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European Conference on Aquaculture and Fisheries: Smart Spatial Analyses in Land Leveling Development and Evaluation of Models for Tractor Performance Parameters - JAMIL ASAAD, University of Damascus.

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Abstract

The objective of this research was to develop two methods of computational intelligent (CI) techniques, namely, artificial neural network (ANN) and adaptive neural fuzzy inference system (ANFIS).Furthermore, to develop mathematical model using Design Expert software for modeling and predicting performance parameters of the Massey Ferguson (MF-285) tractor under various field conditions. In this study a MF-285 tractor was instrumented with a low cost and precise data logging system as a means of recording and monitoring the effectual parameters on performance of tractor such as forward speed and instant fuel flow rate during field operation. A moldboard plow was used as tillage tool during the experiments under various tillage depths, engine speeds, forward speeds, tire inflation pressures, moisture contents and cone indexes. Acquired data were used to develop accurate models for drawbar pull, rolling resistance, slippage, Temporal Fuel Consumption (TFC), Area-specific Fuel Consumption (AFC), Specific Fuel Consumption (SFC), drawbar power, axle power, net traction ratio, tractive efficiency and power loss.

The results showed that all developed models (ANN, ANFIS and mathematical) had satisfactory performance for predicting aforementioned parameters of tractor in various field conditions. For drawbar pull, ANN technique achieved optimum model with topology 6-8-1 and Levenberg-Marquardt learning method with MSE of 0.000515 and R^2 of 0.997. ANFIS method produced the best model with indicators statistical MSE of 0.00541 and R^2 of 0.979 for rolling resistance. The premium model for anticipating slippage achieved by ANN with topology 6-8-1 and Bayesian regulation with MSE of 9.3621e-08 and R^2 of 0.9999.For drawbar power, the best result was obtained by the ANN with 6-7-1 topology and Bayesian regulation training algorithm with R^2 of 0.995 and MSE of 0.00024.

The obtained result showed that the 6-7-1 structured ANN with Levenberg-Marquardt training algorithm represented a good prediction of tractive efficiency with R^2 equal to 0.989 and MSE of 0.001327.Also the model of ANN is overcome other models in predicting axle power (Levenberg-Marquardt with structure 6-7-1, MSE of 0.0001683 and R^2 of 0.996), power loss (Bayesian regulation with topology 6-9-1, MSE of 0.0001032 and R^2 of 0.985) and net traction ratio (Levenberg-Marquardt with structure 6-9-1, MSE of 0.0006814 and R^2 of 0.994).

The performance of predicting fuel consumption (TFC, AFC and SFC) is acceptable. The ANN model with 6-7-1 structure and Levenberg-Marquardt training algorithm had the best performance with R^2 of 0.969 and MSE of 0.13427 for TFC prediction. The 6-8-1 topology showed the best power for prediction of AFC with R^2 and MSE of 0.885 and 0.01348 with Levenberg-Marquardt training algorithm. ANFIS method achieved the best model for prognostication SFC with MSE of 0.01475 and R^2 of 0.9454.

The obtained results confirmed that the ANN, ANFIS and mathematical models are able to learn the relationships between the input variables and performance parameters of tractor, very well.

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Leveling ends up in additional economical irrigation and, if fustigation and chemigation square measure applied, in additional economical use of fertilizers and pesticides. In associate unlevelled field, high spots won't be lined by irrigation water, and also the dissolved nutrients and/or pesticides would possibly percolate unused into the soil. Just in case of low spots, water and also the dissolved nutrients and chemicals would possibly accumulate there and make zones of water work and nutrient or chemical accumulation. This successively can disturb soil aeration and water uptake by crops. In either case, the uniformity of the crop cowl is disturbed and yields would possibly decrease.Levelling may be done manually or with machinery and corresponding instrumentality. Significant earth movement ought to be avoided so as to stay the natural soil structure undisturbed, so maintaining smart growing conditions for the crop roots and keeping prices low.

Experienced farmers usually do land leveling consistent with visual assessment, e.g. on little plots with hoes, or with draft animals and instrumentality like ploughs and bars or scrapers. Instrumentality like grading blades and hydraulically operated levelers mounted on wheels square measure used with tractors.

More advanced and complex leveling instrumentality is operated with a optical device electrode, a optical device detector or receiver, and a hand tool force by a tractor. When the specified level or slope of the sector and/or the distinction of the high and low spots are surveyed, the electrode is about to send a rotating lightweight light beam, ray of light, shaft, shaft of light irradiation} making a plane of optical device light on top of the sector surface. The optical device light-weight is employed because the leveling reference. It directs the mechanism of the moving tractor and hand tool, and thereby controls the leveling. The highest profit may be obtained with exactitude optical device leveling; however it's not normally used. This may flow from to a spread of factors: restricted access to optical device units (the few units accessible can't be used all year spherical, however solely throughout a restricted amount before planting rice or wheat); infrastructural issues (too slim roads, too high water tables for the significant machinery); or gender constraints. Alternative vital problems square measure the comparatively high prices compared to regular leveling (although they arise just the once in four years) and also the increase of prices per unit once used on little, individual plots of but one Fadden. Application of tractors in farming is plain as an influence provide. Therefore, performance model for evolving parameters of tractors and implements square measure is essential for farm machinery, operators and makers alike. The target of this study was to assess the prognostic capability of many configurations of ANNs for performance evaluating of tractor in parameters of bar power, fuel consumption, rolling resistance and rubbing potency. A standard tillage system including a moldboard plough with 3 furrows was used for grouping knowledge from MF285 Massey Ferguson tractor. To predict performance parameters, ANN models with back-propagation algorithmic program were developed employing a MATLAB software package with completely different topologies and coaching algorithms. For bar power the simplest result was obtained by the ANN with 6-7-1 topology and Bayesian regulation coaching algorithmic program with R2 of zero.995 and MSE of zero.00024. The ANN model with 6-7-1 structure and Levenberg-Marquardt coaching algorithmic program had the simplest performance with R2 of zero.969 and MSE of zero.13427 for TFC prediction.

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