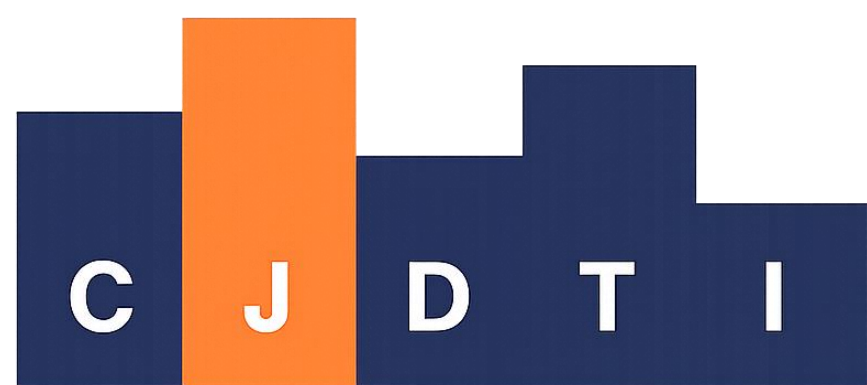


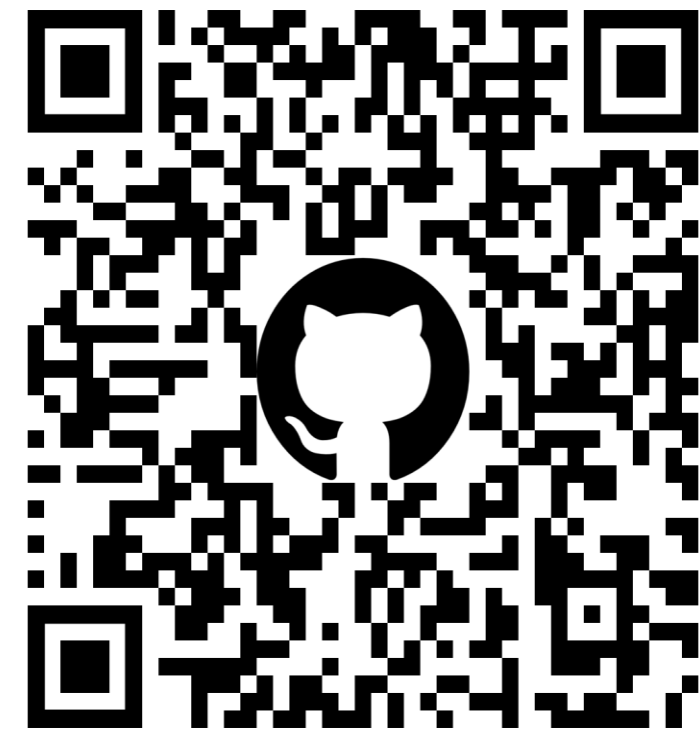


Forecasting Jail Bed Utilization for Central Virginia Regional Jail

Bella Lu, Rachel Seo, Jonas Lee, Loreto Peter Alonzi III, Michael Smith, K. Preston White Jr., Frank E. Dyer, and Matthew Vitale

Criminal Justice Data Training Initiative

Reference: Lu, B et al., "Forecasting Jail Bed Utilization for Central Virginia Regional Jail," 2026 Systems and Information Engineering Design Symposium (SIEDS), Accepted for Publication



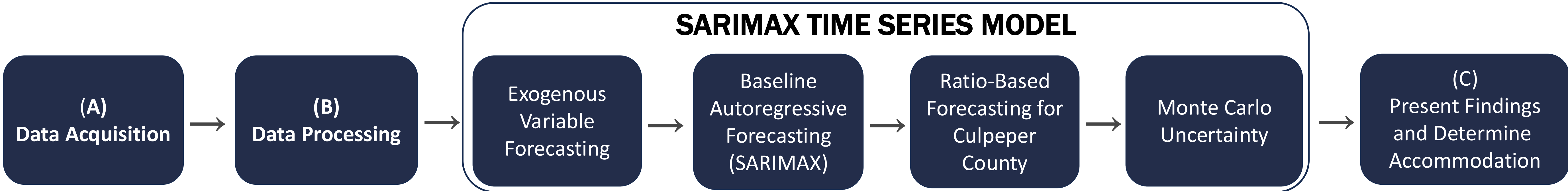
Abstract

CVRJ is evaluating whether to admit Culpeper County as a sixth member jurisdiction, using a ten-year forecast of jail bed utilization using a SARIMAX time-series model that integrates crime and booking data. The findings support CVRJ's capacity to accommodate Culpeper County and identify the conditions necessary for sustainable membership and facility stability.

