Objective
Rossmann Drug Stores is hosting a Data Science Competition on Kaggle with the goal of predicting sales based on several store features.

Features:
- Date
- Day of Week
- Store Age
- Store Type
- Promotions
- Past Sales
- Etc.

Predict Sales:
Min. Residual Mean Square % Error:
\[
RMSPE = \sqrt{\frac{1}{n} \sum_{i=1}^{n} \left( \frac{y_i - \hat{y}_i}{y_i} \right)^2}
\]

Results

<table>
<thead>
<tr>
<th>Model</th>
<th>RMSPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF</td>
<td>11.98%</td>
</tr>
<tr>
<td>HMM</td>
<td>16.52%</td>
</tr>
<tr>
<td>RNN</td>
<td>13.20%</td>
</tr>
<tr>
<td>GB</td>
<td>11.26%</td>
</tr>
</tbody>
</table>

Model #1: Random Forest Regression
Random Forest Regression is an ensemble learning algorithm that operates by aggregating many random decision trees to make predictions while avoiding overfitting. We started by using the Random Forest algorithm because its bagging techniques are robust to data abnormalities and because random forest packages are widely available.

Model #2: Hidden Markov Model
Hidden Markov Modeling is a sequence / state estimation model that assumes that the dataset derives from a Markov Process with hidden state information. Hidden Markov Models are appropriate for this dataset since its data evolves over time, a phenomenon unaccounted for in ensemble learning.

Model #3: Recurrent Neural Network Regression
Recurrent Neural Networks work similarly to Neural Networks with the addition of feedback loops. The internal recursive states allow this kind of neural network to exhibit dynamic temporal behavior, making it appropriate for processing time series data.

Model #4: Gradient Boosting Regression
Gradient Boosting is an ensemble learning algorithm that uses a weighted average of simple models to learn a more complex model. The algorithm first uses a simple model to fit the data, then a simple model to fit the residuals between the data and the first model. This process continues on each model's residuals until an appropriate fit is found.