

PREDICTION OF GDP AND ENERGY CONSUMPTION USING NTL

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INTRODUCTION

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- 1. Analyze Economic Activity Using Nighttime Lights**
- 2. Understand Energy Consumption Patterns**
- 3. Support Sustainable Development**

PROBLEM STATEMENT

Understanding Economic Growth & Energy Use

- Economic growth and energy consumption are key indicators of a country's progress.
- In Pakistan, studying these factors helps in better planning and policy-making.

Limitations of Traditional Indicators

- Measures like GDP provide a broad view.
- They do not capture regional and time-based variations in economic activity.

USING NIGHT LIGHTS

Traditional economic data (like GDP) takes months or years to collect, but VIIRS nighttime lights provide near real-time updates. This allows for faster economic assessments.

RESEARCH OBJECTIVES ACHIEVED

Utilized regression and time series models to estimate GDP and energy consumption using VIIRS NTL data.

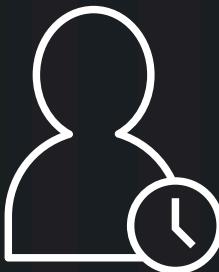
Demonstrated a positive correlation between NTL data and the targeted economic indicators.

Highlighted the potential of remote sensing data in forecasting economic factors, especially in data-scarce environments.

METHODOLOGY

1-DATA SOURCE

- Nighttime Light Data: VIIRS DNB annual composite data (2013–2023) obtained via Google Earth Engine (GEE).
- GDP Data: World Bank Open Data platform.
- Energy Consumption Data: International Energy Agency (IEA) and World Bank.



2-PROCESSING STEPS

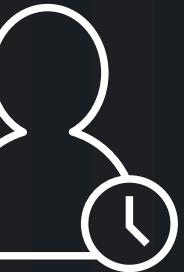
- Standardized country names across datasets.
- Handled missing values by excluding regions with incomplete data.
- Extracted four key band values from NTL data: Median (masked), Average (masked), Minimum, and Maximum.



3-Modeling Techniques:

- Regression Models: Linear Regression, Ridge Regression, Lasso Regression, Random Forest Regressor, XGBoost Regressor
- Time Series Models: SARIMAX, LSTM

METHODOLOGY



4-Feature Engineering:

- Incorporated past values of GDP and energy consumption for time series models.
- Applied log transformation to target variables to address skewness.
- Normalized input features for regression models.



5-Training and Evaluation:

