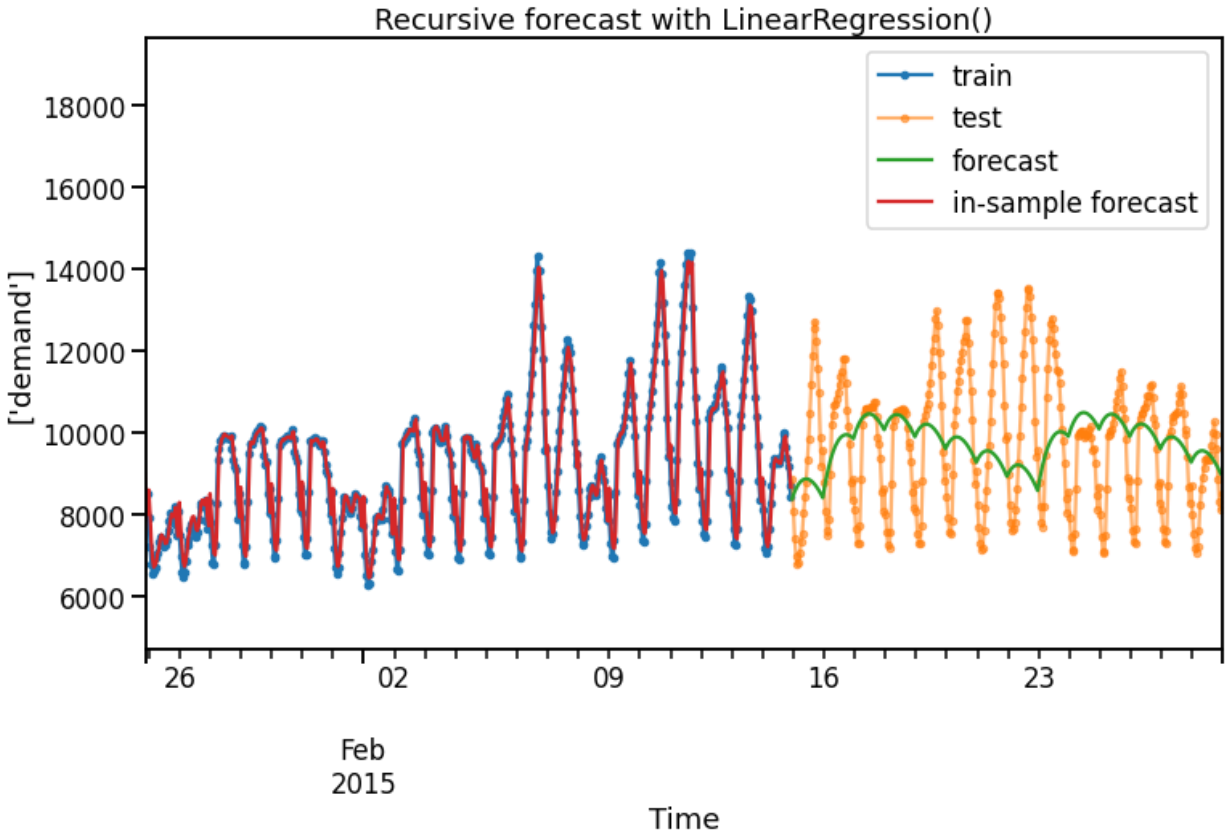
Why do linear models struggle with datetime features?

Seasonality features

Example: Electricity demand



Features

- Trend feature: t,
- Lag of 1 hour: y_{t-1}
- **Hour of day**
- **Day of week**
- **Month of the year**

Model

- Linear regression

Why do linear models struggle with datetime features?

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Hour of day	Day of week	Month of year
1	2	2
2	2	2
3	2	2
4	2	2

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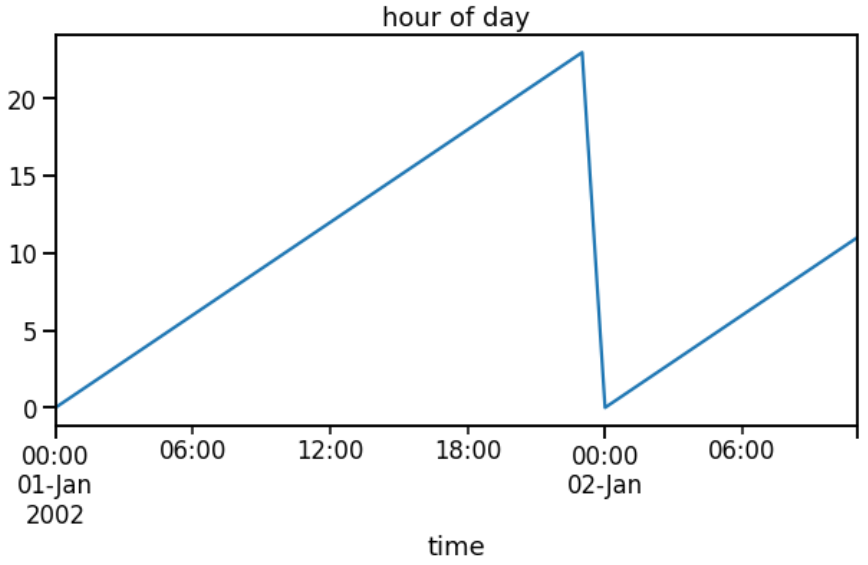

