

ABSTRAK

PENGEMBANGAN MODEL TINGKAT KEPARAHAN BANJIR BERDASARKAN PARAMETER CURAH HUJAN, JARAK DARI SUNGAI, ORDE SUB-DAS, ELEVASI, LERENG, *LAND USE-LAND COVER*, DAN *LITHOLOGICAL PERMEABILITY INDEX* STUDI KASUS PADA DAS DI KOTA BALIKPAPAN

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Masih kurang inventarisasi dan pemetaan koordinat titik dan parameter banjir di Kota Balikpapan. Lokasi titik-titik banjir belum mendapatkan *assessment* status tingkat keparahan guna prioritas mitigasi. Banjir di wilayah tersebut disebabkan oleh gabungan beberapa parameter yang dapat digunakan untuk prediksi yang akurat dan *pemetaan* detail melalui pemodelan. Perekaman data banjir dapat dilakukan secara simultan dengan format standar berupa parameter banjir dan koordinat lokasi banjir melalui peran masyarakat. Data hasil pengukuran selanjutnya dapat diklasifikasikan menurut tingkat keparahan banjir melalui algoritma klusterisasi yang sesuai. Tingkat keparahan banjir hasil klusterisasi dan *labeling* akan dimodelkan dengan algoritma *artificial neural networks* (ANNs). Metoda yang digunakan terdiri dari pengembangan *cloud database* dan aplikasi, implementasi sistem *citizen science* untuk pengumpulan data, klasifikasi dengan algoritma *unsupervised machine learning*, dan pemodelan dengan algoritma ANN. Hasil klusterisasi digunakan sebagai parameter output, dan curah hujan, jarak dari sungai, orde subdas, elevasi, lereng, *land use land cover* (LULC), dan *lithological permeability index* (LPI) yang diekstrak dari layer GIS menjadi input model ANN.

Tiga *novelty* dari penelitian ini adalah pengembangan perangkat lunak dan implementasi metode *citizen science* untuk merekam pengukuran parameter banjir di lokasi penelitian, klasifikasi tingkat keparahan banjir, dan pemodelan keparahan banjir. Hasil pemodelan 3 kelas tingkat keparahan banjir menggunakan ANNs, dengan dua hidden layer yang masing-masing memiliki 9 node, dengan output layer berupa kelas keparahan banjir, menghasilkan model yang cukup akurat. Hasil pemodelan menunjukkan akurasi 0,7197 sampai dengan 0,7252, dengan moderate Cohen's *Kappa* 0,5756 sampai 0,5835. Model selanjutnya dapat digunakan untuk memprediksi tingkat keparahan banjir pada titik-titik beresolusi 200 m dan hasilnya divalidasi dengan distribusi genangan hasil pengolahan citra *global surface water* (GSW) *Joint Research Centre* (JRC) Uni Eropa. Hasil validasi menunjukkan sebaran keparahan banjir tingkat sedang identik dalam pola distribusinya dengan pola sebaran genangan banjir.

Kata kunci: *artificial neural networks, citizen science, clustering, keparahan banjir, lithological permeability index*

ABSTRACT

FLOOD SEVERITY LEVEL MODEL DEVELOPMENT BASED ON RAINFALL, DISTANCE FROM RIVER, SUB-CATCHMENT ORDER, ELEVATION, SLOPE, LAND USE-LAND COVER (LULC), AND LITHOLOGICAL PERMEABILITY INDEX PARAMETERS A CASE STUDY OF A FEW RIVER BASINS IN BALIKPAPAN CITY

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The flood event frequently hits the Balikpapan City area, but there is a lack of inventory and mapping effort of flood coordinates and parameters. Flood locations have not yet gotten flood severity level status assessment for further mitigation. The flood in the area is caused by the interaction of several parameters that can be used for accurate prediction and detailed mapping through modeling. The objectives of this research are to simultaneously record flood parameters and coordinates in a standardized form through community participation. Furthermore, the collected data is able to be classified based on flood severity level using the relevant clustering method. The last objective is the model development of flood severity level utilizing an artificial neural network (ANN) algorithm. The employed methods consist of the development of cloud databases and apps, the implementation of citizen science for collecting flood data, clustering data using machine learning, and the modeling of clustering results as output. Meanwhile, rainfall, elevation, slope, distance from river, order of sub-catchment area, Land Use Land Cover (LULC), and lithological permeability index were extracted from GIS layers used as input into the ANN algorithm.

Three novelties of this research are the software development and the implementation of the citizen method in flood measurement, flood severity level (FSL) classification, and the development of the FSL model based on an ANN algorithm. Result modeling of 3 classes of flood severity level using ANNs that were trained with two layers and 9 neurons for each layer has created an accurate model. The output layer consists of the flood severity classes as an output of clustering. The best trained model reached an accuracy of 0.7197 to 0.7252, with a moderate Cohen's Kappa 0.5756 to 0.5835., then the model was implemented in flood severity level prediction in grid points with a resolution 200m in the research area and then the predicted flood severity levels was validated by the distribution of flood inundations as a result of processing of GSW images from JRC of the European Union. Such validation showing the distribution of moderate flood severity points is identical to the flood inundation distribution pattern.

Keywords: *artificial neural networks, citizen science, clustering, flood severity, lithological permeability index*