

A Machine Learning Approach to Retail Sales Forecasting Using Localized Weather Features

Weather-driven consumer demand: building explainable machine learning models that adapt to changing local weather conditions for precise sales forecasting

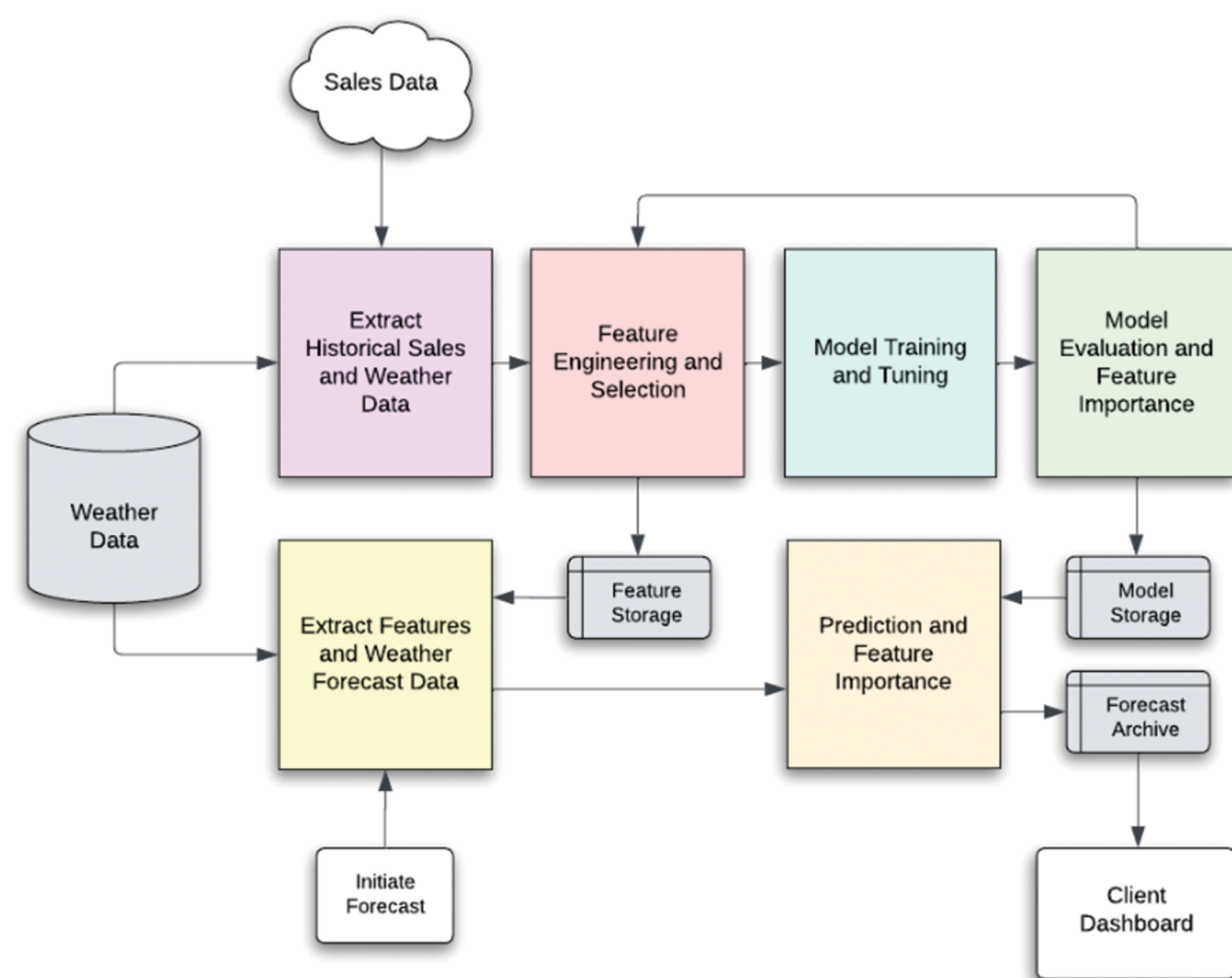
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PROJECT SUMMARY

Weather is an important factor that influences consumer behavior and sales in industries such as restaurants and retailers. Forecasting models that incorporate weather data can help industries to adjust their inventory, staffing, and marketing strategies to optimize sales. The goal of this research is to improve the performance and explainability of existing machine learning models and integrate new insights into the current product, such as hourly-level forecasting. A significant challenge is modeling the complicated ways consumer behaviour changes in response to forecasted weather. By engineering new hourly features, it was found that aggregated and lagged weather features improved model performance and better captured the effect of weather on sales as measured using SHapley Additive exPlanations (SHAP) values. Through experimentation with various time intervals and feature combinations, it was found that a three-hour lag performed better than real-time weather features. Other time series features were built to improve prediction during peak sales hours. The resulting hourly models improved the goodness-of-fit by 5.8% for an average score of 93.4% and reduced forecasting error by 60.6% on average compared to baseline daily forecasting models.

REFERENCES

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