

## MOTIVATION



Minimize Financial Loss

Contribute the stability of  
Turkish Electricity Market

## CURRENT SYSTEM



In KEPSAŞ, hourly electricity consumption forecast is done in intuitional way. The company does not have any systematical way of forecasting.

## METHODOLOGY

APPROACH 1 :

Deep Neural Networks  
and Python Programming  
LanguageData set feature columns: Days, months,  
hours, special holidays, weather variables  
and past values of consumption

## METHODOLOGY

APPROACH 2 :

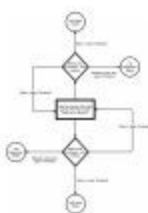


Figure 1: Regression by Classification Splitting Decision Scheme

7 final subclasses are built and there are 13 different ML models integrated. Classifications in this methodology are done via Random Forest, and regressions are done via MLP (Multi-Layer Perceptron).

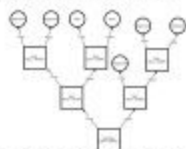


Figure 2: Flow Chart of the Dataset in the Case Study

## RESULTS

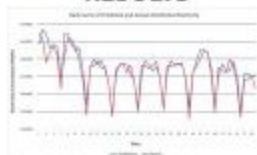


Figure 3: Predicted and Actual Electricity Distribution Forecasts

Table 1: Daily SMPE Comparison with the Forecasts of the Company

Day	Actual (MWh)	SMPE (MWh)	Relative
Monday	2,314	0,26	0
Tuesday	2,24	1,4	1
Wednesday	2,40	0,31	0
Thursday	2,25	1,4	1
Friday	2,27	1,25	1
Saturday	2,41	1,4	1
Sunday	2,40	2,81	1

Table 2: Hourly SMPE Comparison with the Forecasts of the Company

Hour	Actual (MWh)	SMPE (MWh)	Relative	Actual (MWh)	SMPE (MWh)	Relative
1	2,80	0,0	0	2,80	0,00	0
2	2,81	0,0	0	2,81	0,00	0
3	2,82	0,0	0	2,82	0,00	0
4	2,83	0,0	0	2,83	0,00	0
5	2,84	0,0	0	2,84	0,00	0
6	2,85	0,0	0	2,85	0,00	0
7	2,86	0,0	0	2,86	0,00	0
8	2,87	0,0	0	2,87	0,00	0
9	2,88	0,0	0	2,88	0,00	0
10	2,89	0,0	0	2,89	0,00	0
11	2,90	0,0	0	2,90	0,00	0
12	2,91	0,0	0	2,91	0,00	0
13	2,92	0,0	0	2,92	0,00	0
14	2,93	0,0	0	2,93	0,00	0
15	2,94	0,0	0	2,94	0,00	0
16	2,95	0,0	0	2,95	0,00	0
17	2,96	0,0	0	2,96	0,00	0
18	2,97	0,0	0	2,97	0,00	0
19	2,98	0,0	0	2,98	0,00	0
20	2,99	0,0	0	2,99	0,00	0
21	3,00	0,0	0	3,00	0,00	0

1

The pattern of electricity consumption depends on many different parameters such as seasons, hours, weekdays, holidays, temperature and etc. Due to complexity of the forecast, the experience based forecasting method is not sustainable. The company needs systematic forecasting method.

2

KEPSAŞ does not have any study related to electricity prices and they just operate in intra day market according to their personal experience. In order to operate in intra day market more actively, the company needs to forecast electricity prices.

## PROBLEM DEFINITION

## MOTIVATION



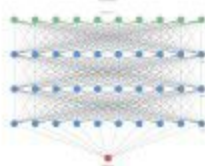
To compensate the error made in the day ahead market, the companies should be actively participate the intra day market. When they operate in that market, they need to forecast system marginal prices to make lucrative transactions.

## CURRENT SYSTEM



Due to various factors affecting electricity prices, it is very hard to make an accurate price forecast. Electricity companies need to forecast the prices in order to compensate the forecast error made in day ahead market. However, KEPSAŞ does not have any price forecasting system yet.

## METHODOLOGY



Differently from the consumption dataset, price dataset mainly focuses on past values of the price, as SMF value depends on the PTF price and electricity consumption values. Deep Neural Networks were used.

Table 3: Hyperparameters of the Model for Price Forecasting

Hyperparameter	Value
Epoch Number	1, 2, 3, 4, 5
Layer Numbers	128, 256, 512, 1024, 2048
Split Method	70, 20, 10, 10%
Batch Size	32, 128, 256
Advanced Gradient Descent	Ada, RMS, Adam
Optimizer Type	Adam, AdamW

## RESULTS

Table 4: SMPE of Hourly Price Forecasts

Hour	Range	Minimum	Maximum
1	18,00%	3,20%	121,00%
2	18,00%	3,20%	121,00%
3	18,00%	3,20%	121,00%
4	18,00%	3,20%	121,00%
5	18,00%	3,20%	121,00%
6	18,00%	3,20%	121,00%
7	18,00%	3,20%	121,00%
8	18,00%	3,20%	121,00%
9	18,00%	3,20%	121,00%
10	18,00%	3,20%	121,00%
11	18,00%	3,20%	121,00%
12	18,00%	3,20%	121,00%
13	18,00%	3,20%	121,00%
14	18,00%	3,20%	121,00%
15	18,00%	3,20%	121,00%
16	18,00%	3,20%	121,00%
17	18,00%	3,20%	121,00%
18	18,00%	3,20%	121,00%
19	18,00%	3,20%	121,00%
20	18,00%	3,20%	121,00%
21	18,00%	3,20%	121,00%
22	18,00%	3,20%	121,00%
23	18,00%	3,20%	121,00%
24	18,00%	3,20%	121,00%