ABSTRAK

Geometri merupakan salah satu materi matematika yang memerlukan pendekatan visual dan interaktif. Penelitian ini bertujuan mengembangkan aplikasi *Augmented Reality* berbasis Android yang mampu mengenali objek bangun ruang berbentuk bola dan tabung secara *real-time* menggunakan kombinasi metode *Histogram of Oriented Gradients* dan *Support Vector Machine*. Pengembangan sistem mencakup dua tahap utama, yaitu pembangunan model klasifikasi dan pengembangan aplikasi AR. Pembangunan model meliputi beberapa tahapan, yaitu pengumpulan dataset, pembagian data, augmentasi data, *preprocessing*, ekstraksi fitur *Histogram of Oriented Gradients*, serta pelatihan model *Support Vector Machine*. Pengembangan aplikasi *Augmented Reality* dilakukan menggunakan metode *Multimedia Development Life Cycle* yang terdiri dari enam tahap, yaitu konsep, desain, pengumpulan material, perakitan, pengujian, dan distribusi. Aplikasi dikembangkan menggunakan Unity dan terhubung ke model klasifikasi melalui server Flask dengan arsitektur *client-server* melalui jaringan WiFi lokal. Hasil evaluasi model *Support Vector Machine* mencapai performa terbaik pada k=5 dengan rata-rata akurasi sebesar 91.25% dan akurasi terbaik sebesar 97.50% pada *fold* 2. Hasil pengujian alpha menunjukkan bahwa aplikasi berjalan dengan baik dan mampu mengenali objek dengan tepat pada berbagai jarak, sudut kamera, dan kondisi pencahayaan yang telah ditentukan. Hasil pengujian beta menunjukkan bahwa aplikasi memperoleh persentase sebesar 81.3% dengan interpretasi sangat baik. Aplikasi ini dapat menjadi media pembelajaran interaktif yang mendukung pemahaman siswa sekolah dasar terhadap materi bangun ruang secara lebih menarik dan menyenangkan.

Kata Kunci: *Augmented Reality*, *Histogram of Oriented Gradients, Support Vector Machine,* Bangun Ruang, *Multimedia Development Life Cycle*

ABSTRACT

Geometry is a mathematics topic that requires a visual and interactive approach. This study aims to develop an Android-based Augmented Reality application capable of recognizing sphere and cylinder-shaped geometric objects in real time using a combination of the Histogram of Oriented Gradients method and Support Vector Machine. The system development consisted of two main stages: classification model development and AR application development. Model development included several stages, namely dataset collection, data splitting, data augmentation, preprocessing, Histogram of Oriented Gradients feature extraction, and Support Vector Machine model training. The Augmented Reality application was developed using the Multimedia Development Life Cycle method, which consists of six stages: concept, design, material collecting, assembly, testing, and distribution. The application was developed using Unity and connected to the classification model through a Flask server in a client – server architecture over a local WiFi network. The results of the Support Vector Machine model evaluation achieved its best performance at k = 5, with a mean accuracy of 91.25% and highest fold accuracy of 97.50% on fold 2. Alpha testing results showed that the application ran well and was able to correctly classify objects across various predetermined distances, camera angles, and lighting conditions. The beta testing results showed that the application achieved a score of 81.3%, interpreted as very good. This application can serve as an interactive learning medium that supports elementary school students understanding of geometric solids, in a more engaging and enjoyable way.

Keywords: Augmented Reality, Histogram of Oriented Gradients, Support Vector Machine, Geometric Solids, Multimedia Development Life Cycle