

电力市场

基于启发式最小二乘支持向量机的中长期电力负荷预测

李如琦¹, 苏浩益¹, 王宗耀², 邓国良¹, 陈铁洲¹

1. 广西大学 电气工程学院, 广西壮族自治区 南宁市 530004; 2. 南昌工程学院 机械与电气工程学院, 江西省 南昌市 330099

摘要:

针对中长期负荷预测, 提出了基于年负荷总量、年负荷增长量、年负荷增长率、年负荷增长加速率、年国内生产总值等5个指标的启发式最小二乘支持向量机中长期负荷预测模型。首先, 通过核函数将低维输入变量空间映射到高维特征空间, 建立核偏最小二乘回归模型, 拟合出单位国内生产总值电耗; 然后以单位国内生产总值电耗为启发式算子, 在历史负荷数据的基础上合理假设待预测年的负荷总量, 利用启发式算子反推出该负荷值对应的年国内生产总值, 形成支持向量机扩展训练样本, 将支持向量机外推预测转化为内插求值。最后, 用训练好的支持向量机求出预测结果。实际算例的结果表明, 所提出的方法预测精度较高, 具有较强的可行性和实用性。

关键词: 负荷预测 支持向量机 核偏最小二乘回归 启发式算子 单位国内生产总值电耗

Medium-and Long-Term Load Forecasting Based on Heuristic Least Square Support Vector Machine

LI Ruqi¹, SU Haoyi¹, WANG Zongyao², DENG Guoliang¹, CHEN Tiezhou¹

1. School of Electrical Engineering, Guangxi University, Nanning 530004, Guangxi Zhuang Autonomous Region, China; 2. Department of Machinery and Electronic Engineering, Nanchang Institute of Technology, Nanchang 330099, Jiangxi Province, China

Abstract:

Founded on total amount of annual load, annual load growth amount, annual load growth rate, acceleration rate of annual load growth and annual gross domestic product (GDP), a long-term load forecasting model based on heuristic least square support vector machine (LS-SVM) is built. Firstly, the low dimensional input variable space is mapping to high dimensional characteristic space by kernel function and a kernel partial least squares regression model is built to fit out power consumption per unit of GDP; then taking the power consumption per unit of GDP as heuristic operator, on the basis of historical data the total load amount in the forecasted year is reasonably assumed, and then using the heuristic operator the annual GDP corresponding to the assumed total load amount is obtained by inverse method to form expanded training samples of SVM and the extrapolation forecasting of SVM is changed into interpolation evaluation; finally, the forecasting result is solved by well-trained SVM. Calculation results of actual case show that using the proposed method the forecasting results with higher accuracy can be obtained, and the proposed method is practicable.

Keywords: load forecasting support vector machine kernel partial least squares regression heuristic operator electricity consumption per unit of GDP

收稿日期 2010-08-18 修回日期 2010-11-16 网络版发布日期 2011-11-11

DOI:

基金项目:

通讯作者: 苏浩益

作者简介:

作者Email: suhaoyi8888@126.com

参考文献:

- [1] 牛东晓, 曹树华, 赵磊, 等. 电力负荷预测技术及其应用[M]. 北京: 中国电力出版社, 1998: 5-30. [2] 张伏生, 刘芳, 赵文彬, 等. 灰色Verhulst模型在中长期负荷预测中的应用[J]. 电网技术, 2003, 27(5): 37-39. Zhang Fusheng, Liu Fang, Zhao Wenbin, et al. Application of grey verhulst model in middle and long term load forecasting[J]. Power System Technology, 2003, 27(5): 37-39(in Chinese). [3] 周德

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(315KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 负荷预测
- ▶ 支持向量机
- ▶ 核偏最小二乘回归
- ▶ 启发式算子
- ▶ 单位国内生产总值电耗

