Model prediksi potensi sumber energi terbarukan tenaga surya di Wilayah Indonesia dengan teknik jaringan syaraf tiruan (artificial neural network) pemanfaatan parameter cuaca sebagai prediktor model prediksi potensi energi surya = Artificial neural network technique for renewable energy solar power potential prediction model in Indonesia utilization weather parameter for model predictor

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Abstrak

[ABSTRAK
Energi Surya merupakan Sumber Energi Terbarukan yang sangat potensial sebagai alternatif sumber energi khususnya kelistrikan, baik untuk mengurangi dampak lingkungan, maupun meningkatkan pelistrikan di daerah terpencil. Penelitian ini dilakukan untuk membangun Model Prediksi Sumber Energi Terbarukan Tenaga Surya di Indonesia. Dalam Studi ini diajukan prosedur optimalisasi Jaringan Syaraf Tiruan berdasarkan Theorema Cybenko tentang universalitas JST dengan 1-hidden layer, dan algoritma Neural Network Construction with Cross-validation Samples (N2C2S) dalam optimalisasi jumlah neuron pada hidden layer. Pemodelan dilakukan pada wilayah Indonesia menggunakan gabungan data meteorologi dan Radiasi Global Surya Bulanan dari SSE NASA dan BMKG selama 4 tahun di 14 lokasi untuk proses training JST, dan 6 lokasi sebagai target prediksi. Pola JST Feed forward multi layer digunakan dalam model ini dengan menerapkan metoda pembelajaran back propagation. Hasil modeling menunjukkan bahwa model JST dengan 1 hidden layer menghasilkan model kriteria akurasi yang sangat baik dengan MAPE 4,1% dan R2 0,82, dibandingkan dengan MAPE 7,52% dan R2 0,48 pada teknik regresi sebagai metoda yang umum digunakan dalam modeling prediksi. Penelitian ini juga mendemonstrasikan bahwa model JST dapat merepresentasikan prediksi lebih akurat dari teknik regresi, khususnya di mana terjadi dinamika yang tinggi pada variabel prediktornya. Hal ini menyimpulkan tidak saja bahwa dengan prosedur optimisasi JST dapat disusun secara optimal untuk memberikan struktur yang lebih sederhana, namun JST yang dihasilkan memberikan piranti prediksi yang akurat dan responsif terhadap dinamika data, dengan akurasi yang dapat dipertanggungjawabkan.
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ABSTRAK
This study is focused on modeling the Global Solar Radiation using Artificial Neural Network to predict GSR in a location in Indonesia which is available with meteorological data but lack with radiation measurement data. In this study, an optimalisation of ANN development is proposed based on Cybenko Theorem on universal approximator of single-hidden layer Multi Layer Perceptor combined Neural Network Construction with Cross-validation Samples (N2C2S) algorithm for optimum number of hidden neuron. Data for weather and solar radiation parameter are taken from NASA and BMKG (Indonesian Meterological and Climatology Agency) for 20 cities in Indonesia during the period for 4 year, divided into two groups of 14 cities for model development and 6 cities for model validation. The developed model provides much better performance with MAPE of 4,1% and of R2 0,82, as to compare with the widely used regression technique with MAPE of 7,52% and R2 of 0,48. The simulation shows that an ANN with single-hidden

layer is an excellent approximator for the solar radiation function in the targeted area, in particular in the periode where high dynamics is present in predictor variables. This shows that not only the model is able to predict the solar radiation in a good agreement with the actual data, but more importantly that the high dynamics fluctuation of parameter is successfully captured., This study is focused on modeling the Global Solar Radiation using Artificial Neural Network to predict GSR in a location in Indonesia which is available with meteorological data but lack with radiation measurement data. In this study, an optimalisation of ANN development is proposed based on Cybenko Theorem on universal approximator of single-hidden layer Multi Layer Perceptor combined Neural Network Construction with Cross-validation Samples (N2C2S) algorithm for optimum number of hidden neuron. Data for weather and solar radiation parameter are taken from NASA and BMKG (Indonesian Meterological and Climatology Agency) for 20 cities in Indonesia during the period for 4 year, divided into two groups of 14 cities for model development and 6 cities for model validation. The developed model provides much better performance with MAPE of 4,1% and of R2 0,82, as to compare with the widely used regression technique with MAPE of 7,52% and R2 of 0,48. The simulation shows that an ANN with single-hidden layer is an excellent approximator for the solar radiation function in the targeted area, in particular in the periode where high dynamics is present in predictor variables. This shows that not only the model is able to predict the solar radiation in a good agreement with the actual data, but more importantly that the high dynamics fluctuation of parameter is successfully captured.]