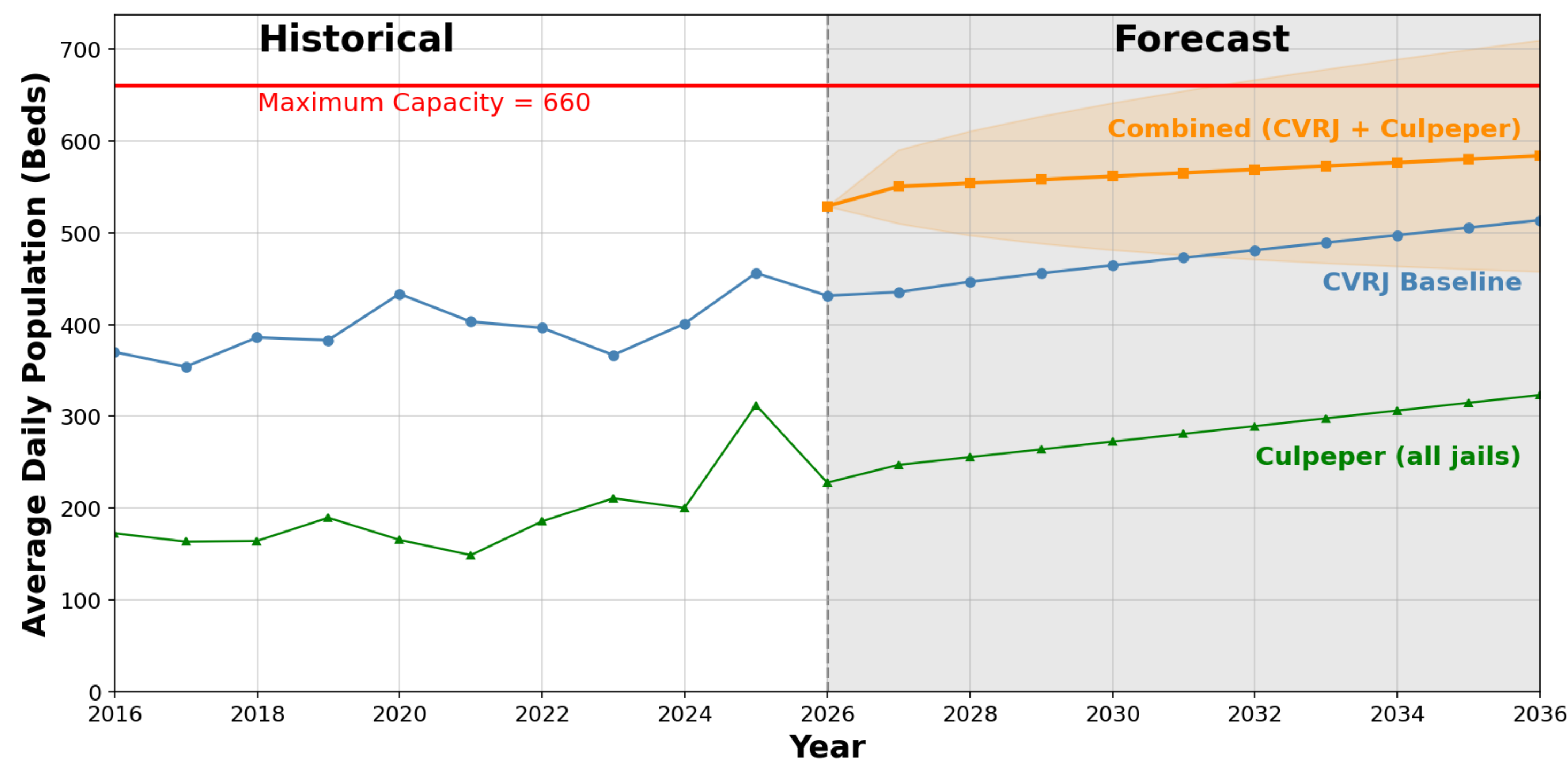
Background and Introduction

The CJDTI at UVA School of Data Science is applying statistical modeling and visualization techniques to forecast jail bed utilization at CVRJ, with the dual objectives of projecting future population trends and generating data-driven projections to support Culpeper County's operational planning. The project addresses a gap in CVRJ's existing data analysis capacity by delivering an intuitive dashboard that translates complex statistical outputs into actionable intelligence for facility administrators and decision-makers. The overarching goal is to equip CVRJ leadership with the analytical tools needed to support proactive, evidence-based operational strategies that improve public safety outcomes.

