation through the development of artificial intelligence-based educational systems.

Keywords: Javanese Gamelan, CNN, ResNet-50, Transfer Learning, Image Classification.