Assignment 1: Predicting Power Load Using Deep Learning and GPT

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Background

Public power load datasets can help us better understand the relationship between load and meteorological factors, providing decision-making support for energy management and optimization.

Task

Select an appropriate deep learning models to predict time series data based on the given data. The assignment submission should include:

- Dataset

- Model design parameters

- Model hyperparameters

- Evaluation metrics and performance analysis

- Research repot

Use Python and the PyTorch framework to implement the model.

Public Power Load Datasets

1. The public dataset from the Intelligent Energy Systems (IES) at Arizona State University, Tempe campus. The dataset includes load data (electric, cooling, and heating loads) and meteorological data (temperature, pressure, wind intensity, dew point temperature, cloud cover, wind direction, and humidity).

2. The public power load forecasting dataset. Available: [Power Load Forecasting Dataset](https://mp.weixin.qq.com/s/Oy38thKwmC13kUhw6qDa9w)

Data Preprocessing

- Split the dataset into training and testing sets.

- Normalize and standardize the data to facilitate model training and evaluation.

Model Construction

Design a deep learning model with meteorological data as input and load data as output. Typically, machine learning models for load forecasting use supervised learning to predict the nonlinear relationship between historical load data and predicted values. Common machine learning models include:

- Regression Tree (RT)
- Support Vector Regression (SVR)
- Extreme Gradient Boosting (XGBoost)
- Light Gradient Boosting Machine (LightGBM)
- Multilayer Perceptron (MLP)
- Long Short-Term Memory (LSTM)
- Gated Recurrent Unit (GRU)
- Transformer Neural Network (TNN)
- Convolutional Neural Network (CNN)
- Recurrent Neural Network (RNN)
- Graph Neural Network (GNN)
- GPT model

Choose an appropriate model based on the data features.

Model Training

Train the model using the training set, adjust model parameters, and optimize the model's performance. The model can be trained using backpropagation and gradient descent methods.

Model Evaluation

Evaluate the model's predictive ability using the test set.

Results Analysis

Analyze the model's predictions and compare the influence of different meteorological factors on the load data. Based on the analysis results, propose methods to improve the model structure and parameters to enhance the model's predictive accuracy and stability.

Conclusion

Summarize the experiences and insights gained from this assignment, discuss the application prospects of deep learning models in load forecasting, and propose directions for further research.

This assignment expects students to grasp the basic principles and application methods of deep learning while developing their data analysis and model construction skills. Additionally, by studying the relationship between load data and meteorological data, students can gain a deeper understanding of the practical applications in energy management and optimization.