MEASURE OF ENERGY CONSUMPTION USING AI

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import energyusage

# user function to be evaluated

def recursive\_fib(n):

if (n <= 2): return 1

else: return recursive\_fib(n-1) + recursive\_fib(n-2)

energyusage.evaluate(recursive\_fib, 40, pdf=True)

# returns 102,334,155

It will return the value of your function, while also printing out the energy usage report on the

command line. Optional keyword arguments:

pdf(default = False): generates a PDF report, alongside the command-line utility

powerLoss (default = 0.8): accounts for PSU loss, can be set by user if known for higher accuracy

of results

energyOutput (default = False): prints amount of energy used by the process and time taken. The

order is time, energy used, return of function

printToScreen (default = True): controls whether there is a terminal printout of the package running

energyOutput (default = False): determines whether the energy used and time taken are output.

When set to true the order is time used, energy used, return value of function.

locations (default = ["Mongolia", "Iceland", "Switzerland"]): allows selecting the countries in the

emissions comparison section for the terminal printout and pdf. These can be set to the name of

any country or US state.

year (default = 2016): controls the year for the data. Default is 2016 as that is currently the most

recent year of data from both of our sources. Note that only this year of data is included in the

package installation but more can be added in a process described later.With a connected site,

energy systems can be managed and orchestrated to prioritize or engage particular power sources

or actions, reducing operational expenses. For example, AI-powered applications can tell the

power systems to switch to using the batteries during times when tariffs are higher (peak load

shifting), or when the grid power usage reaches a certain power grid alternating current limit (AC

limit).With advanced network design and optimization services, AI is already making a big impact

on energy performance in hardware and software. When it comes to network design, the

functionalities are centered on planning – using different AI models to give communication

service providers (CSPs) a deeper understanding of the network and its users, enabling them to

build with precision. Every network and site is unique, so it’s important for energy-efficient

solutions (such as Ericsson’s 5G radio access network (RAN) portfolio) to provide a wide range of

products adapted to each radio site’s needs.

CSPs want to deploy sites – and services – where the customer demand is. With AI insights, they

can identify which locations 5G sites, new carrier additions or other resources should be deployed,

so they can be used where they will be most efficient.

Network optimization services, however, represent the area with the biggest impact. As we

described in a recent Ericsson Technology Review article on AI and ensuring energy-efficient

networks, AI predictions – coupled with energy-saving functionalities – can make vital decisions

based on the network’s needs. They can decide what resources will be needed in the coming hours

and if all the capacity in the frequency bands within the Radio Access Network (RAN) will be

needed during that time. They can then dynamically turn off or on different frequency bands or

resources according to upcoming demand, saving energy when demand is low.

Artificial intelligence (AI) and energy-saving features can help CSPs reduce energy consumption

and operating costs. Here we explore the benefits of AI for sustainable networks – and why

connecting all site equipment to the management system is key for energy efficiency and

unlocking new revenues.

Most of the companies try to reduce energy consumption and costs by implementing various

energy conservation measures. This is important for two main goals: (1) decreasing costs and (2)

reducing carbon emission for the planet.

In order to save energy, energy data should be analyzed comprehensively, and actions should be

taken in light of the insights from the analyzed data. However, basic statistical techniques have

become insufficient to analyze energy consumption and to give meaningful insights. Hopefully,

there are state-of-art applications or more complex techniques such as Machine Learning and

Artificial Intelligence methods. Machine Learning is a branch of Artificial Intelligence (AI) focused

on building an application that learns from data and improves its accuracy over time without being

programmed to do so.[1] That means AI learns from data by analyzing it and therefore does not

need a human to give insights.

Recent studies have shown that AI and ML can be used in different domains with different kinds of

datasets. One of the applications of machine learning is forecasting which is basically predicting

future values. In light of these studies, predicting the energy consumption of the future is possible

and could be very useful for energy savings and budgeting. So the question here would be “How

can we use AI for forecasting energy consumption?”

AI in Forecasting Energy Consumption

The energy consumption data is gathered in different time intervals and these data are called as

time-series data. Since the AI learns from data, it is very crucial to collect data in a healthy way.

Therefore, the data should be cleaned and transformed to desired datasets properly for training

the AI model to forecast energy consumption precisely. Then, energy data is preprocessed, models

are evaluated again and again, selected model are trained and the forecasting results are

visualized.

The energy consumption of buildings and facilities commonly consists of periodic consumption

behaviors, trends and patterns. Analyzing these consumption data with these pieces allows

forecasting future energy consumption information. At that point, ML algorithms help to analyze

historical data and develop forecasting applications.

Machine Learning algorithms and frameworks become significantly important to extract

knowledge and insights into the energy industry. Plenty of tasks and techniques developed and

studied due to that purpose and one of those is time series forecasting. Time series forecasting is

an approximation task which is aiming to estimate future values of observations based on current

and past values of the sequence and developing a model describing the underlying relationship.

There is a lot of research and different methods and techniques about time series forecasting. The

methods are based on analyzing the time series data to develop a model describing the

relationship between past and current data. There are Machine Learning techniques such as

Autoregressive Integrated Moving Average (ARIMA) and Artificial Neural Networks (ANN) which

are two of the several techniques in forecasting tasks.

Artificial Neural Networks (ANN) that are suitable for building data-driven models, can handle

nonlinear relationships in the energy consumption dataset. ANN algorithms are very popular over

the last decades. There is a lot of research about the usage of ANN as a time series forecasting

technique and there are also ANN algorithms such as Recurrent Neural Networks (RNN) and LongShort Term Memory networks (LSTM) as time series forecasting techniques.

How Forecasting Creates Value?

As Faradai, we are developing SaaS products for energy management. Faradai Platform has

various modules to analyze energy usage or energy production, and Energy Consumption

Forecasting is one of these tools.

Forecasting is crucial for energy managers to track the success of energy conservation projects

and to calculate the feasibility of energy saving investments. It is also important for energy budget

managers to prepare highly accurate budgets for the next quarter or year and to procure costeffective energy tariffs.

Energy consumption forecasting also allows facility or building managers to track energy

consumption trends, forecast future energy consumptions, take actions and reschedule

operations beforehand. Precautions make it possible to decrease energy usage and billing costs.

For example, with machine learning and deep learning techniques, it is possible to forecast future

loads and combine that forecasting results with the dynamic hourly market price. That helps the

technical staff to be aware of the future invoice of each hour and to be able to decide the schedule

of loads and to plan to shut down or shifting of the unnecessary loads to the cost-effective

periods. By estimating the total consumption and shiftable loads of the facility and matching them

with the dynamic tariff, the savings potential is calculated and the facility officials are informed in

advanced through our application.

Besides from economical benefits of energy forecasting, there are obvious advantages from an

environmental point of view. The reduction of energy consumption and carbon emission

represents a crucial goal for a healthy planet. For this purpose, forecasting renewable energy

production with AI is also quite possible.

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