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**Data science and Machine Learning in the Energy Industry**

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**Abstract::**

Modern power systems face new challenges due to the increasing infeed of fluctuating renewable generation, aging assets and changing market conditions. As a result, grid operators need improved situational awareness and decision support for effective control and improved grid reliability. Digitalization, is seen as one of the main forces driving the energy transition and will have a big impact on many aspects of the power industry. Emerging technologies like data science and machine learning will be actively applied to predict renewable generation and electric loads. In transmission and distribution grids, IoT sensors will acquire large amounts of data. This data can be analyzed and correlated with other data sets to gain new insights. Deep learning techniques including recurrent neural networks (RNN) and convolution neural networks (CNN) are expected to improve the prediction accuracy of time series energy data. At the same time, many hurdles must be overcome to realize the full potential as many industrial projects using data science and machine learning still fall short of expectations.

This presentation will present some theory and practical examples where data science and machine learning are applied in the energy industry, while also discussing potential pitfalls and risks.

The following use cases are discussed:

- **Improved distributed generation management.** Machine Learning can help utilities realize the next-generation grid through enhanced distributed resource management that automatically flows power through the grid to deliver more reliable energy and greater customer choice.
- **Asset optimization.** Machine learning could be used to develop industry intelligence that will predict the probability of failure. These algorithms take into account industry-wide early failure rates for equipment, creating a richer understanding of premature failure risks for enhanced asset maintenance, workflow, and portfolio management.

- **Outage management.** Utilities can use analytics-validating models to predict and identify outages. Machine learning and device automation allow for better resource management, reducing downtime and improving reliability. Self-healing grids can automatically detect and address vulnerabilities, reducing the likelihood of outages.
- **Customer engagement.** Utilities are mining data with the aid of machine learning to understand customer behavior and service needs. Using this data, utilities can provide faster and more intuitive interactive customer service via voice response, personalization, and service matching.