Abstract by Michael Murphy - A dynamic artificial neural network for the prediction of milk yields from dairy cattle

Accurately predicting milk yields from dairy cattle is an inherently difficult undertaking. Pasture based dairy cattle are subject to a host of stochastic conditions (weather, disease, grass growth, etc.) which dictate the levels of milk production during a typical season. In this study, a dynamic artificial neural network model is proposed to predict annual daily milk yield using daily lactation records pertaining to Holstein Friesian dairy cattle. The network architecture selected was the non-linear auto regressive model with exogenous input (NARX). This model's main advantage over other time series analyses tools is its ability to actively learn and take into account exogenous data that affects the future values of the time series. The daily milk yield is treated as a time series, the cow number is feed through as an exogenous input and a number is chronologically assigned to the day of milking dependent on its position during the cycle. The NARX learns the characteristics of the yield curve relative to time of the year, by doing this, seasonal dependent external inputs such as weather conditions and cow metabolic conditions are indirectly taken into account during the training of the network and implemented through the NARX generalisation abilities. Several model configurations were tested, the quality of each network was measured using coefficients of determination, sum of the squared errors, and root mean square errors. Three previous lactation cycles with corresponding cow numbers were used to train the network. The model was then used to predict milk yield for both an entire annual lactation cycle and a continuous 50 day rolling cycle. The model was capable of predicting daily milk yield with a mean average percentage error of 11.48 and 6.11 for a full lactation cycle and a 50 day rolling period, respectively.