Forecasting Individuals' Uptake Of H1N1 And Seasonal Flu Vaccines

PHASE 3 PROJET

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Overview

- Recent global health challenges include major pandemics like H1N1 and COVID-19, alongside outbreaks like Zika and Ebola, profoundly impacting public health.
- Understanding these pandemics, marked by shared viral characteristics, is key to grasping how individual behaviors influence vaccine choices.
- Historical data analysis offers insights for personalized public health strategies and predicting future vaccination trends.
- This knowledge aids in resource distribution, stakeholder engagement, and refining pandemic response tactics.

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Problem:

- Predict whether people received H1N1 and seasonal flu vaccines during 2009 H1N1 pandemic
- Important to understand drivers of vaccine decisions to improve public health strategies
- This analysis intends to identify key factors that influenced if someone got vaccinated
- World Health Organization is stakeholder seeking insights to enhance vaccine uptake

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Data Overview:

- Dataset is from survey of over 26,000 people during 2009 H1N1 flu pandemic
- Captures attitudes, knowledge, behaviors related to H1N1 and seasonal flu
- Indicates through labels whether each person received H1N1 and/or seasonal vaccine
- Rich dataset enabling analysis of patterns influencing vaccine choices

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Analysis Approach:

- Explore distributions and relationships in survey data to uncover insights
- Prepare data for modeling through encoding, addressing missing vals, scaling
- Build classification models to predict likelihood of H1N1 and seasonal vaccine uptake
- Assess accuracy of predictions to determine effective modeling techniques

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Modeling: Prediction Models

- Used 3 main types of models to predict likelihood of vaccine uptake - Logistic Regression, Random Forest, and Gradient Boosting
- Logistic Regression calculates probability of vaccine uptake based on survey data
- Random Forest constructs a "forest" of decision trees trained on sections of data to make predictions
- Gradient Boosting sequentially develops an ensemble model, each new predictor improving on deficiencies of the previous one

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Modeling: Preparing Models

- Split dataset into training and validation subsets to test model performance
- Handled imbalanced classes where few vaccine recipients relative to non-recipients
- Scaled numerical data like income and normalized units for model compatibility
- Encoded text responses as binary categories for model interpretation

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Evaluation: Evaluation Metrics

- Accuracy - percentage of correct vaccine uptake predictions overall
- Precision - for those predicted to get vaccine, how many actually did
- Recall - out of all who got vaccine, how many did model correctly predict
- F1-score - balance between precision and recall for a class
- ROC AUC - separation measure between recipients and non-recipients

