FACTORS INFLUENCING UPTAKE OF SEASONAL FLU VACCINE

PRESENTER: COLLETA KIILU

MODULE: DSF – PT_08_P3

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Background

- Vaccination is a critical public health intervention for controlling and preventing the spread of infectious diseases.

- In 2009, the H1N1 influenza virus, known as "swine flu," caused a global pandemic, resulting in 151,000 to 575,000 deaths worldwide in its first year.

- To combat this pandemic, an H1N1 vaccine was made available in October 2009.

- The United States National 2009 H1N1 Flu Survey, conducted in 2009-2010, collected data on vaccination uptake for both H1N1 and seasonal flu.

- The survey explored respondents' vaccination status alongside information about their socioeconomic and demographic backgrounds, health behaviors, and opinions on vaccine efficacy and illness risk.

Objectives

- **General Objective**: To understand which factors influence the seasonal flu vaccine uptake.

- **Specific Objectives**

  - To determine how socioeconomic factors influence an individual's uptake of the seasonal flu vaccines.

  - To determine how behavioral factors influence an individual's uptake of the seasonal flu vaccines.

  - To determine how demographic background factors influence an individual's uptake of the seasonal flu vaccines.

  - To understand how an individual's knowledge, perception, and attitude towards seasonal flu vaccines influence the uptake of the vaccines.

- **Research Questions**

  - How do socioeconomic factors influence an individual's uptake of the seasonal flu vaccines?

  - How do behavioral factors impact an individual's uptake of the seasonal flu vaccines?

  - How do demographic background factors affect an individual's uptake of the seasonal flu vaccines?

  - How does an individual's knowledge, perception, and attitude toward seasonal flu vaccines influence the uptake of the vaccines?

Data Understanding

- The data used for this project was collected over the phone between late 2009 and early 2020.

- It was sourced from <u>Driven Data</u>(CDC, NCRID and NCHS (2012), National 2009 H1N1 Flu Survey)

- For purposes of this study, the data was split as follows:

  - