

## INTISARI

### Metode CNN - *Extreme Learning Machine* Untuk Klasifikasi Kerusakan DNA Menggunakan *Comet Assay*

Oleh

YUES TADRIK HAFIYAN

16/394103/PA/17194

Dalam perkembangan teknologi di bidang medis, dihasilkan citra *comet assay* untuk menganalisis kerusakan DNA secara visual. Untuk mengklasifikasi kerusakan DNA tersebut dengan citra *comet assay*, telah dilakukan berbagai penelitian untuk mengukur klasifikasi, yaitu menggunakan *tool* yang menghasilkan akurasi 11.5% dan menggunakan metode *deep learning* CNN dengan akurasi 60.5%.

Pada penelitian ini, diimplementasikan metode gabungan antara CNN dan ELM, dimana CNN sebagai *feature extractor* dan ELM sebagai *classifier*, bertujuan menghilangkan proses *backpropagation* sehingga menghilangkan terjadinya *vanishing gradient* dan mengurangi waktu *training* yang lama.

Metode CNN-ELM ini dibagi menjadi 2 model, yaitu model CNN-ELM itu sendiri yang menghasilkan rata-rata akurasi terbaik pada 96.96% pada *training speed* 193.49 detik, serta model *transfer learning*-ELM yang menghasilkan akurasi 93.4% pada *training speed* 46.39 detik.

**Kata kunci :** *Deep learning, convolutional neural network, extreme learning machine, transfer learning, comet assay*

## ABSTRACT

### **CNN-Extreme Learning Machine Method For DNA Damage Classification Using Comet Assay**

By

YUES TADRIK HAFIYAN

16/394103/PA/17194

In the development of technology for medicine, comet assay images produced to analyze DNA damage by visual. To classify the DNA damage by comet assay image, there has been several research to measured classification, included using tool that resulted in accuracy 11.5% and using CNN deep learning method that resulted in accuracy 60.5%.

In this research, the method that fusion between CNN and ELM has been implemented, which is CNN as feature extractor and ELM as a classifier, that expect to remove the backpropagation process, therefore also remove vanishing gradient and decreasing the long training duration.

This CNN-ELM method divided into 2 models, including CNN-ELM model itself that resulted in accuracy rate at 96.6% and training speed at 193.49 seconds, also transfer learning-ELM model that resulted in accuracy rate at 93.4% and training speed at 64.39 seconds.

**Keywords :** *Deep learning, convolutional neural network, extreme learning machine, transfer learning, comet assay*