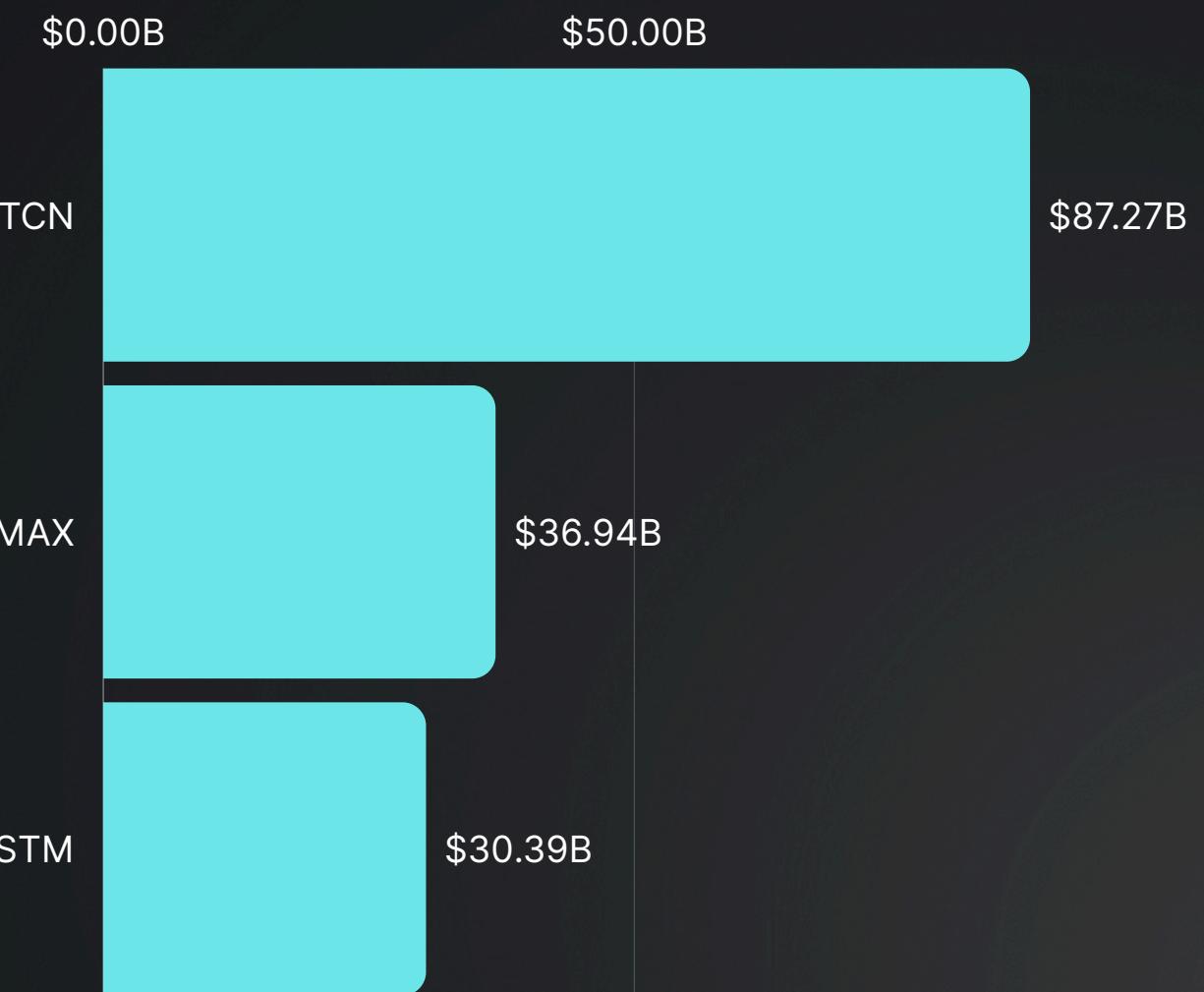
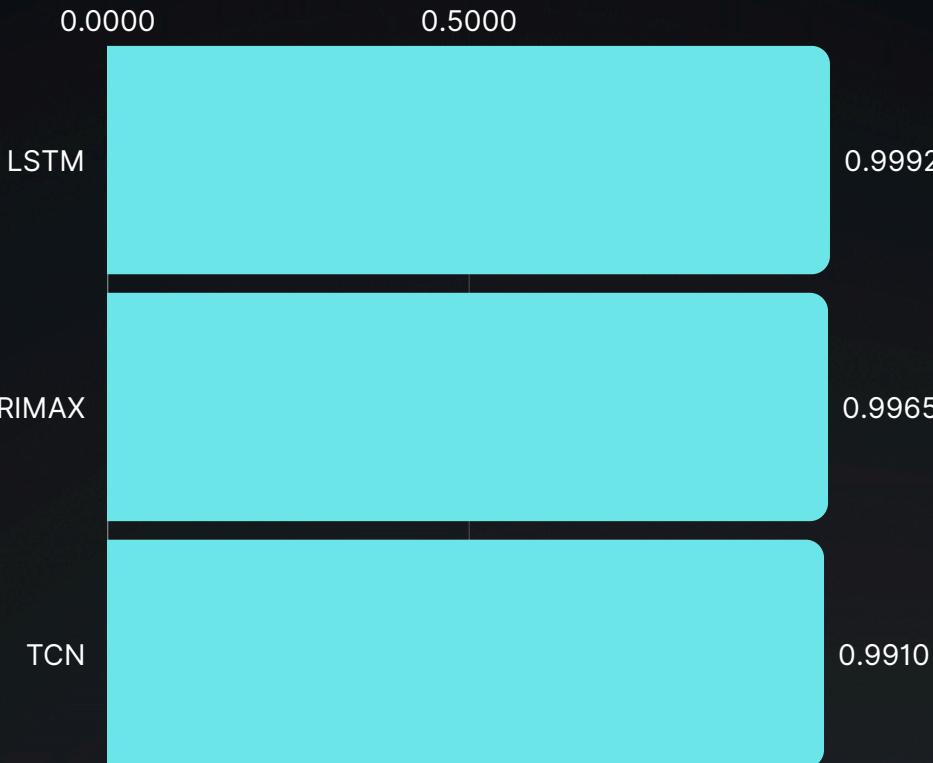
- Data split into 80% training and 20% testing sets.
- Evaluated model performance using R^2 (coefficient of determination) and Mean Absolute Error (MAE).

