Data driven state estimation for electric power systems

In this work, the state estimation problem of electric power systems is represented through a mathematical programming approach. Initially, a non-linear mathematical model based on the classical method of weighted least squares is proposed to solve the state estimation problem for comparative purposes. Due to the inherent limitations that this classical model ...

Data-driven methods have emerged as practical approaches for extracting reliable representations from non-linear system data, enabling the identification of dynamics and system parameters essential for analysing ...

This paper evaluates a dynamic state estimation algorithm for power transmission systems, which operates without knowledge of the underlying system model. It relies purely on measurement data from phasor measurement units (PMUs) along with input data to the system (such as loads, field voltages). The algorithm uses Gaussian processes (GPs) to approximate ...

to the missing input data. 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].

Chapter 9 - Data-driven state estimation in electric power systems. ... highlighting network component modeling and power flow equations for state estimation before addressing quasi static state estimation in electrical power systems using Weighted Least Squares (WLS) classical and alternatives formulations. ...

This paper contains six sections altogether. In Section 2, the probabilistic model of electric vehicles and the charging power model of cluster electric vehicles are established. Section 3 constructs a probabilistic model for photovoltaic power generation and a probabilistic model for wind power generation. In Section 4, the power system state estimation objective function is ...

2022 IEEE PES GM Panel Session. Data-Driven State and Parameter Estimation in Power Distribution Systems. Authors: Dr. Yuzhang Lin, Dr. Balasubramaniam Natarajan, Dr. Yang Weng, and Dr. Nanpeng Yu. Chair: Dr. Yuzhang Lin and Dr. Nanpeng Yu. Read More >

Therefore, the data-driven QAOA enables efficient search of the maximum sections of power delivery and data traffic in cyber-physical power systems. The contributions of this work are summarized ...

In the process of power system state estimation (PSSE), the redundancy of the measurement information is to improve the data accuracy, and then the system"s operating state can be estimated or predicted. The first research on state estimation of power systems dates back to the 1970s [1].

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We would like to submit the paper titled "Bad data identification for power system state estimation based on data-driven and interval analysis" to Electric Power Systems Research for possible evaluation and ... China. His-research interests include power system planning, power system state estimation, big data acquisition, and preprocessing.

We propose an original GNN implementation over the power system"s factor graph to simplify the incorporation of various types and numbers of measurements both on power system buses ...

The power system state estimation (SE) algorithm estimates the complex bus voltages based on the available set of measurements. Because phasor measurement units (PMUs) are becoming more widely employed in transmission power systems, a fast SE solver capable of exploiting PMUs" high sample rates is required. To accomplish this, we present a ...

Deng, Z. et al. Data-driven state of charge estimation for lithium-ion battery packs based on Gaussian process regression. Energy 205, 118000 (2020). Article Google Scholar

A graph neural network (GNN)-based time-synchronized state estimator that considers the physical connections of the power system during the training itself is formulating that outperforms both the model-based linear state estimators and a data-driven deep neural network-based state estimATOR in the presence of non-Gaussian measurement noise and topology changes.

2.2 State estimation with raw measurements. In the system with M PMUs installed, we assume the whole system can be observable by deploying all these PMUs for all system buses, i.e. .This corresponds to say that, the voltage phasors, of all buses in the system, can be measured to form a raw measurement vector y, which is denoted as .. We then define as the ...

This paper presents a real-time robust power system forecasting-aided state estimation method based on the Bayesian framework, deep learning, and Gaussian mixture model to dynamically estimate the ...

A grand challenge for state estimation in newly built smart grid lies in how to deal with the increasing uncertainties. To solve the problem, we propose a data-driven state estimation approach based on recent targeted investment on sensors, data storage, and computing devices. An architecture is proposed to use power system physics and pattern to systematically clean ...

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 ...

Data driven state estimation for electric power systems

To further improve the model accuracy, a data-driven method based on a graph convolution neural network is introduced to realize state estimation, which can fully consider ...

In the literature [12], a multi-task learning framework based on deep learning is proposed, which can simultaneously estimate the state of the electric power system and the natural gas system and ...

To enable online data-driven SE, techniques such as dimension reduction and k-dimensional tree indexing are employed with 1000 times speed up in simulations. Further numerical results ...

This paper presents a novel data driven approach to perform state estimation of power transmission system using deep neural networks (DNN). The network is trained offline using ...

State variables are related to certain measurements. Once the system topology and location of measurement units are given, the sparse pattern of H is determined. Taking a four-bus system as an example (where bus 4 is the reference bus, illustrated in Fig. 1), the nonzero elements deriving from nodal power injection measurements are influenced by both the ...

Existing state estimation efforts for power systems can be categorized into model-based and machine learning based approaches [3], [4], [5], [6] the domain of model-based state estimation, two directions have emerged as key areas of focus: (1) static state estimation (SSE) and (2) dynamic state estimation (DSE) [7].SSE determines the unknown states of a power ...

A methodology is developed to assess the time-domain power quality state estimation (PQSE) in electrical systems based on the Kalman filter implemented using parallel processing techniques through ...

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This article focuses on presenting the unique applications for deriving power system dynamic models from measurement data. Dynamic behaviors are difficult to capture, especially for applications lack of analytic models. That is where data driven/machine learning techniques can play a critical role. Indeed, there is a long history of power ...

The other uses a deep learning algorithm to generate pseudo-measurement data with low estimation errors and then applies data-driven or model-driven methods for state estimation. Currently, deep learning networks have been used in the initial application of state estimation of the distribution power system.

Robust and Fast Data-Driven Power System State Estimator Using Graph Neural Networks Ognjen Kundacina, Student Member, IEEE, Mirsad Cosovic, Member, IEEE, Dejan Vukobratovic, Senior Member, IEEE Abstract--The power system state estimation (SE) algorithm estimates the complex bus voltages based

on the available set of measurements.

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