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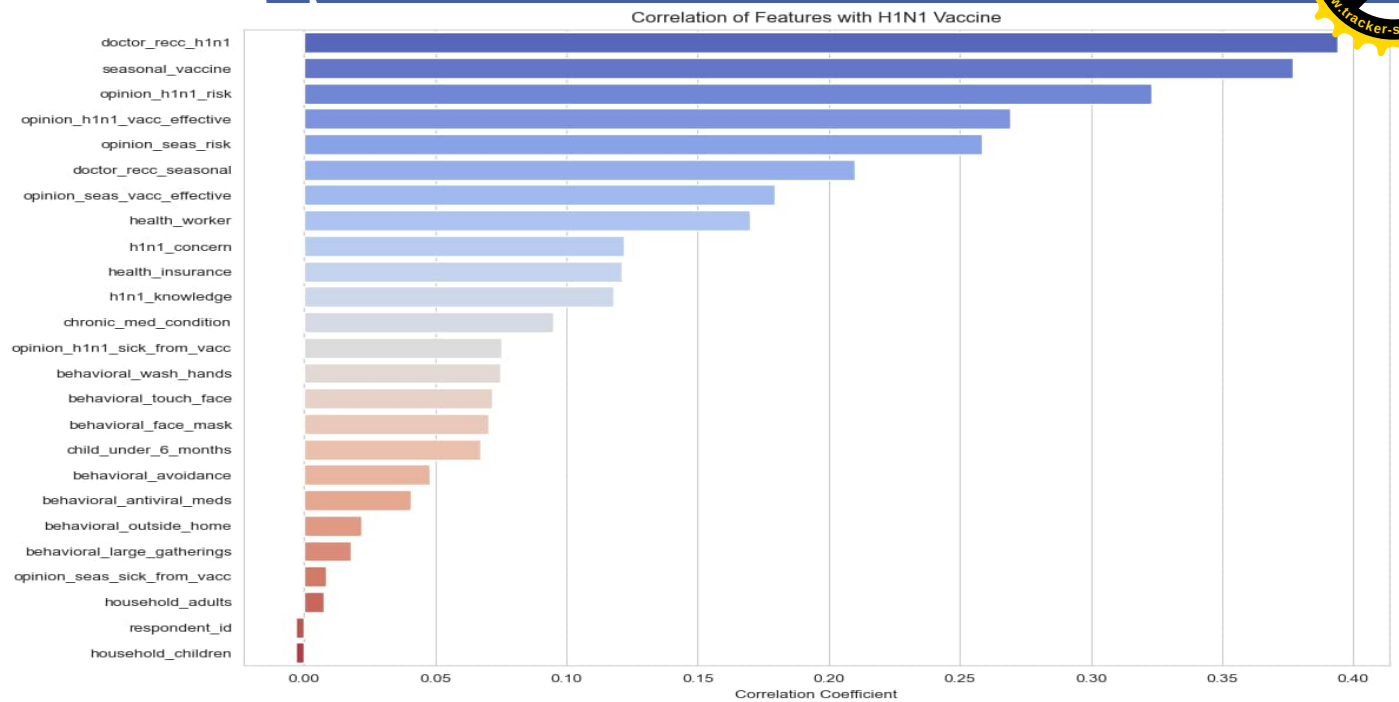
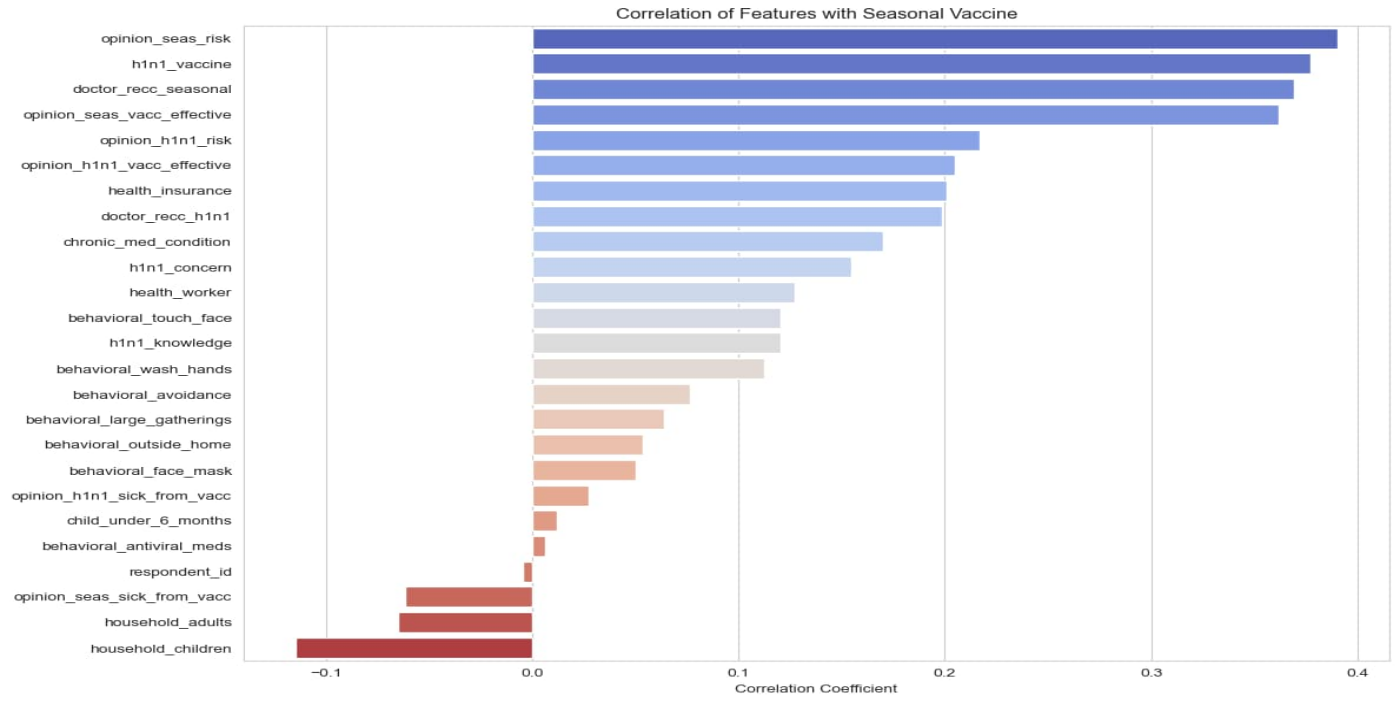
Correlation of Features For the 2 Vaccines





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Evaluation: Model Performance

- Accuracy highest in Gradient Boosting and Random Forest for H1N1 vaccine
- Logistic Regression best at detecting true vaccine recipients (recall)
- Random Forest most precise in predicting those not vaccinated
- For seasonal vaccine, Logistic Regression and Random Forest had best balance
- All models showed good discrimination between vaccinated and unvaccinated groups