RESULTS



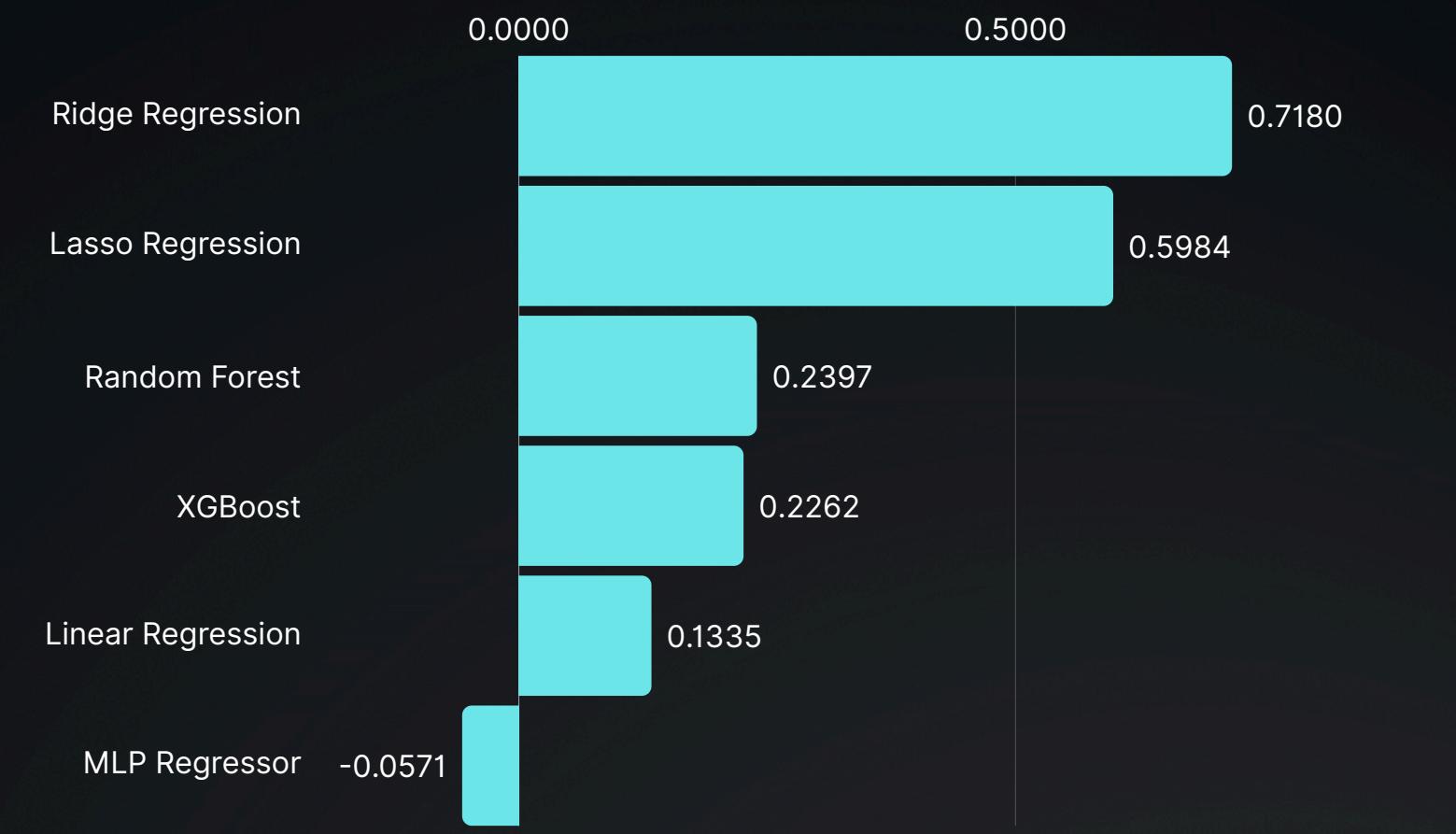
GDP : PREDICTION RESULTS

Model	R ² Score	MAE (in actual GDP units)
LSTM	0.9992	\$30.39B
