

Forecasting Bitcoin Price Trends: A Multi-Model Sentiment Analysis of Bluesky Discussions

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Abstract

In response to restricted and costly access to X (formerly Twitter), this study evaluates Bluesky, a decentralized platform with a free open API, as an alternative data source for sentiment-informed Bitcoin forecasting; using the Bluesky API and an asynchronous TypeScript-based Node.js scraper we collected and stored 257,019 posts (Jan 1, 2024 to Sep 26, 2025) with full metadata in a SQLite database. After language filtering and blacklist/whitelist moderation, texts were cleaned, tokenized, normalized, and scored using two sentiment pipelines (VADER and FinBERT); scores were aggregated to daily intervals and synchronized with historical Bitcoin OHLCV from a validated Kaggle dataset. For forecasting, we compared a FinBERT-augmented GRU, a classical ARIMA baseline, and a stacking ensemble that combined both; model selection and evaluation employed MAPE, RMSE, and prediction-interval analysis. Findings indicate FinBERT-derived features provided greater predictive value than VADER and were used in the final GRU; while the GRU with FinBERT improved short-term responsiveness to volatility, a well-specified ARIMA baseline achieved the lowest point-forecast error in our experiments (GRU Test MAPE $\approx 5.27\%$ vs. ARIMA $\approx 0.94\%$; ensemble MAPE $\approx 0.97\%$), and ensemble weighting showed heavy reliance on the ARIMA component: evidence that sentiment adds complementary but context-dependent value. We recommend that future researchers (1) expand multi-platform and on-chain features to boost signal; (2) adopt transformer/attention architectures or stronger non-linear meta-learners for ensembles; and (3) use walk-forward validation and economic backtests (simulated trading) to better assess real-world utility.

Keywords: Bluesky API; FinBERT; VADER; GRU; ARIMA; sentiment analysis; Bitcoin forecasting.