Forecasting Model Pipeline Architecture



Results (C)

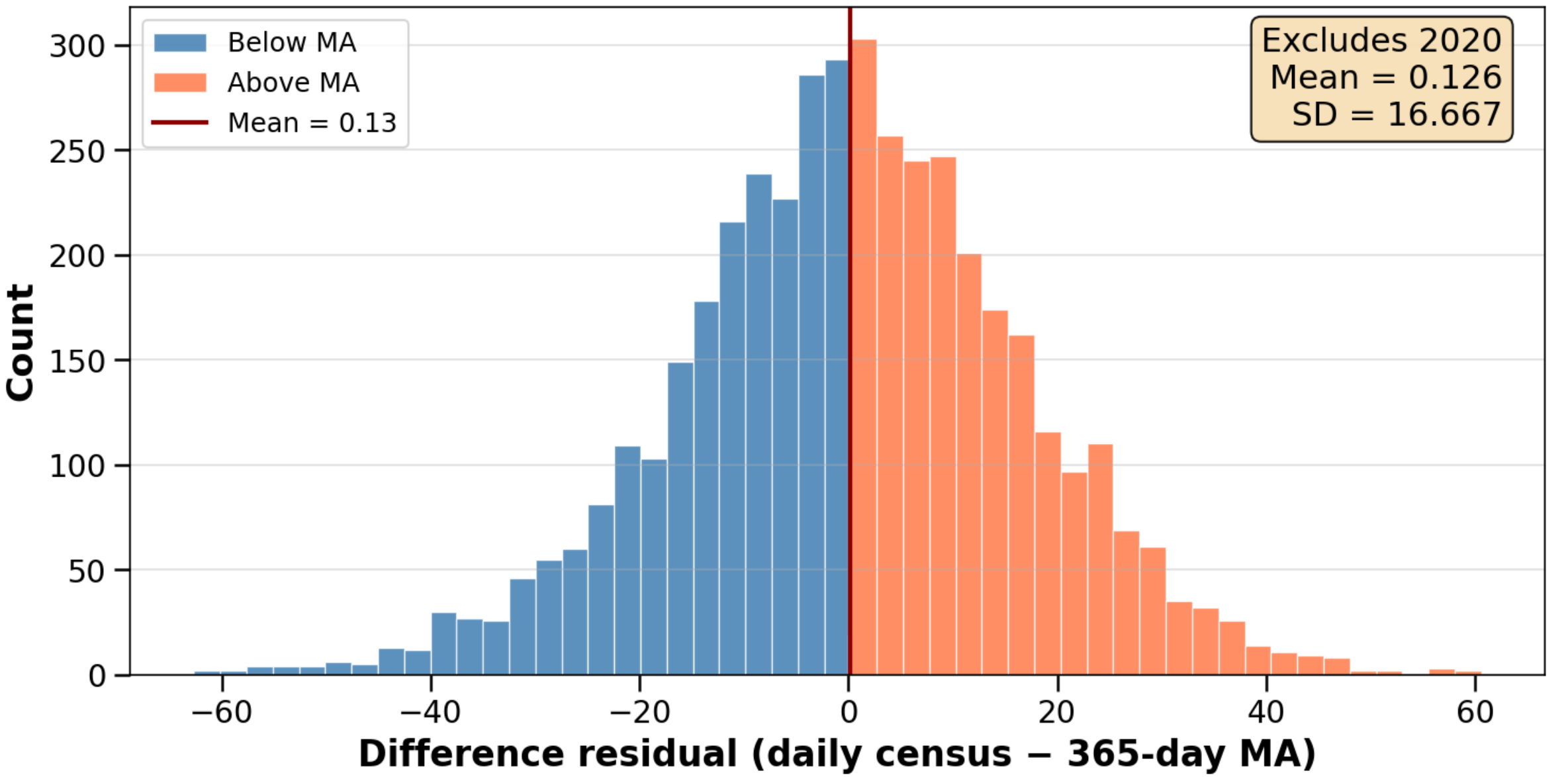


Year	Point Estimate	With Culpeper Prob. Exceeding 660 Beds	Without Culpeper Prob. Exceeding 660 Beds
2031	569	~17.6%	~0.0007%
2035	584	~27.2%	~0.018%