本文作者相关文章

PubMed

强. 改进的灰色Verhulst模型在中长期负荷预测中的应用[J]. 电网技术, 2009, 33(18): 124-127. Zhou Deqiang. Application of improved gray verhulst model in middle and long term load forecasting[J]. Power System Technology, 2009, 33(18): 124-127(in Chinese). [4] 伍力, 吴捷, 叶军. 负荷中长期预测中一种改进的模糊聚类算法[J]. 电网技术, 2000, 24(1): 36-38. Wu Li, Wu Jie, Ye Jun. An improving fuzzy clustering algorithm in long-term load forecasting[J]. Power System Technology, 2000, 24(1): 36-38(in Chinese). [5] 孙广强, 姚建刚, 谢宇翔, 等. 基于新鲜度函数和预测有效度的模糊自适应变权重中长期电力负荷组合预测[J]. 电网技术, 2009, 33(9): 103-107. Sun Guangqiang, Yao Jiangan, Xie Yuxiang, et al. Combination forecast of medium-and long-term load using fuzzy adaptive variable weight based on fresh degree function and forecasting availability[J]. Power System Technology, 2009, 33(9): 103-107(in Chinese). [6] 罗治强, 张焰, 朱杰. 粗集理论在电力系统负荷预测中的应用[J]. 电网技术, 2004, 28(3): 29-32. Luo Zhiqiang, Zhang Yan, Zhu Jie. Application of rough set theory in electric power load forecast[J]. Power System Technology, 2004, 28(3): 29-32(in Chinese). [7] Parkd C. Electric load forecasting using an artificial neural network[J]. IEEE Transactions on Power Systems, 1991, 6(2): 442-449. [8] 李春祥, 牛东晓, 孟丽敏. 基于层次分析法和径向基函数神经网络的中长期负荷预测综合模型[J]. 电网技术, 2009, 33(2): 99-104. Li Chunxiang, Niu Dongxiao, Meng Limin. A comprehensive model for long-and medium-term load forecasting based on analytic hierarchy process and radial basis function neural network[J]. Power System Technology, 2009, 33(2): 99-104(in Chinese). [9] 赵登福, 王蒙, 张讲社, 等. 基于支撑向量机方法的短期负荷预测[J]. 中国电机工程学报, 2002, 22(4): 26-30. Zhao Dengfu, Wang Meng, Zhang Jianshe, et al. A support vector machine approach for short term load forecasting[J]. Proceedings of the CSEE, 2002, 22(4): 26-30(in Chinese). [10] 赵登福, 庞文晨, 张讲社, 等. 基于贝叶斯理论和在线学习支持向量机的短期负荷预测[J]. 中国电机工程学报, 2005, 25(13): 8-13. Zhao Dengfu, Pang Wenchen, Zhang Jianshe, et al. Based on Bayesian theory and online learning SVM for short term load forecasting[J]. Proceedings of the CSEE, 2005, 25(13): 8-13(in Chinese). [11] 刘耀年, 庞松岭, 李鉴. 基于粗糙集理论和最小二乘支持向量机的中长期负荷预测[J]. 中国电力, 2007, 40(10): 42-44. Liu Yaonian, Pang Songling, Li Jian. Medium and long-term load forecasting based on rough sets and least square support vector machines[J]. Electric Power, 2007, 40(10): 42-44(in Chinese). [12] 毛李帆, 姚建刚, 金永顺, 等. 中长期负荷预测的异常数据辨识与缺失数据处理[J]. 电网技术, 2010, 34(7): 148-153. Mao Lifan, Yao Jiangan, Jin Yongshun, et al. Abnormal data identification and missing data filling in medium-and long-term load forecasting[J]. Power System Technology, 2010, 34(7): 148-153(in Chinese). [13] 牛东晓, 吕海涛, 张云云. 贝叶斯框架下最小二乘支持向量机的中长期电力负荷组合预测[J]. 华北电力大学学报, 2008, 35(6): 62-66. Niu Dongxiao, Lü Haitao, Zhang Yunyun. Combination method of mid-long term load forecasting based on support vector machine within the Bayesian evidence framework[J]. Journal of North China Electric Power University, 2008, 35(6): 62-66(in Chinese). [14] 肖先勇, 葛嘉, 何德胜. 基于支持向量机的中长期电力负荷组合预测[J]. 电力系统及其自动化学报, 2008, 20(1): 84-88. Xiao Xianyong, Ge Jia, He Desheng. Combination method of mid-long term load forecasting based on support vector machine[J]. Proceedings of the CSU-EPSA, 2008, 20(1): 84-88(in Chinese). [15] 张雪君, 陈刚, 周杰, 等. 基于粒子群优化鲁棒支持向量回归机的中长期负荷预测[J]. 电力系统保护与控制, 2009, 37(21): 77-81. Zhang Xuejun, Chen Gang, Zhou Jie, et al. Medium and long-term load forecast based on PSO-RSVR[J]. Power System Protection and Control, 2009, 37(21): 77-81(in Chinese). [16] Rosipal R J. Trejo L. Kernel partial least squares regression in reproducing kernel Hilbert space[J]. Journal of Machine Learning Research, 2001, 2(6): 97-123. [17] 姚林, 阳建宏, 何飞, 等. 基于核偏最小二乘的锌层重量预测模型[J]. 控制工程, 2008, 15(2): 154-157. Yao Lin, Yang Jianhong, He Fei, et al. Forecasting model for zinc coating weights based on kernel partial least squares[J]. Control Engineering of China, 2008, 15(2): 154-157(in Chinese). [18] 陈帅, 朱建宁, 潘俊, 等. 最小二乘支持向量机的参数优化及其应用[J]. 华东理工大学学报: 自然科学版, 2008, 34(2): 278-282. Chen Shuai, Zhu Jianning, Pan Jun, et al. Parameters optimization of LS-SVM and its application[J]. Journal of East China University of Science and Technology: Natural Science Edition, 2008, 34(2): 278-282(in Chinese). [19] 毛李帆, 江岳春, 姚建刚, 等. 采用正交信号修正法与偏最小二乘回归的中长期负荷预测[J]. 中国电机工程学报, 2009, 29(16): 82-88. Mao Lifan, Jiang Yuechun, Yao Jiangan, et al. Medium and long term load forecasting based on orthogonal signal correction and partial least-squares regression[J]. Proceedings of the CSEE, 2009, 29(16): 82-88(in Chinese). [20] 上海统计局. 2006上海统计年鉴[M]. 北京: 中国统计出版社, 2006: 10-85.

