The 15th International Workshop on Electric Power Control Centers
Reykjavik, Iceland, May 12-15, 2019

Power Grid Control Operation AI System
- Analysis and Discussion of Key Technologies -

Xin Shan, Mingyu Zhai, Zonghe Gao, Bo Wang, Xianliang Teng
NARI Group Corporation

New generation of artificial intelligence (AI) technologies based on deep learning techniques has been developing very rapidly. Becoming the strategic technology, it leads a new round of scientific and technological revolution and industrial transformation, and it has already risen to the level of national strategy that has attracted attention of all walks of life.

As a “decision brain” of power system operations, power grid dispatching and control provides comprehensive decision making & control services, combining the large amount of data with system analysis, operational procedures and professional experience. How to use AI technology to discover grid operation characteristics and simulate dispatcher decision & control is the research hotspot and future development direction of smart grid dispatching and system control.

We start this presentation by introducing the overall PGCO AI system architecture. Characteristics of grid dispatching and control system are analyzed, and overall framework is proposed. This system consists of an intelligent learning system and the real-time dispatching and control system.

Real-time dispatching and control system includes real-time monitoring, analysis, decision making and closed-loop control of power grid, and provides operational data and rules learned from experience to the intelligent learning system. The intelligent learning system becomes a parallel system to real-time dispatching and control systems. It is based on the high-performance computing platform, integrated with real-time operational data as well as on the inputs from the external meteorological environment, equipment geolocation, dispatching

procedures, and operational logs from other systems. Using machine learning, deep learning and other technologies, through the discovery of data characteristics and learning of empirical rules, PGCO AI System provides knowledge guidance and improves the intelligence level of real-time dispatching and control systems.

Secondly, the key technology analysis is carried out from three points of view:

(1) power grid prediction and identification based on deep learning
(2) intelligent assistant decision making based on knowledge graph, and
(3) dispatcher assistant based on voice interaction

(1) Power grid prediction and identification is based on deep learning. AI application scenarios are analyzed for the power supply side, grid side and load side. AI key technologies include machine learning, deep learning and other technologies which provide additional advantages in big data analysis. Based on training and learning of massive grid operation data, the system can discover the operating rules and characteristics of power grids to improve the prediction accuracy of power generation, load and equipment sudden failures.
(2) The intelligent assistant decision-making is based on the use of a knowledge graph. Application scenarios include various aspects of equipment maintenance operation, fault handling and transmission line fault recovery. The objective is that the repetitive and mechanical work of the past scheduling can be automatically completed by the machine, which can reduce the amount work of daily monitoring and control.
(3) The voice-based dispatcher assistant is based on applications of AI technologies including face recognition, voice interaction and automatic mapping, as well as speech recognition and intelligent information retrieval. The goal is the replacement of the cumbersome process of manual retrieval of queries and statistical analysis, and improvement of the human-computer interaction “friendliness” with the control system. As far as the technical verification is concerned, the applications of machine learning, knowledge graph and speech recognition technologies in real-time

monitoring of power grid are verified in the following areas: sudden equipment failure prediction, transmission line fault recovery decision-making assistant and intelligent information retrieval.

Finally, the role of artificial intelligence in present and future power grid regulations as well as new technical challenges are summarized and discussed.

Please send the Abstract to **dsobajic@gridengineering.com** by April 12