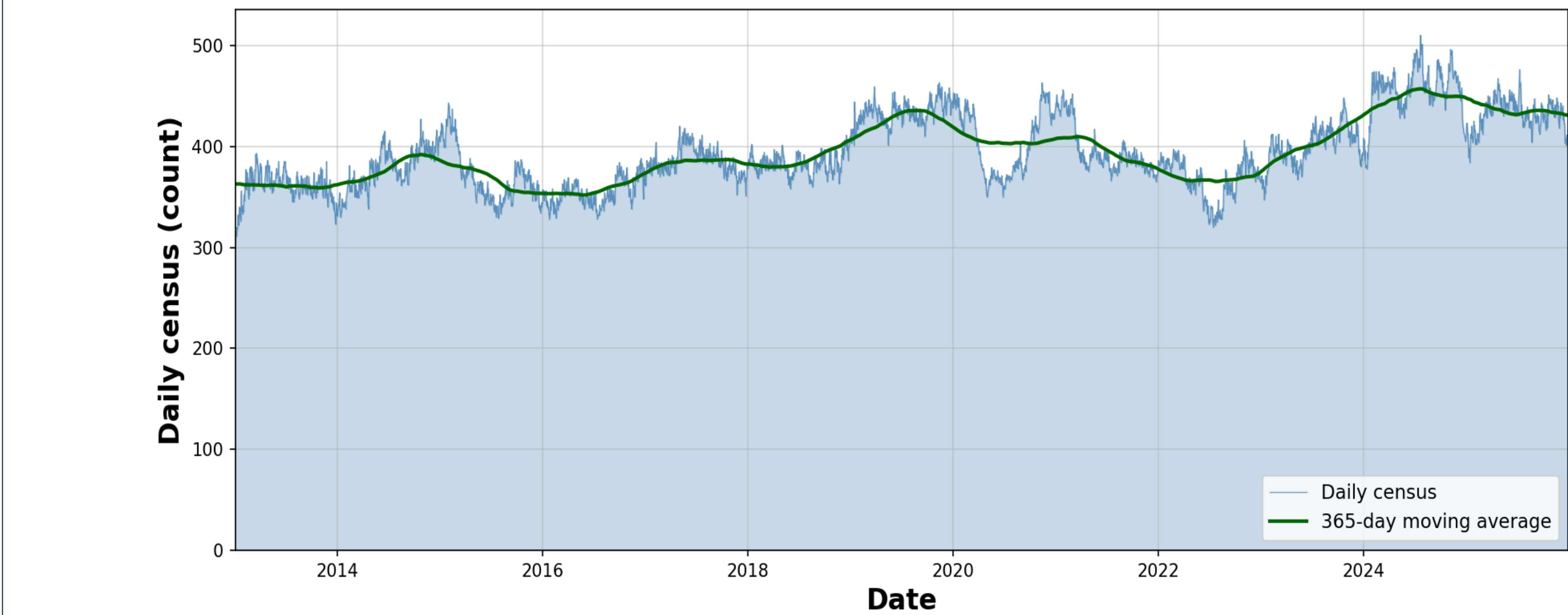
Data (A)

Sources and Title

Superintendent Dyer	Annual Average Daily Population for Culpeper County Inmates
Lieutenant McDaniel	De-identified Booking Dataset for CVRJ
Matthew Vitale	Virginia Beyond 20/20 Census Data



Data Overview (B)



Limitations and Future Work

Limitations: Absence of Culpeper daily booking data
Future Work: Future work should prioritize the acquisition and integrations of daily booking data because it will enable more detailed time-series modeling and improve the precision of bed utilization forecasts.

Acknowledgements

