

## INTISARI

### Lapisan *Connectionist Temporal Classification* (CTC) pada Arsitektur Model *Convolutional Recurrent Neural Networks* (CRNN) untuk Rekognisi Lembar Skor Catur Tulisan Tangan

Oleh

Fadil Irsyad Muhammad

20/462311/PA/20283

Dalam pertandingan catur *Over-the-Board* (OTB), setiap pemain diwajibkan untuk mencatat gerakan catur mereka secara manual pada lembar skor catur, yang kemudian didigitalisasi untuk catatan resmi pertandingan catur. Proses digitalisasi lembar skor ini memerlukan waktu dan tenaga, terlebih dengan adanya risiko kesalahan transkripsi tulisan tangan. Penelitian ini bertujuan untuk mengimplementasikan model *Convolutional Recurrent Neural Networks* (CRNN) dengan lapisan *Connectionist Temporal Classification* (CTC) pada data citra lembar skor catur tulisan tangan. Data yang digunakan diambil dari *Handwritten Chess Scoresheet (HCS) Dataset 2021*. Evaluasi dilakukan dengan menggunakan metrik berupa akurasi karakter dan *Character Error Rate* (CER) pada model CRNN dengan lapisan CTC (CRNN-CTC) dan CRNN tanpa lapisan CTC. Hasil penelitian menunjukkan bahwa model CRNN-CTC memberikan performa yang lebih baik dibandingkan model CRNN tanpa lapisan CTC, dengan akurasi karakter sebesar 70,25% pada data latih dan 51,46% pada data uji, serta CER sebesar 0,28205 pada data latih dan 0,45685 pada data uji. Penerapan lapisan CTC terbukti mampu mengurangi kesalahan prediksi sekuensial pada citra lembar skor catur tulisan tangan.

## ABSTRACT

### **Connectionist Temporal Classification (CTC) Layer on Convolutional Recurrent Neural Networks (CRNN) Model Architecture for Handwritten Chess Scoresheets Recognition**

By

Fadil Irsyad Muhammad

20/462311/PA/20283

In Over-the-Board (OTB) chess tournaments, each player are required to record their moves manually on the chess scoresheet, which is later digitized for official chess tournament documentation. This scoresheet digitization process is time-consuming and laborious, especially with a risk of errors in handwritten transcription. This research aims to implement a Convolutional Recurrent Neural Networks (CRNN) model with Connectionist Temporal Classification (CTC) layer on handwritten chess scoresheet dataset. Data utilized are sourced from Handwritten Chess Scoresheet (HCS) Dataset 2021. The evaluation was conducted using metrics in the form of character accuracy and Character Error Rate (CER) on the CRNN model with CTC layer (CRNN-CTC) and CRNN without CTC layer. The results showed that the CRNN-CTC model provided better performance than the CRNN model without CTC layer, with a character accuracy of 70.25% on training data and 51.46% on test data, and a CER of 0.28205 on training data and 0.45685 on test data. The application of the CTC layer was proven to be able to reduce sequential prediction errors in handwritten chess scoresheet images.