SARIMAX	0.9965	\$36.94B
TCN	0.991	\$87.27B



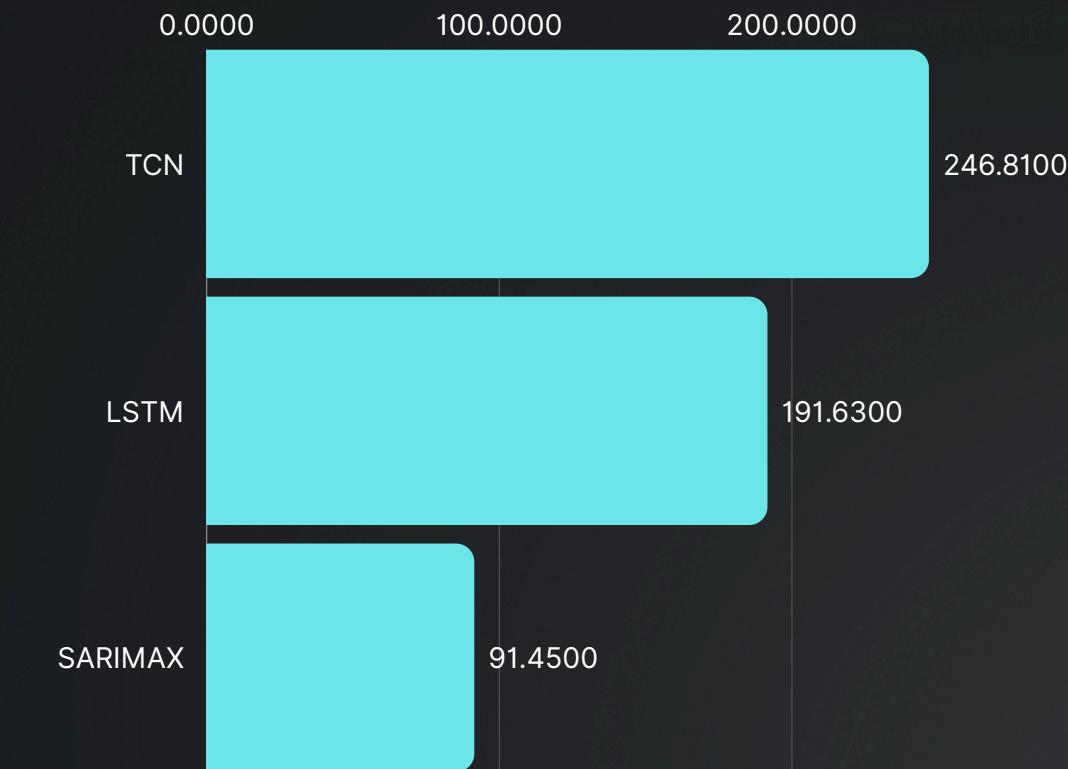
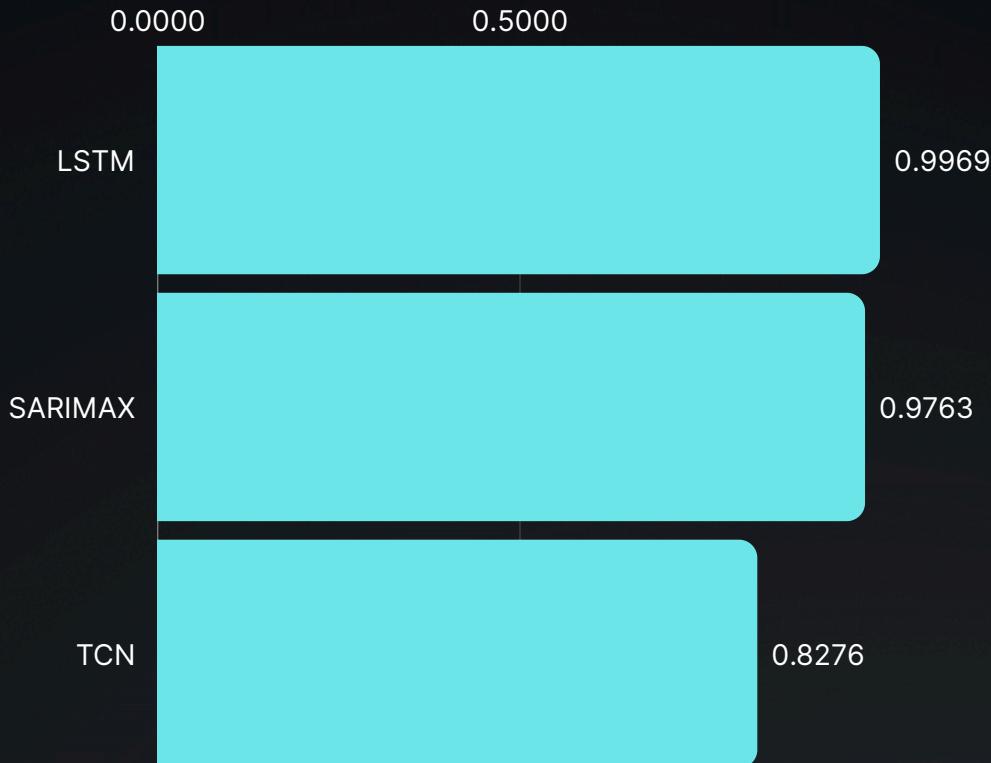
GDP : PREDICTION RESULTS

