Distributed machine learning in power system state estimation

This paper is organized as follows: Sect. 2 briefly explains the nonlinear (WLS) algorithm for power system state estimation followed by Sect. 3 which describes the multivariate Gaussian distribution based synthetic data generation with copula. Section 4 explains the two machine learning algorithms which have outperformed the other algorithms during the ...

The Working Group (WG) on Machine Learning for Power Systems (MLPS) is the professional home for researchers and engineers involved in the application of the latest machine learning techniques for the operation and planning of power systems. ... "Novel Data-Driven Distributed Learning Framework for Solving AC Power Flow for Large ...

Robustness is an important performance index of power system state estimation, which is defined as the estimator"s capability to resist the interference. However, improving the robustness of state estimation often reduces the estimation accuracy. To solve this problem, this paper proposes a power system state estimation method for generalized M-estimation of ...

The solution of the distribution system state estimation (DSSE) relies on the presence of physical measurements in real time. Sometimes, these measurements may not reach the control center due to the defects in meter functionality, the large communication time delays, and denial-of-service (DoS) attacks on communication channels. Addressing this issue, a ...

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Recent updates to the IEEE 1547-2018 standard allow active participation of distributed energy resources (DERs) in power grid services with the goal of increased grid reliability and resiliency. With the rapid growth of DERs towards a low inertia converter-dominated grid, the DERs can provide fast frequency response (FFR) services that can quickly counteract ...

Then, an output feedback model predictive controller is designed based on the state estimates provided by the machine-learning-based estimators to stabilize the closed-loop system at the steady-state. A chemical process example is utilized to illustrate the effectiveness of the proposed machine-learning-based state estimation and control ...

State estimation is a critical application that provides situational awareness and permits efficient operation of the smart grid. The secure, accurate, and fast computation of the state estimates is crucial to execute the

complex decisions and diverse control actions needed in real time to provide reliable, economic, and safe power systems that integrate distributed and ...

locally, with no effect on the rest of the power system"s results. Index Terms--Machine Learning, Graph Neural Networks, Power Systems, State Estimation, Real-Time Systems I. INTRODUCTION Motivation: The power system state estimation (SE) is a problem of determining the state of the power system repre-

Note that the Network Topology Processing functional block verifies the accuracy of the network parameters included as Inputs.The Observability Analysis functional block establishes that there is sufficient data available for the State Estimation Algorithm functional block, and these two blocks may be integrated together in some methods. As discussed earlier, the relative lack ...

Maintaining reliability during power system operation relies heavily on the operator"s knowledge of the system and its current state. With the increasing complexity of power systems, full system monitoring is needed. Due to the costs to install and maintain measurement devices, a cost-effective optimal placement is normally employed, and as such, state ...

Index Terms--state estimation, graph neural networks, ma-chine learning, power systems, real-time I. INTRODUCTION The state estimation (SE), which estimates the set of power system state variables based on the available set of mea-surements, is an essential tool used for the power system"s monitoring and operation [1].

Deregulation of energy markets, penetration of renewables, advanced metering capabilities, and the urge for situational awareness, all call for system-wide power system state estimation (PSSE). Implementing a centralized estimator though is practically infeasible due to the complexity scale of an interconnection, the communication bottleneck in real-time monitoring, ...

The demand for more accurate system situational awareness, coupled with the limitations of traditional techniques, has motivated the development of a new approach for power system state estimation. Existing state estimation efforts for power systems can be categorized into model-based and machine learning based approaches [3], [4], [5], [6].

in distributed state estimation of power systems in numerical experiments on IEEE test cases. 1. Introduction Power system state estimation aims to recover the system"s current underlying voltage phasors, given supervisory control and data acquisition (SCADA) measurements, PMU measurements, and a system model based on assumed parameters [1 ...

Abstract: Transition to a sustainable energy environment results in aggregated generator and load dynamics in the distribution network. State estimation is a key function in building adequate network models for online monitoring and analyzes. The requirements of distribution system state estimation (DSSE) is becoming

stringent because of the needs of ...

In 2006, Hinton et al. first proposed the concept of deep belief network [21].Hence, deep learning has been gradually applied to the power system. In [22], a full data-driven method based on deep learning was proposed, which can accurately fill up the missing data without depending on PMU observability and network topologies [23], a voltage sag estimation ...

Index Terms--Power system state estimation, power system state forecasting, least-absolute-value, proximal linear algorithm, deep learning, recurrent neural networks, data validation. I. INTRODUCTION Recognized as the most significant engineering achievement of the twentieth century, the North American power grid is

A deep learning (DL)-based state estimator is proposed in which uses a deep neural network (DNN) for power system state estimation (PSSE) and a recurrent neural network (RNN) for state forecasting. In [10], a shallow neural network is used for the proper initialization of states in the Gauss-Newton algorithm which speeds up the convergence ...

Foundational and state-of-the-art anomaly-detection methods through power system state estimation are reviewed. Traditional components for bad data detection, such as chi-square testing, residual-based methods, and hypothesis testing, are discussed to explain the motivations for recent anomaly-detection methods given the increasing complexity of power ...

approach for power system state estimation. Existing state estimation efforts for power systems can be categorized into model-based and machine learning based approaches [3]-[6]. In the domain of model-based state esti-mation, two directions have emerged as key areas of focus: (1) static state estimation (SSE) and (2) dynamic state estimation