

INTISARI

PENERAPAN ALGORITMA *CONVOLUTIONAL NEURAL NETWORK* UNTUK KLASIFIKASI GEMPA VULKANIK DI GUNUNG MERAPI PERIODE JANUARI-JUNI 2020

Oleh

Tian Nurul Hanipah

19/442443/PA/19192

Merapi merupakan salah satu gunung api paling aktif dan berbahaya di Indonesia. Banyaknya data dari hasil pemantauan aktivitas Merapi menjadi masalah apabila analisisnya hanya mengandalkan kemampuan manual karena seringkali dibutuhkan pengambilan keputusan yang cepat dan akurat. Oleh karena itu, penggunaan *machine learning* dan otomatisasi dapat membantu untuk mempercepat proses tersebut apabila dibandingkan dengan algoritma tradisional atau proses manual. Penelitian sebelumnya menunjukkan bahwa klasifikasi jenis tipe gempa vulkanik Gunung Merapi dapat dilakukan menggunakan beberapa macam algoritma *machine learning* seperti XGBoost. Pada penelitian ini dibuat sejumlah empat percobaan model *machine learning* menggunakan algoritma *neural network* dengan tipe *Convolutional Neural Network* (CNN) untuk mengklasifikasikan secara otomatis lima tipe gempa vulkanik Gunung Merapi. Keempat model tersebut merupakan model CNN 1D, model CNN 1D (SMOTE *Over-sampling*), model CNN 2D, dan model CNN 2D (*Under-sampling*). Dengan *over-sampling* dan *under-sampling* menunjukkan keseimbangan data antarkelas yang digunakan pada model. Fitur data yang digunakan pada model CNN 1D dan CNN 1D (SMOTE *Over-sampling*) adalah berupa durasi, amplitudo, dan nilai spektrum amplitudo sedangkan model CNN 2D dan model CNN 2D (*Under-sampling*) menggunakan gambar bentuk spektrum amplitudo. Penelitian ini menggunakan total 8015 data peristiwa gempa vulkanik Gunung Merapi periode Januari-Juni 2020 yang disediakan oleh Balai Penyelidikan dan Pengembangan Teknologi Kebencanaan Geologi (BPPTKG) Yogyakarta. Hasil penelitian menunjukkan model CNN 1D memiliki nilai akurasi sebesar 84,52%, model CNN 1D (SMOTE *Over-sampling*) memiliki nilai akurasi sebesar 91,28%, model CNN 2D memiliki akurasi sebesar 69,99%, dan model CNN 2D (*Under-sampling*) memiliki nilai akurasi sebesar 88,46%.

Kata Kunci : *Machine Learning, Convolutional Neural Network, Gempa Vulkanik, Gunung Merapi*

ABSTRACT

APPLICATION OF CONVOLUTIONAL NEURAL NETWORK ALGORITHM FOR CLASSIFICATION OF VOLCANIC EARTHQUAKES AT MOUNT MERAPI IN THE JANUARY-JUNE 2020 PERIOD

By

Tian Nurul Hanipah

19/442443/PA/19192

Merapi is one of the most active and dangerous volcanoes in Indonesia. The large amount of data from the results of monitoring Merapi's activity becomes a problem if the analysis only relies on manual skills because there is often a requirement for quick and accurate decision-making. Therefore, the use of machine learning and automation can help to speed up this process compared to traditional algorithms or manual processes. Previous studies show that classification of the types of volcanic earthquakes at Mount Merapi can be done using various machine learning algorithms such as XGBoost. In this research, four machine learning model experiments were conducted using neural network algorithm with the Convolutional Neural Network (CNN) type to automatically classify five types of volcanic earthquakes at Mount Merapi. The four models are the 1D CNN model, 1D CNN (SMOTE Over-sampling) model, 2D CNN model, and 2D CNN (Under-sampling) model. Over-sampling and under-sampling show the balance of data between classes used in the model. The data features used in the 1D CNN and 1D CNN (SMOTE Over-sampling) models are duration, amplitude and amplitude spectrum values, while the 2D CNN model and 2D CNN (Under-sampling) model utilize images of the amplitude spectrum shape. This research uses a total of 8015 data of volcanic earthquake events at Mount Merapi in the January-June 2020 period provided by the Geological Disaster Technology Research and Development Center (BPPTKG) Yogyakarta. The research results show that the 1D CNN model has an accuracy value of 84.52%, the 1D CNN (SMOTE Over-sampling) model has an accuracy value of 91.28%, the 2D CNN model has an accuracy value of 69.99%, and the 2D CNN (Under-sampling) model has an accuracy value of 88.46%.

Keywords: Machine Learning, Convolutional Neural Network, Volcanic Earthquake, Mount Merapi