

Weather Forecasting

ARIMA, Exponential Smoothing and Support Vector Regression
Model

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Introduction

- Weather forecasting is crucial for many industries
- Machine learning has improved forecast accuracy
- More accurate, localized forecasts needed in complex regions
- Project aims to develop tailored ML model for target region
- Data sources include historical weather and satellite imagery
- Goal is to provide accurate forecasts for informed decision making
- Improved forecasts can benefit multiple industries
- Field of Study: Time Series, Machine Learning

Research Problem

- Comparative study of statistical and machine learning models for weather forecasting in Göztepe, İstanbul, Turkey
- 11 years of data (2009-2019) used for developing models based on daily average temperature (dry-wet), air pressure, and wind speed
- ARIMA, Exponential Smoothing, and Support Vector Regression (SVR) models applied and evaluated using different training and test data sets
- Performance evaluated using metrics such as MAE, RMSE, and R2 to compare models
- Machine learning models formulated using different learning methods to analyze reliability for practical weather forecasting

- Previous research used ARIMA and ANFIS models to forecast weather in Istanbul (2000-2008).
- There is limited research on using Exponential Smoothing and Support Vector Regression on more recent data.

Results

Model	Best Parameters	MAE	RMSE	R2
ARIMA	(1,0,0)	3.520	5.225	-0.010
Exponential Smoothing	('add', 'add', 7)	9.304	9.576	-2.39
Support Vector Regression	'C': 10, 'epsilon': 0.1, 'gamma': 0.1	2.000	4.570	0.23

Conclusion

- Support Vector Regression model was the most accurate, with a mean absolute error of 2.000 and an R^2 value of 0.23.
- ARIMA Model better than Exponential Smoothing

In the future work will apply these models:

- Neural Networks (e.g. LSTM, GRU) for time series prediction
- Prophet, a forecasting library developed by Facebook for time series prediction
- Gaussian Processes for time series prediction
- Hybrid models combining multiple techniques (e.g. ARIMA with machine learning models) for improved accuracy.

- 1 Box, G.E.P. and G.M. Jenkins, 1976. Time Series Analysis : Forecasting and Control. Holden Day Inc. San Francisco, CA.