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# 1 Introduction

The world is facing an electricity crisis. The continual increase in electricity consumption requires a corresponding increase in electricity production, and the environment is suffering the consequences. Much of the world’s electricity is generated through burning fossil fuels, an activity which causes environmental problems like global warming through the release of carbon dioxide into the atmosphere. Other methods of electricity generation may not have such a direct effect on the environment, but the negative consequences are still evident: the environmental impact of mining uranium and disposing of nuclear waste for nuclear power and the use of fossil fuels in the manufacturing of solar panels are just two examples (1).

The electricity we generate is valuable, but it is often treated as an inexhaustible resource and little thought is given to how it is consumed leading to inefficiency and waste. In the household, the prediction helps for to maintain the demand and help household consumers decrease their consumption and assist in reducing overall electricity demand and its environmental consequences.

## Background

The average French household consumes about 4760 kWh electricity per year (2). However, your specific energy consumption depends on energy usage and accommodation. Household consumption has increased over the previous decades with the rise in electricity hungry consumer appliances (3) . In the residential sector, consumption is directly related to consumer behavior. The thesis will help the electricity producers in peak demand (4) to ensure that they have enough electricity for a household in its peak demand. It also benefits the consumers to avoid the unnecessary wastage of electricity in a household and to know their consumption before if this implemented in power sectors. Prediction helps to determine how customers can use electricity, and then schedule utilities operations. It's about the potential use. Forecasters are seeking to learn, hourly or weekly. The basis on which customers respond to price, weather, climate change issues and personal economic circumstances (4).

Forecasting is an important problem that spans many fields including business and industry, government, economics, environmental sciences, medicine, social science, politics, and finance. Forecasting problems are often classified as short-term, medium-term, and long-term. Short-term forecasting problems involve predicting events only a few time periods (days, weeks, and months) into the future. Medium-term forecasts extend from 1 to 2 years into the future, and long-term forecasting problems can extend beyond that by many years. In this thesis only short term forecasting is made for an hour and a week. Short- and medium-term forecasts are required for activities that range from operations management to budgeting and selecting new research and development projects. Long-term forecasts impact issues such as strategic planning. Short- and medium-term forecasting is typically based on identifying, modeling, and extrapolating the patterns found in historical data. Because these historical data usually exhibit inertia and do not change dramatically very quickly, statistical methods are very useful for short- and medium-term forecasting. (5)

### Thesis context

The thesis will help the electricity producers in peak demand to ensure that they have enough electricity for a household in its peak demand through forecasting. It also benefits the consumers to avoid the unnecessary wastage of electricity in a household and to know their consumption before if this implemented in power sectors. Additionally, Thesis gives a brief overview on time series prediction and LSTM algorithms. The Thesis explains Exploratory data analysis on the dataset to visualize the power consumption data with various patterns.

## 1.2 Problem

The problem considered by this thesis is predicting the average electricity consumption for a household in France. Studies have found that as the forecasting time increases, the data become more structured and hard to solve with simple machine learning algorithms, and accuracy will be less. This thesis is an inquiry into how a selection is made on Machine learning algorithms work on time series data set. Especially, the thesis deals with the following questions:

* How to analyze and visualize the power consumption data?
* How to build forecast models for small time steps for an hour and a week using LSTM?
* What are the advantages and disadvantages of the prediction model?
* How does this Prediction benefit in the Power sector?

Additionally, this thesis intends to provide a general compare of ARIMA model over LSTM for time series prediction and where to use these for the better prediction results.

## 1.3 Purpose

The purpose of the thesis is to present a theoretical and practical investigation into the use of LSTM Machine learning method for forecasting the average electricity consumption for a household. The purpose of this work is to determine how effective is the prediction and to evaluate how beneficial it is. These approaches are in the forecasting model to inform the implementation of the method is shown in section 1.1.1.

## 1.4 Motivation

The motivation of the thesis will help the electricity producers in peak demand to ensure that they have enough electricity for a household in its peak demand (4). It also benefits the consumers to avoid the unnecessary wastage of electricity in a household and to know their consumption before. if this implemented in power sectors. It also describes the overview of Machine learning and exploring dataset and their features briefly and how do we make use of this dataset to visualize the power consumption using Exploratory data analysis and for the prediction through LSTM model.

### 1.4.1 Benefits and sustainability

This Thesis offers a theoretical strategy for implementing the knowledge of machine learning in the electricity sector to have sufficient electricity for the benefit of their electric power forecasting. This is going to help Consumers, by helping them minimize their costs and the environment through reduced consumption of electricity.

Secondarily, the method will enable other researchers working in the electricity sector. Predicted consumption for a household and small numbers of households by providing evaluation of the efficiency of a range of unique algorithms and theoretical Information on the implementation of the algorithms.

This thesis uses a data set containing several readings of the power, voltage, intensity and sub metering readings for electricity consumption for 4 years in a household. This research is carried out using a fixed data set from a single point in time, but for thesis purposes. This will stay relevant and applicable for a prolonged period of time. The characteristics of electricity consumptions and the patterns of consumption for a household are unlikely to change over the coming decades, except for an increasing trend which changes too slowly to alter the results of this research.

## 1.5 Research Methodology

The prediction of electricity consumption includes the analysis and use of quantitative data Sets and evaluation of the precision of the prediction are based on quantitative error measures, and so on The methodologies used in this work are primarily quantitative.

The thesis approach would be experimental, since it focuses on cause and effect, and relationship and causality between dependent and independent variables in the dataset. The thesis time horizon will be cross-sectional, meaning that it is the study of electricity consumption at a particular point in time. Finally, the thesis techniques and procedures will come from field of machine learning.

The work presented by this thesis is an evaluation of the effectiveness of a selection of supervised machine learning method at predicting the hourly electricity consumption of a household in France. The work of this thesis demonstrates that Recurrent Neural network (LSTM) is the most accurate method within the constraints of the problem considered (6). In addition to accuracy, the advantages and disadvantages of different deep learning machine learning method are explained. and a simple comparison of the same model is considered for predicting power for a hour and a week is made and to verify the model whether it fits for predicting accurately for different times, and it gives a brief overview of the power consumption in France for the seasons and residential sectors.

## 1.6 Outline

Chapter 2 will present the theoretical background of machine learning and the methods used, some theoretical considerations specific to time series data, and the extant research related to electricity consumption forecasting. Chapter 3 will provide a description and explanatory analysis of the data set used and visualizations, and a description of the algorithms implemented for the experimental section. Chapter 4 includes the LSTM forecasting model and the results from the experiments along with a discussion of the results. Chapter 5 presents the conclusions of this work and some future direction.

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