Temporal Ensemble Learning of Univariate Methods for Short Term Load Forecasting in Smart Grids

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Introduction
- Accurate short term load forecasting (STLF) essential for facilitating demand response programs
- Predict following 1 hour load given history
- Existing work have shown simpler models work better than neural networks for STLF under 6 hours horizon
- We propose using an ensemble of models by partitioning the dataset temporally to improve existing models

Experiments
- We evaluate the models based on a 5 month dataset of 50k aggregated user load in LA
- We test the ensemble method on:
  - Kernel Regression (KR)
  - Support Vector Regression (SVR)
  - Multi-layer Perceptron (MLP)
  - Recurrent Neural Network (RNN)
- Evaluation measures:
  - Mean Average Percentage Error (MAPE)
  - Root Mean Squared Error (RMSE)

<table>
<thead>
<tr>
<th>Ensemble</th>
<th>MAPE(%)</th>
<th>RMSE</th>
<th>MAPE(%)</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>KR</td>
<td>1.03</td>
<td>124.41</td>
<td>1.16</td>
<td>158.13</td>
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<td>SVR</td>
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<td>126.41</td>
<td>1.50</td>
<td>186.97</td>
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<td>MLP</td>
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<td>1.56</td>
<td>181.10</td>
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<td>RNN</td>
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<td>266.75</td>
<td>1.56</td>
<td>200.54</td>
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</tbody>
</table>

Model
- Exploit regularity in data’s daily patterns
- Instead of one model, train specialized models for specific time of day
- Combine results of models by ridge regression to ensure most models are taken into account for the final output

Discussion
- 21.3% and 11.2% improvement in RMSE and MAPE respectively by using ensemble over single model for KR
- Partitioning the problem by day of time simplified it so that KR and SVR can better model the load

Future Work
- Extend prediction horizon
- Extend the model for prediction of individual users
- Use of mixture models for user profiling should be done to cluster users with similar consumption patterns