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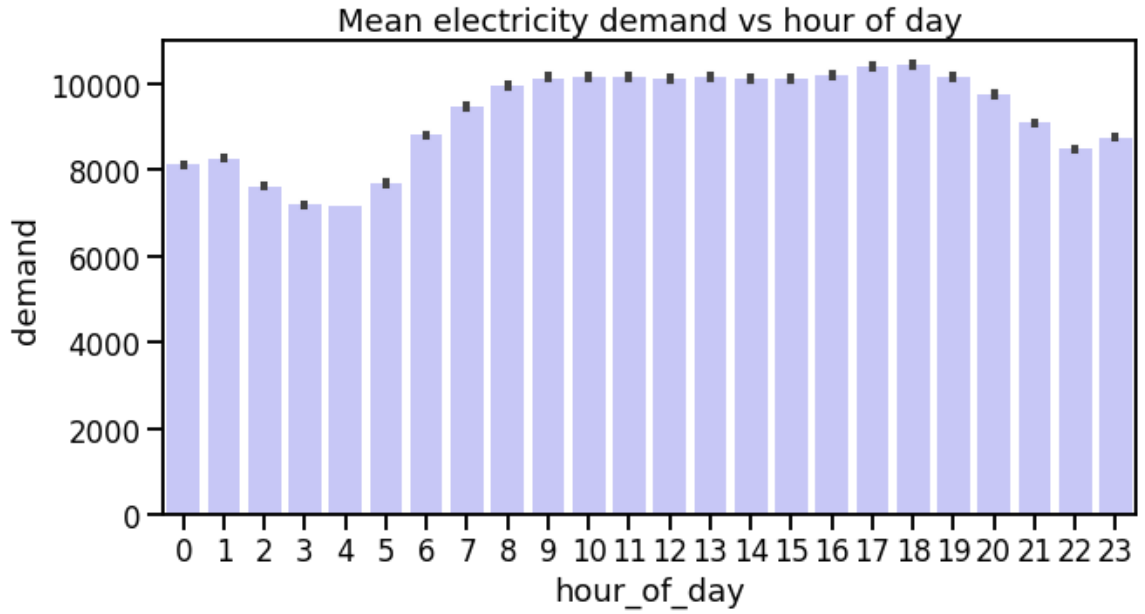

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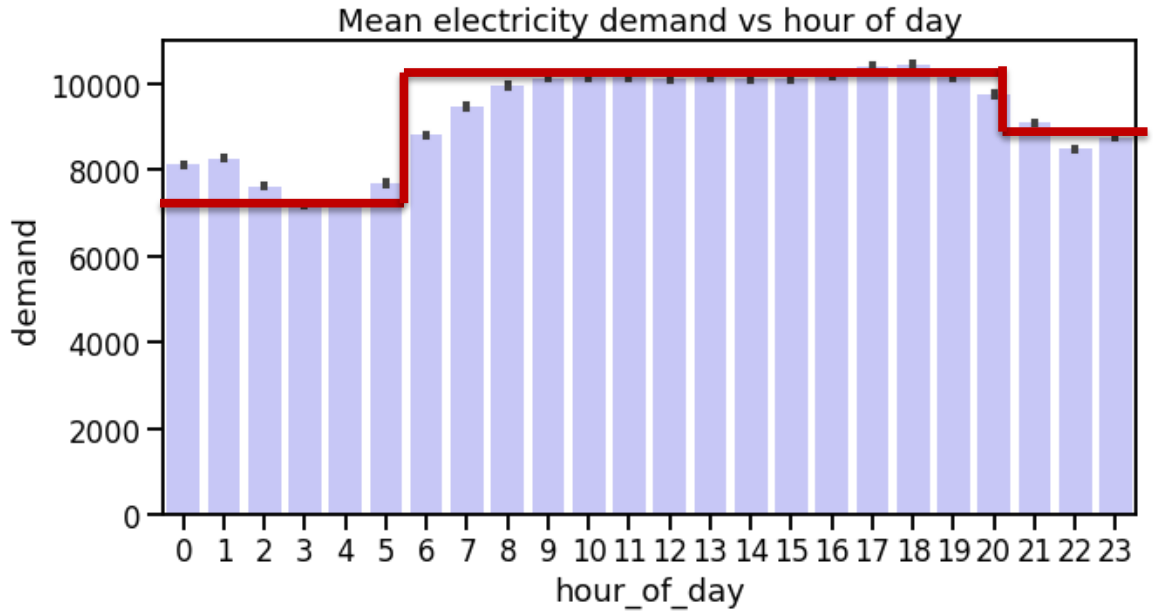

