

INSTISARI

PURWARUPA SISTEM PENGUKURAN KADAR UNSUR HARA NITROGEN, FOSFOR, DAN KALIUM (NPK) BERBASIS *LOCAL BINARY PATTERN* DAN JARINGAN SARAF TIRUAN *BACKPROPAGATION*

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Unsur hara NPK adalah unsur hara makro yang berperan penting pada tumbuh dan kembang tanaman, oleh karena itu diperlukan pengukuran kadar unsur hara NPK untuk mengetahui kondisi kesuburan tanah sebelum masa penanaman lahan, namun pengukuran kadar melalui uji laboratorium memerlukan waktu yang relatif lama. Penelitian ini membangun purwarupa sistem pengukuran kadar unsur hara NPK berbasis aplikasi *smartphone* dengan memanfaatkan citra tanah, khususnya ciri tekstur yang diproses dengan *local binary pattern* dan jaringan saraf tiruan *backpropagation*, guna mempercepat proses pengukuran.

Sampel data pada penelitian ini diambil pada tanah persawahan di daerah Provinsi Daerah Istimewa Yogyakarta dengan bervariasi pengambilan jarak pada 30 cm hingga 110 cm dengan interval 20 cm dan sudut pada -30° hingga 30° dengan interval 10° . Dataset citra dilakukan proses prapengolahan data untuk meningkatkan kualitas dan menyesuaikan format citra. Hasil prapengolahan diekstrak menggunakan *local binary pattern uniform* untuk mendapatkan fitur tekstur. Fitur tekstur tersebut menjadi masukan dari model jaringan saraf tiruan yang dilatih dengan algoritme *backpropagation* dengan bervariasi parameter model jaringan.

Model tersebut diuji untuk mengetahui pengaruh jarak dan sudut pengambilan citra, kecepatan pemrosesan sistem, dan pengaruh parameter jaringan saraf tiruan. Model dengan nilai akurasi teroptimal diimplementasikan dalam aplikasi *smartphone*. Hasil dari pengujian didapatkan rata-rata waktu komputasi sebesar 0.65 detik, didapatkan jarak optimal sebesar 50 cm dengan sudut 0° dengan nilai akurasi pengukuran pada masing-masing kadar unsur hara sebesar kadar nitrogen 91.80%, sedangkan kadar fosfor 83.49%, dan kadar kalium 82.54%, sehingga rata-ratanya 84.16%.

Kata kunci: *local binary pattern*, *backpropagation*, unsur hara NPK

ABSTRACT

NITROGEN, PHOSPOR, AND KALIUM SOIL NUTRIENT MEASUREMENT PROTOTYPE BASED ON LOCAL BINARY PATTERN AND BACKPROPAGATION NEURAL NETWORK

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Nutrient elements of NPK are macro nutrients that play an important role in the growth and development of plants, therefore it is necessary to measure NPK nutrient content to measure how well soil fertility condition before the land planting period, but NPK measurement through laboratory tests takes a relatively long time. This research develops prototype of NPK nutrient measurement system based on mobile application by using soil image for determine textural characteristic, the textural characteristics are processed with local binary pattern and backpropagation neural network to accelerate the measurement process.

Sample data in this research was taken on rice field land in the province of Yogyakarta Special Region by varying the distance at 30 cm to 110 cm with interval 20 cm and angle image capture at -30° to 30° with interval 10°. Datasets were being pre-processed to improve image quality and adjust image format. Preprocessed results are extracted using local binary pattern uniform to obtain texture features. The texture features were being input of neural network model, that being trained with a backpropagation algorithm by varying parameters of the neural network model.

The model tested to determine the effect of distance and angle of image capture, system processing speed, and effect of artificial neural network parameters. The best model is implemented on smartphone application. The results obtained average of computation time 0.65s, and the optimal result is obtained at distance capture of 50 cm and angle capture of 0° with the measurement accuracy at each soil nutrient level of nitrogen 91.80%, while phosphorus 83.49%, and potassium 82.54%, therefore the average is 84.16%.

Keywords: *local binary pattern, backpropagation, NPK soil nutrient*