Model	R ² Score	MAE (in actual GDP units)
Ridge Regression	0.718	\$393.36B
Lasso Regression	0.5984	\$434.39B
Random Forest	0.2397	\$508.22B
XGBoost	0.2262	\$520.39B
Linear Regression	0.1335	\$747.21B
MLP Regressor	-0.0571	\$695.94B



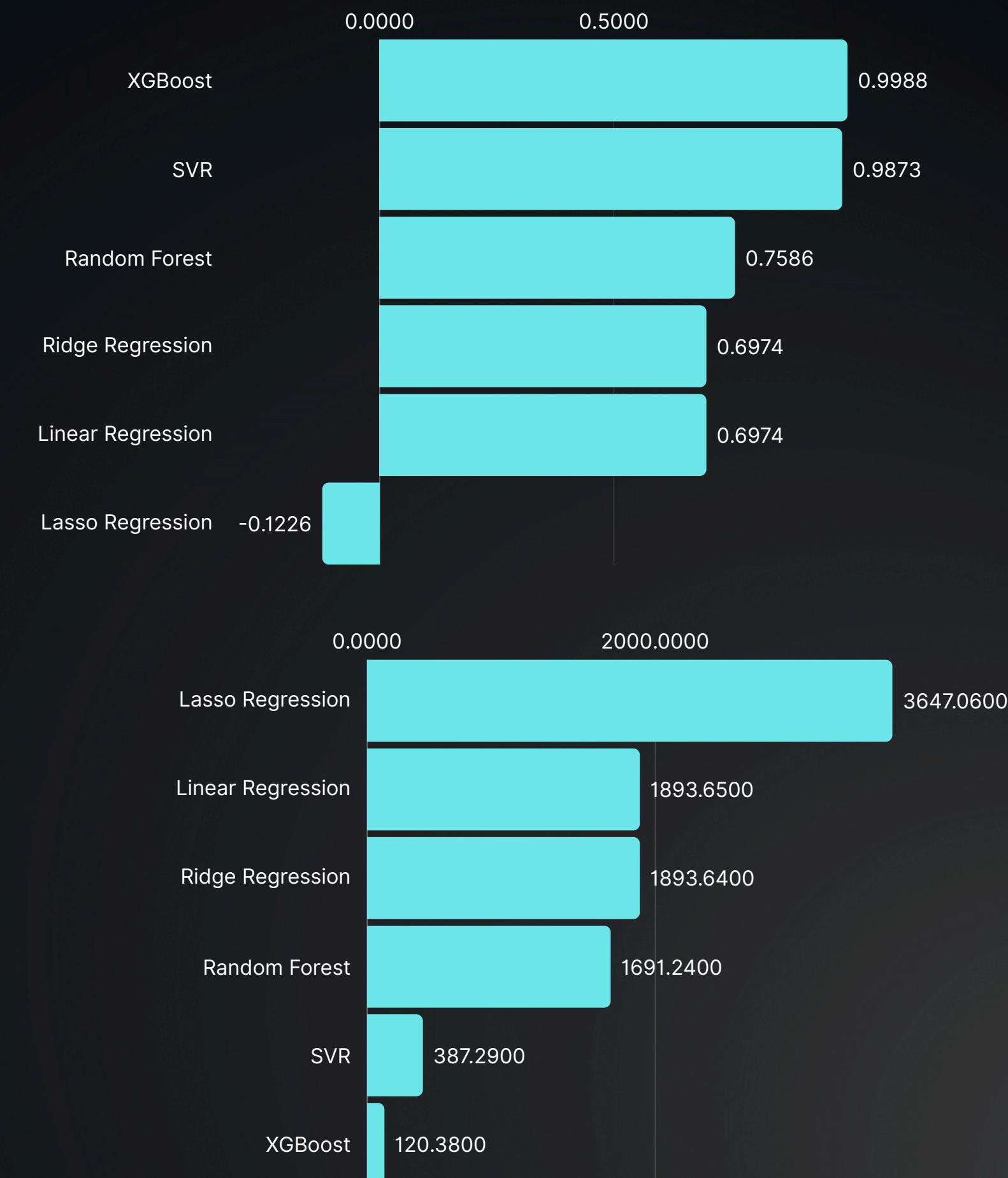
Energy Consumption: PREDICTION RESULTS

Model	R ² Score	RMSE
LSTM	0.9969	191.63
SARIMAX	0.9763	91.45
TCN	0.8276	246.81



GDP : PREDICTION RESULTS

Model	R ² Score	RMSE
SVR	0.9873	387.29
Random Forest	0.7586	1691.24
Linear Regression	0.6974	1893.65
Ridge Regression	0.6974	1893.64
Lasso Regression	-0.1226	3647.06
XGBoost	0.9988	120.38



DEMO VIDEO

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CONCLUSION

- VIIRS NTL data serves as a reliable proxy for estimating GDP and energy consumption, particularly in regions lacking comprehensive statistical data.
- Time series models, especially LSTM and SARIMAX, outperformed traditional regression models, indicating the significance of temporal dependencies in economic indicators.
- The integration of remote sensing data into economic analysis offers a promising avenue for real-time monitoring and forecasting of economic activities.

THANK YOU
