Hertie School

Master of Data Science for Public Policy

Deep Learning - Assignment 3 - Tutorial Proposal - Group 4

Date: 16.11.2023

Instructors: Prof. Lynn Kaack & T.A. Chiara Fusar Bassini

1 Tentative tutorial title

"Understanding Household Energy Consumption: A Deep Learning Approach"

2 Names of all group members

- Alvaro Guijarro May - Matriculation number: 226883
- Augusto Fonseca - Matriculation number: 225984
- Luke Smith - Matriculation number: 224233

3 Description of preferred topic

Our tutorial, titled "Understanding Household Energy Consumption: A Deep Learning Approach," aims to apply sequence modeling techniques to analyze and predict household electric power consumption. We plan to use the "Individual Household Electric Power Consumption" dataset from the UCI Machine Learning Repository, which includes diverse measures of electricity usage in a household over four years. The tutorial will focus on employing Recurrent Neural Networks (RNNs), particularly Long Short-Term Memory (LSTM) networks, to understand patterns in energy usage and forecast future consumption. This involves guiding users through data preprocessing, model building, training, and evaluation. We will implement the tutorial in Python using TensorFlow and Keras, presented as an interactive Jupyter Notebook. For developing this tutorial, we'll leverage TensorFlow documentation, research papers on energy consumption forecasting, and online forums for community support.

4 Description of alternative topic

If our primary topic isn't feasible, we propose "Anomaly Detection in Household Energy Consumption Using Autoencoders" as an alternative. This tutorial will concentrate on identifying anomalies in electricity usage, essential for detecting issues like equipment malfunctions or energy wastage. We plan to use autoencoders, a neural network type suitable for time series anomaly detection. The focus will be on learning how to compress and reconstruct input data to identify anomalies. We will use the same dataset but with a different approach, highlighting unexpected patterns in consumption. The implementation will be in Python with TensorFlow and Keras, and the tutorial will be structured as a Jupyter Notebook. Resources will include academic papers on anomaly detection in time series data and online community forums.

5 Optional comments

Our choice of topics is driven by a keen interest in demonstrating the practical applications of deep learning. In our primary topic, "Understanding Household Energy Consumption," we aim to showcase how sequence modeling, specifically using LSTM networks, can be applied to a critical real-world issue like energy efficiency. This approach not only provides insights into deep learning's capabilities in handling time series data but also addresses global concerns about sustainable energy use. By analyzing and predicting household energy patterns, we can contribute to smarter energy management solutions, which are vital in the context of environmental conservation and reducing carbon footprints.

Similarly, our alternative topic, "Anomaly Detection in Household Energy Consumption," highlights the application of autoencoders, a form of unsupervised learning, in identifying irregularities in energy consumption data. This topic is crucial from both a safety and efficiency standpoint, as it can help in the early detection of system malfunctions or unusual usage patterns, leading to timely interventions.

Both topics are not only academically enriching, offering a deep dive into different facets of deep learning, but also socially relevant, underscoring the technology's potential in everyday life applications. We believe these tutorials will enable our classmates to appreciate the intersection of deep learning techniques with real-world scenarios, motivating them to apply these skills in areas that have a tangible impact on society and the environment.