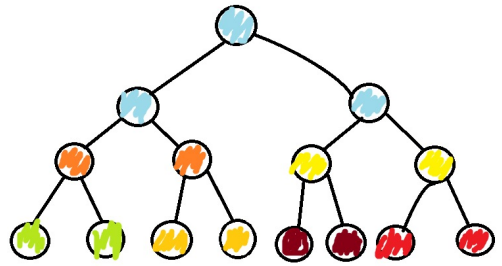

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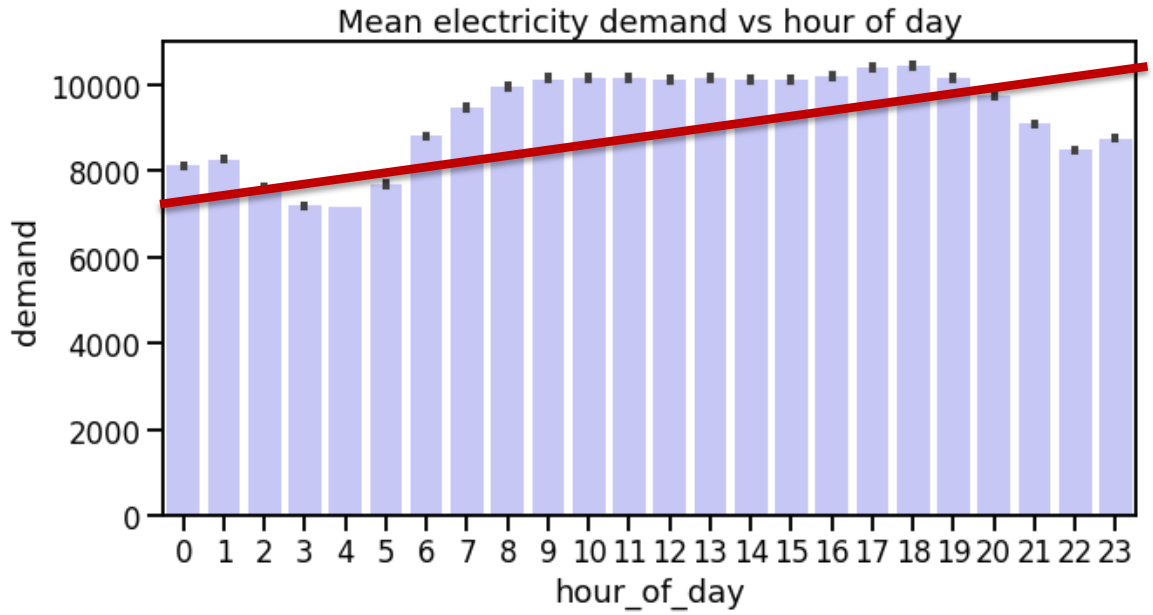

$$y = \beta_0 + \beta_1 hour\_of\_day + \beta_2 x_2 + \cdots$$

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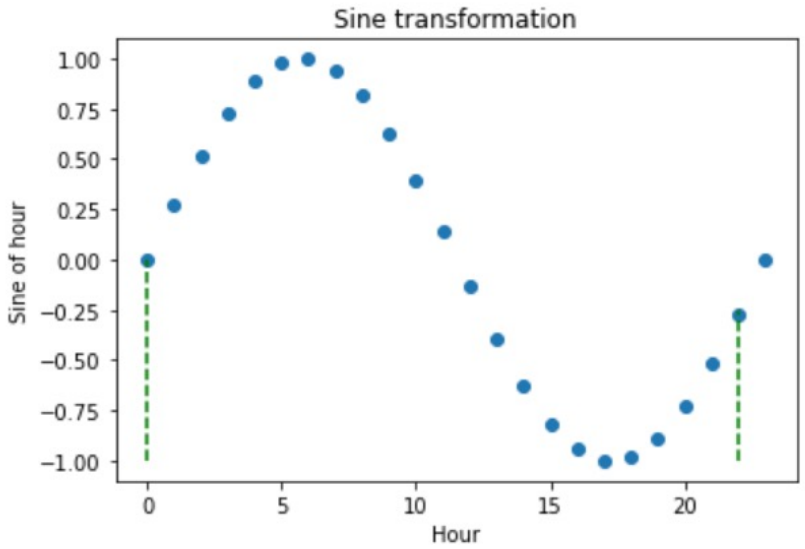
- Linear models are constrained to fit a linear relationship between the target and features.
- Additional feature engineering can help linear models better use date & time variables!

Cyclical features:



Treat datetime features as a categorical variable and use:

- **One hot encoding (seasonal dummies)**
- **Target encoding**

Summary

Using features directly from the date and time can help capture multiple seasonalities.

Easy to compute and works well with tree-based models.

Does not work well with linear models.