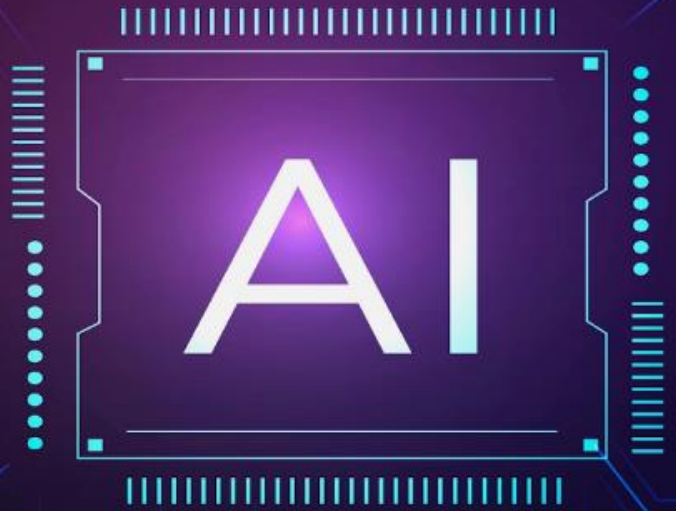
SHYENA TECH YARNS

A Data Science Company



Case Study

Synthetic Data Generation for Energy Optimization Platform

www.shyenatechyarns.com

About the Client

The Client is a Leading Player in Consumer Electric Goods based in Taiwan

Business Problem

Our client, a prominent leader in the Consumer Electric industry, aspired to revolutionize the way energy is optimized in Smart Homes. To achieve this, they aimed to build a comprehensive Energy Optimization platform that harnesses sensor data from various sources. However, a significant challenge emerged – the availability of limited real-world sensor data in time series form. The success of the platform hinged on accurate data fusion techniques that could incorporate redundant data from sensors such as temperature, pressure, occupancy, humidity, and weather data.

Solution

Recognizing the importance of robust data fusion for accurate energy optimization, our team embarked on a mission to create a solution that would overcome the data scarcity hurdle. We devised a multi-pronged approach that leveraged both generative AI models and physics-based simulations.

Our first strategy involved using generative time series models like Variational Autoencoders (VAEs) and Long Short-Term Memory networks (LSTMs). These models excel in capturing temporal patterns and generating sequences of sensor data that emulate real-world sensor interactions. By training the VAEs and LSTMs on the limited available data, we were able to generate synthetic sensor data that could mimic the behaviors and characteristics of real sensors.

Complementing this approach, we turned to the powerful Physics-Based Simulator EnergyPlus. This sophisticated simulator models the intricate dynamics of energy systems in buildings. By configuring EnergyPlus to simulate the interactions between temperature, pressure, occupancy, humidity, and weather, we generated synthetic sensor data that adhered to the fundamental principles of energy consumption and optimization.

Outcome

The outcomes of our innovative approach were transformative. By using generative time series models and the physics-based simulator, we successfully generated synthetic sensor data that closely resembled real-world sensor interactions. This synthetic data was rich in temporal patterns and sensor correlations, essential for accurate data fusion.

Armed with this synthetic sensor data, we developed advanced data fusion models that seamlessly integrated redundant sensor inputs. These models combined the VAEs and LSTMs' ability to capture temporal dependencies with the accuracy of the physics-based simulation data. As a result, the data fusion techniques achieved precise energy optimization that otherwise wouldn't have been possible due to limited real-world data.

This breakthrough laid the foundation for the creation of the Energy Optimization platform for Smart Homes. The fusion of synthetic and real data enabled accurate predictions and effective energy management, elevating consumer experience and reducing energy consumption.

In conclusion, our innovative approach of generating synthetic sensor data through generative time series models and physics-based simulation provided a remedy for the data scarcity challenge. By enabling accurate data fusion, we empowered our client to realize their vision of an advanced Energy Optimization platform that ushers in a new era of energy-efficient Smart Homes.

Technology Used

Variational Autoencoders (VAEs), Long Short-Term Memory networks (LSTMs), Physics-Based Simulator EnergyPlus & Python

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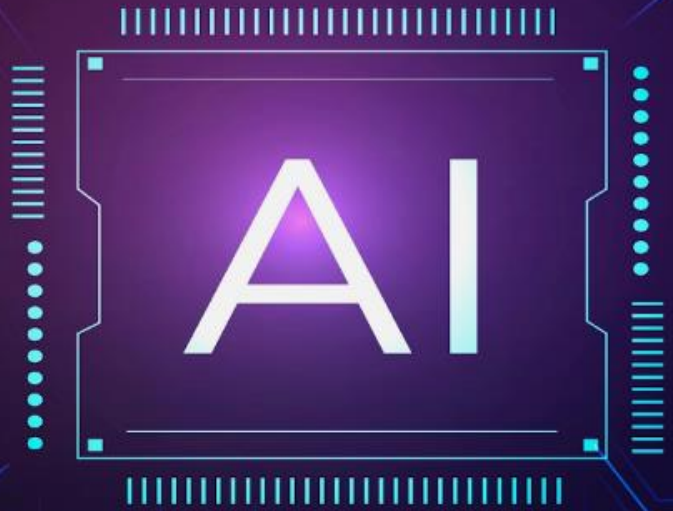

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