A novel hybrid algorithm for electricity price and load forecasting in smart grids with demand-side management.

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*BOX-Jenkins forecasting

Palabras clave proporcionadas por el autor:
ABC Artificial Bee Colony
AEMO Australian energy market operator
ANEM Australian national electricity market
ANFIS adaptive neural fuzzy inference systems
ANN artificial neural networks
ARIMA Autoregressive Integrated Moving Average
ARMA autoregressive moving average
BNN bayesian neural network
CMI Conditional Mutual Information
CNN cascaded neural network
CPP critical-peak pricing
CS cuckoo search
DAM data association mining
Demand-side management
DLC direct load control
DR dynamic regression
DSM Demand-Side Management
EKF extended Kalman filter
ELM extreme learning machine
EMD empirical mode decomposition
FASE forecast-aided state estimator
Feature selection
FMSE Forecast Mean Square Error

FNN fuzzy neural network
FWPT Flexible Wavelet Packet Transform
GARCH generalized autoregressive conditional heteroskedastic
KELM extreme learning machine with kernel
KKT Karush–Kuhn–Tucker
Load and price forecasting
LSSVM Least Square Support Vector Machine
MAPE Mean Absolute Percentage Error
MeE Median Error
MI mutual information
MIFS mutual information feature selector
MIMO Multi-Input Multi-Output
MLP multi-layer perceptron
mRMR min-redundancy max-relevance
NLSSVM Nonlinear Least Square Support Vector Machine
NMIFS normalized mutual information feature selection
NN neural network
NSW New South Wales
NYISO New York independent system operator
OP-ELM optimally pruned extreme learning machine
PDC Price Duration Curve
PSO particle swarm optimization
PTR peak-time rebate
QLD Queensland
RBF radial basis function
RDFA recursive dynamic factor analysis
RMSE Root Mean Square Error
Smart grids
SVM support vector machine
TF transfer function
ToU time-of-use
VIC Victoria
Wavelet transform
WPT wavelet packet transform
WT wavelet transform

Resumen: Smart grid is a platform that enables the participants of electricity market to adjust their bidding strategies based on Demand-Side Management (DSM) models. Responsiveness of the market participants can improve reliability of system operation as well as capital cost investments. In this regard, the accurate forecast of electricity price and demand in smart grids is an important challenge as their strong correlation makes a separate forecasting to be ineffective. Therefore, this paper proposes a novel hybrid algorithm for simultaneous forecast of price and demand that uses a set of effective tools in preprocessing part, forecast engine and tuned algorithm. To highlight our contributions, the proposed forecast algorithm classified into three main parts. The first part employs a new Flexible Wavelet Packet Transform (FWPT) to decompose a signal into multiple terms at different frequencies, and a new feature selection method that employs Conditional Mutual Information (CMI) and adjacent features in order to select valuable input data. The second part consists of a novel Multi-Input Multi-Output (MIMO) model based on Nonlinear Least Square Support Vector Machine (NLSSVM) and Autoregressive Integrated Moving Average (ARIMA) in order to

model the linear and nonlinear correlation between price and load in two stages. The final part employs a modified version of Artificial Bee Colony (ABC) algorithm based on time-varying coefficients and stumble generation operator, called TV-SABC, in order to optimize NLSSVM parameters in a learning process. The proposed hybrid forecasting algorithm is evaluated on several real and well-known markets illustrating its high accuracy in simultaneous forecast of electricity price and demand. Moreover, the interactive effects of demand-side management programs on load factor (load curve) and price signal are investigated by numerical indices. [ABSTRACT FROM AUTHOR]

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