IMPLEMENTASI *METODE CONTINOUS CONVOLUTIONAL NEURAL NETWORK* UNTUK PENGENALAN POLA PENGANGGE SUARA BALI PADA SINYAL *ELECTROENCEPHALOGRAM*

Oleh

Made Agastya Maheswara, NIM 2115091093

Program Studi Sistem Informasi

Jurusan Teknik Informatika

Fakultas Teknik dan Kejuruan

Universitas Pendidikan Ganesha

ABSTRAK

Pemrosesan sinyal otak membuka peluang pengembangan sistem komunikasi non-verbal, khususnya bagi individu dengan keterbatasan bicara. Salah satu metode yang digunakan adalah *electroencephalogram* (EEG), yang mampu merekam aktivitas otak ketika membayangkan pelafalan huruf (*imagined spelling*). Penelitian ini mengimplementasikan metode *Continuous Convolutional Neural Network* (Continuous CNN) untuk mengklasifikasikan pola *Pengangge Suara* Aksara Bali dari sinyal EEG, sebagai upaya pelestarian aksara tradisional sekaligus penyediaan alternatif komunikasi. Data penelitian berasal dari 31 partisipan berusia 19–24 tahun yang diminta membayangkan enam vokal Aksara Bali (A, I, U, E, O, É). Pemrosesan data meliputi segmentasi, dekomposisi ke empat pita frekuensi (gamma, beta, alpha, theta), ekstraksi fitur menggunakan *Differential Entropy*, *baseline reduction*, dan representasi dalam bentuk *3D cube* (9×9×4). Data tersebut dilatih menggunakan arsitektur Continuous CNN dengan variasi lapisan dan ukuran kernel. Evaluasi dilakukan melalui *10-Fold Cross Validation* dengan metrik akurasi, presisi, *recall*, dan F1-score. Hasil menunjukkan akurasi tertinggi mencapai 90,76%. Model terbaik diintegrasikan ke aplikasi web interaktif sehingga dapat digunakan langsung oleh pengguna.

Kata Kunci: Electroenchepalogram, Aksara Bali, Pengangge Suara, Continous CNN, Imagined Spelling

IMPLEMENTATION OF A CONTINUOUS CONVOLUTIONAL NEURAL NETWORK FOR RECOGNIZING PENGANGGE SUARA PATTERNS IN BALINESE SCRIPT USING ELECTROENCEPHALOGRAM SIGNALS

By

Made Agastya Maheswara, NIM 2115091093

Information System Study Program

Information Engineering Department

Faculty of Engineering and Vocational Studies

Ganesha University of Education

ABSTRACT

Brain signal processing offers opportunities for developing non-verbal communication systems, particularly for individuals with speech impairments. One commonly used method is the electroencephalogram (EEG), which records brain activity when imagining the articulation of letters (*imagined spelling*). This study implements the Continuous Convolutional Neural Network (Continuous CNN) method to classify *Pengangge Suara* patterns of the Balinese script from EEG signals, aiming to preserve traditional script while providing an alternative communication medium. Data were collected from 31 participants aged 19–24 years, who were instructed to imagine six Balinese vowel characters (A, I, U, E, O, É). Data processing included segmentation, decomposition into four frequency bands (gamma, beta, alpha, theta), feature extraction using Differential Entropy, baseline reduction, and representation in a 3D cube format (9×9×4). These processed data were trained using a Continuous CNN architecture with variations in layers and kernel sizes. Evaluation was conducted using 10-Fold Cross Validation with metrics including accuracy, precision, recall, and F1-score. The results showed a maximum accuracy of 90.76%. The best-performing model was integrated into an interactive web application, enabling direct user access.

Keywords: Electroencephalogram, Balinese Script, *Pengangge Suara*, Continuous CNN, Imagined Spelling