Optimization of Energy Consumption in Buildings.

dAlchemy's analytics engine enables building energy management systems to save a lot of power and detect anomalies in the electricity consumption data.

We strive to develop algorithms for power management systems of large buildings and companies to be able to solve complex plug load analysis issues.

ABOUT THE CLIENT

The client is a leading provider of plug load management solutions for the enterprise. It's Plug Load Management Software enables an enterprise to set and administer energy use policies for plug loads across its entire campus.

The client's products can gain unprecedented insight into an enterprise's plug load energy expenditures. It can quickly identify unnecessary loads and automatically shut them off. Simple rules to automatically use less power during peak demand hours, reduce base-load demand, and minimize unnecessary off-hours consumption can be set using the client's solution.

THE CHALLENGE

Electricity use associated with plug loads (any devices that plug into a building's electrical system) has been on the increase, and plug loads in commercial buildings are now one of the fastest growing end uses of energy. Minimizing plug loads is a primary challenge in the design and operation of an energy-efficient building. In order to conserve energy, what if we could stop charging a laptop as soon as it is fully charged? Can we find out if all the devices in an enterprise are running smoothly and being adequately utilized? What is probability of a plugged-in device being a desktop or a laptop or a printer ? How much energy are the devices consuming? Is the device switched on? The answers to these questions could help the client to design an effective enterprise energy management solution.

The client needed help with classification of network-enabled devices and asset identification for which they engaged with dAlchemy.

THE SOLUTION

dAchemy's data-driven insights helped with the solution for the client's problem. The solution involved, first creating the data set by collecting data from multiple Internet of Things (IoT) enabled network devices plugged in.

This data was used to build multiple probabilistic models to give different levels of accuracy regarding the classification of the devices. The model that was used for this particular case for the classification of the device was multivariate logistic regression model. The algorithm was continuously trained to calculate the probability of a device being of a particular class.

THE BENEFITS

dAlchemy provided a practical solution for increasing electrical efficiency by measuring, controlling, and managing electrical plug loads individually. Currently, the data available with dAlchemy for analysis is second level data. By using the power characteristics of a device, dAlchemy was able to predict with 70% accuracy the classification of a device. dAlchemy's solution was also able to predict the make of the product – for example, whether it is HP Notebook PC or Macbook Pro laptop.

Corporate Headquaters
257 Castro Street Suite
#112 Mountain View
CA 94041 - 1286

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Global Offices
Mountain View, CA +1-650-318-1325
Bangalore, India +91-988-605-3289

www.dAlchemy.com

If data of higher granularity is available, dAlchemy's algorithms will be able to improve the accuracy of predictions.

The transparency of this solution provided the client's customers with information such as device uptime, which device had stopped working, which device was about to fail, etc. This gave customers the ability to proactively manage all the devices in the premises and fix devices that needed immediate looking into. The client could identify unnecessary electricity use and establish best electrical efficiency practices, which lead to significant cost savings. This also helped meet the sustainability requirements of enterprises and indirectly, improved employee productivity by efficiently managing devices used by the employees.

THE PROCESS

dAlchemy followed the CRoss-Industry Standard Process for Data Mining (CRISP-DM) Methodology for carrying out this project. CRISP-DM methodology is based on the practical, real-world experience of how people conduct data mining projects and it is described in terms of a hierarchical process model, consisting of sets of tasks described at four levels of abstraction (from general to specific): phase, generic task, specialized task, and process instance.

The following figure shows the six phases of the CRISP-DM reference model.

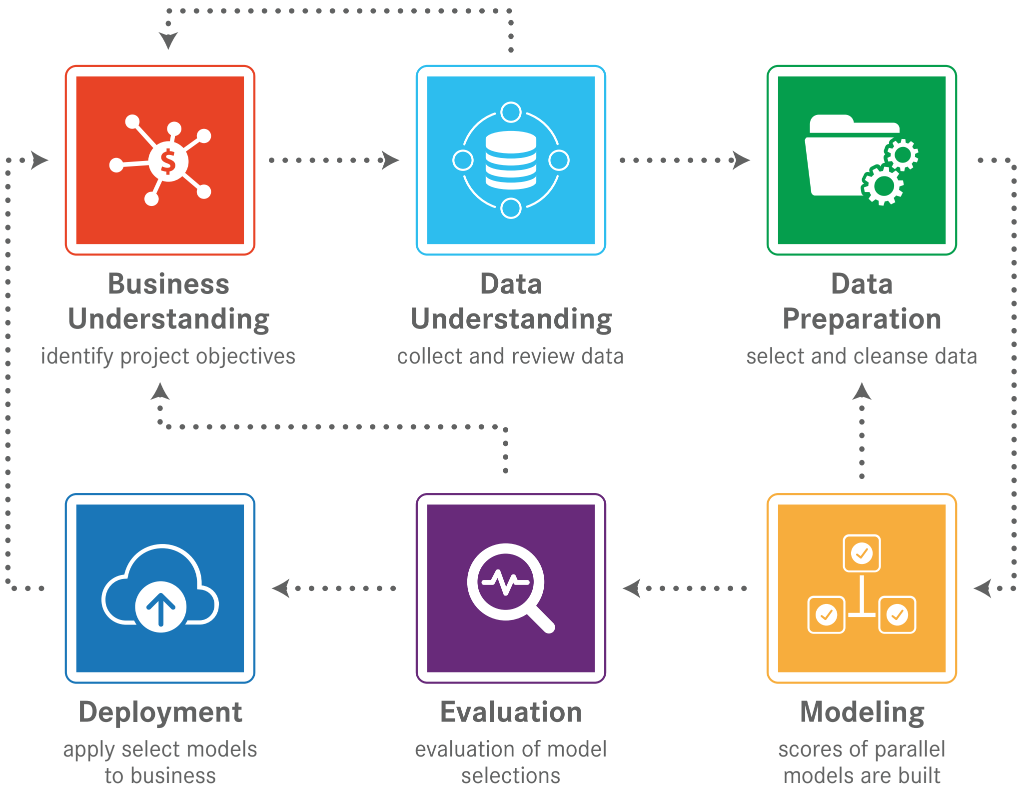

Figure: The phases of the CRISP-DM reference model

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Moving back and forth between the different phases is always required. The outcome of each phase determines which phase, or particular task of a phase, has to be performed next. The arrows indicate the most important and frequent dependencies between phases.

The implementation of this project was completed in 6 months. Thus, machine learning techniques were used to identify assets based on their connectivity. Algorithms developed by dAlchemy's data analytics team helped the client to be able to solve complex plug load analysis issues.

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