本刊中的类似文章

1. 郝文斌, 李群湛, 马庆安, 郑永康. 基于支持向量机的变压器励磁涌流仿真实现[J]. 电网技术, 2006, 30(1): 60-64
2. 龙瑞华, 毛弋, 毛李帆, 孙东杰, 张芳明, 张婷, 陈宇哲. 基于诱导有序加权平均算子和马尔可夫链的中长期电力负荷组合预测模型[J]. 电网技术, 2010, 34(3): 150-156
3. 兰飞, 唐玲. 基于有向无环图支持向量机的水轮发电机组故障诊断模型[J]. 电网技术, 2010, 34(2): 115-119
4. 师彪, 李郁侠, 于新花, 闫旺, 何常胜, 孟欣. 基于改进粒子群?径向基神经网络模型的短期电力负荷预测[J]. 电网技术, 2009, 33(17): 180-184
5. 李妮, 江岳春, 黄珊, 毛李帆. 基于累积式自回归平均传递函数模型的短期负荷预测[J]. 电网技术, 2009, 33(8): 93-97

6. 徐玮 罗欣 刘梅 那志强 吴臻 黄静 姜巍 孙珂.用于小水电地区负荷预测的两阶段还原法[J]. 电网技术, 2009,33(8): 87-92
7. 孙广强 姚建刚 谢宇翔 卜虎正.基于新鲜度函数和预测有效度的模糊自适应变权重中长期电力负荷组合预测[J]. 电网技术, 2009,33(9): 103-107
8. 李予州|吴文传|张伯明|江木|肖岚|路轶 .多时间尺度协调的区域控制偏差超前控制方法[J]. 电网技术, 2009,33(3): 15-19
9. 张思远|何光宇|梅生伟|王 伟|张王俊 .基于相似时间序列检索的超短期负荷预测[J]. 电网技术, 2008,32(12): 56-59
10. 方仍存 周建中 张勇传 李清清 刘力 .基于粒子群优化的非线性灰色Bernoulli模型在中长期负荷预测中的应用[J]. 电网技术, 2008,32(12): 60-63
11. 方群会 刘强 周林 马永强 武剑 .模式分类方法在电能质量扰动信号分类中的应用综述[J]. 电网技术, 2009,33(1): 31-36
12. 张亚军, 刘志刚, 张大波.一种基于多神经网络的组合负荷预测模型[J]. 电网技术, 2006,30(21): 21-25
13. 罗 楠|朱业玉|杜彩月 .支持向量机方法在电力负荷预测中的应用[J]. 电网技术, 2007,31(Supp2): 215-218
14. 叶利东|喻向阳.玉溪电网“十一五”及2020年负荷预测[J]. 电网技术, 2007,31(Supp2): 227-229
15. 毛李帆 江岳春 龙瑞华 李妮 黄慧 黄珊 .基于偏最小二乘回归分析的中长期电力负荷预测[J]. 电网技术, 2008,32(19): 71-77