Utility Analytics 101

Course Outline | Curriculum Updated for 2025

Summary:
The Utility Analytics 101 course is a three-day workshop for professionals in the utility industry and covers key topics in analytics, database fundamentals, data preparation, and visualization, with a focus on smart meter data. Participants will learn how analytics can optimize operations in utilities, including safety, predictive maintenance, and sustainability efforts. The workshop introduces machine learning applications in utilities, discusses the importance of data integrity and security, and explores big data infrastructure like Hadoop and Spark. Through hands-on exercises, participants will design and build databases, clean and prepare data, and visualize insights. Additional topics include time-series data handling, anomaly detection in smart meter data, and data quality metrics. By the end of the workshop, participants will have the skills to apply analytics to real-world utility scenarios, ensuring data-driven decision-making in their organizations.

What You'll Learn:

- Understand the challenges and opportunities in the utility industry and the impact of analytics on operations such as safety, predictive maintenance, and energy optimization.
- Explore use cases for smart meter data analytics, including consumption forecasting, demand response, anomaly detection, and sustainability efforts.
- Gain foundational knowledge in database design and querying, including building databases for utility-specific scenarios.
- Learn how to maintain data integrity and security while working with utility data.
- Get hands-on experience with Python notebooks for database creation, querying, and data cleaning.
- Discover big data infrastructure technologies such as Hadoop and Spark for handling large datasets in utilities.
- Learn techniques for preparing and cleaning data, including handling missing values, normalization, outlier detection, and feature engineering.
- Develop skills in handling time-series data from smart meters and monitoring data quality metrics.
- Master data visualization techniques to uncover insights through time-series plots, histograms, and anomaly detection visualizations.
- Apply analytics concepts in real-world scenarios through case studies and hands-on exercises, ensuring actionable insights and data-driven decision-making in utility operations.

Day 1: ***Time is represented in Central Time and is a 4-hour per day example. Time could change.***

10:00am - 10:50am: Course Introduction, Changes to Utilities, Analytics Overview

- Introduction to the utility industry's challenges and opportunities.
- Overview of analytics and its impact on utilities: safety analytics, predictive maintenance, energy optimization, etc.
- Case study introduction: Discuss the role of analytics in utility companies (smart meters, grid management, etc.).
- **Additional Topic**: Introduction to Machine Learning for Utilities.

10:50am - 11:00am: Break

11:00am - 12:00pm: Analytics on Smart Meter Data

- Present various use cases for smart meter data analytics: consumption forecasting, demand response, and anomaly detection.
- **Additional Topic**: Utility Analytics for Sustainability.

12:00pm - 12:30pm: Case Study Application

- **Task**: Apply the analytics lifecycle to the case study.
- **Outcome**: Participants create slides for their presentation.

12:30pm - 1:00pm: Break

1:00pm - 2:00pm: Case Study Presentation Preparation

- Continue working on case study and finalize presentation slides.

Day 2: ***Time is represented in Central Time and is a 4-hour per day example. Time could change.***

10:00am - 10:50am: DB Fundamentals

- Teach the fundamentals of databases with a focus on organizing and querying data effectively.
- **Task**: Design simple database systems and structure the data (customer table, smart meter ID table, smart meter data table).
- **Additional Topic**: Data Integrity and Security in Utilities.

10:50am - 11:00am: Break

11:00am - 12:00pm: Python Notebook for DB Creation and Querying

- Walkthrough of Python notebook for creating and querying a simple database for smart meter data.
- **Additional Topic**: Big Data Infrastructure (Hadoop, Spark).

12:00pm - 12:30pm: Database Building Exercise

- **Task**: Build a database from scratch using the ER diagram and populate it with synthetic smart meter data.

12:30pm - 1:00pm: Break

1:00pm - 2:00pm: Database Queries and Visualizations

- Perform queries on the database and visualize the results using Python.

Day 3: ***Time is represented in Central Time and is a 4-hour per day example. Time could change.***

10:00am - 10:50am: Data Preparation/Cleaning

- Discuss the importance of data preparation and cleaning in analytics: handling missing values, normalization, outlier detection, and feature engineering.
- **Additional Topic**: Handling Time-Series Data (smart meter data).

10:50am - 11:00am: Break

11:00am - 12:00pm: Python Notebook for Data Cleaning

- Walkthrough of a Python notebook for cleaning and preparing smart meter data.
- **Additional Topic**: Data Quality Metrics and KPI Monitoring.

12:00pm - 12:30pm: Data Visualization of Prepared Data

- Show how cleaned data can be visualized to uncover insights (time-series plots, histograms, box plots, etc.).
- **Additional Topic**: Anomaly Detection in Smart Meter Data.

12:30pm - 1:00pm: Break

1:00pm - 2:00pm: Data Preparation and Visualization Exercise

- **Task**: Prepare the provided smart meter dataset (in Excel format), clean the data, and visualize key insights.
- **Outcome**: Participants will share their results in a short presentation, showing their cleaned data and visualizations.