Forecasting Antimicrobial Resistance:
Machine Learning Approaches for E. Coli Resistance to Ciprofloxacin in India

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Date: September 27, 2025

Abstract

Background: Antimicrobial resistance (AMR) poses a significant threat to global
particularly in developing countries with high antimicrobial consumption
of resistance trends is crucial for effective antibiotic stewardship and
Methods: We analyzed time series data for antimicrobial resistance patte
advanced machine learning algorithms including Facebook's Prophet, autor
integrated moving average (ARIMA), and long short-term memory (LSTM) neu
Results: Our ensemble forecasting approach demonstrated robust predictiv
The LSTM model achieved the highest accuracy (lowest RMSE and MAPE) for
resistance predictions, while Prophet excelled in capturing seasonal pat
Conclusions: This study provides a comprehensive framework for AMR trend
that can inform evidence-based policy decisions and antibiotic stewardsh
The integrated approach combining multiple machine learning algorithms o
predictive accuracy compared to traditional statistical methods.

Keywords: antimicrobial resistance, machine learning, forecasting, Prophet, ARIM

Introduction

Antimicrobial resistance (AMR) represents one of the most significant challenges
healthcare systems worldwide, with the World Health Organization (WHO) p
2050, AMR could cause 10 million deaths annually unless immediate action
Bacteria such as E. Coli have shown remarkable adaptability
to antibiotic pressure, developing resistance to drugs like Ciprofloxaci
alarming rates. In India, where antibiotic consumption is substantial, u
and forecasting these resistance patterns is critical for effective anti
Traditional surveillance approaches provide retrospective insights but l
capabilities necessary for proactive intervention. Time series forecasti
machine learning algorithms offers a promising solution to anticipate re
and inform policy decisions.

This study aims to develop and validate an ensemble forecasting framewor
state-of-the-art machine learning techniques for predicting AMR trends,
focus on E. Coli resistance to Ciprofloxacin in India.

Materials and Methods