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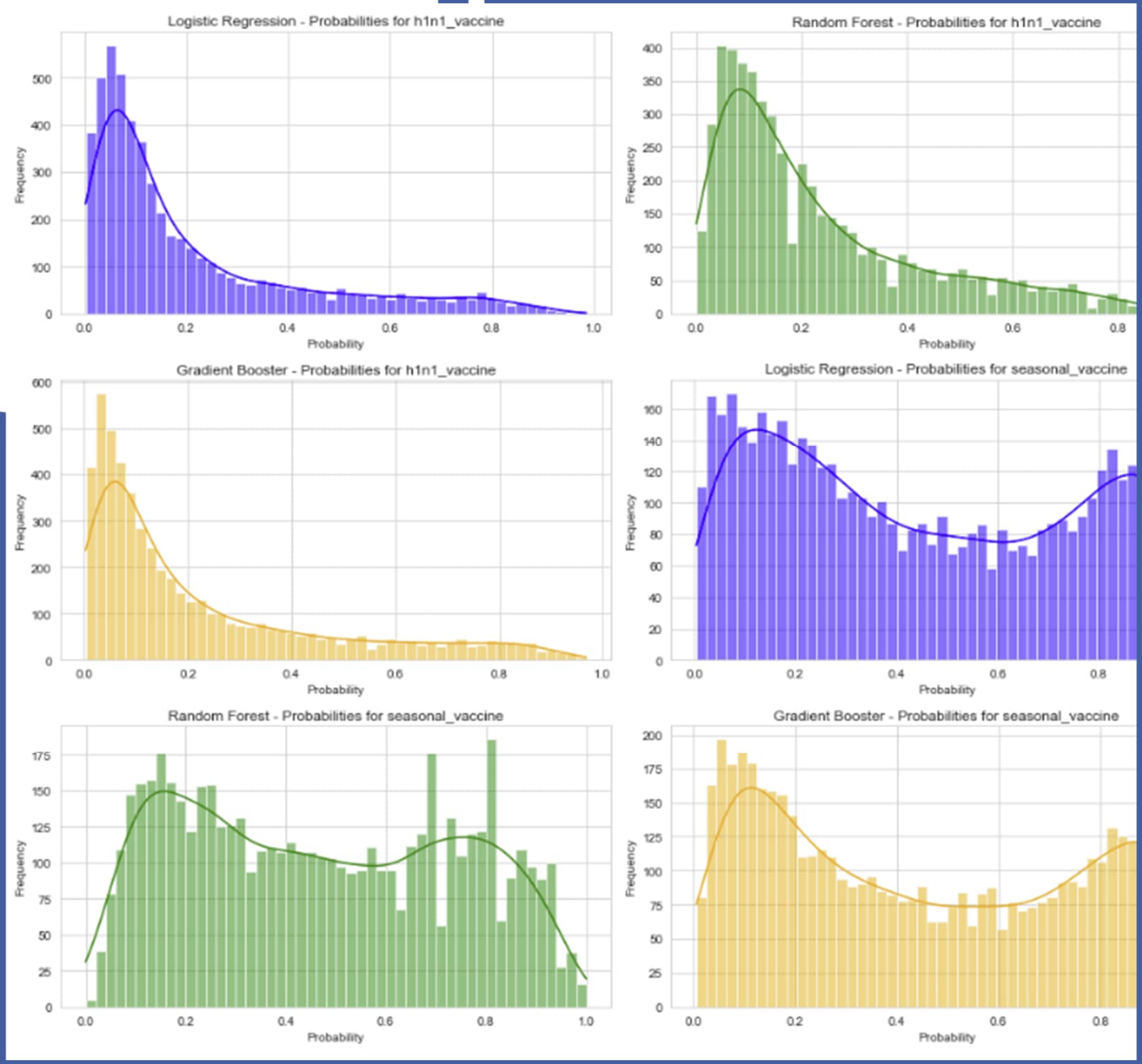

Recommendations

- Improve public education on vaccines, especially for groups with less awareness or inaccurate beliefs
- Direct customized vaccine campaigns and affordable services towards communities with lower uptake rates based on poverty, education level or race
- Expand health insurance coverage which could indirectly increase vaccine acceptance
- Ensure vaccine access, information and awareness reaches all groups equally, regardless of demographics

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Next Step

- Expand data collection through additional survey administrations to validate findings and monitor ongoing trends
- Gather supplementary datasets encompassing wider demographic and psychosocial attributes to build more comprehensive predictive models
- Conduct stratified analyses focused on population subgroups to uncover specialized insights related to education, income, race, etc.
- Implement integrated qualitative and quantitative investigations to acquire richer perspectives on attitudes, beliefs, behaviors surrounding vaccines

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THANK YOU!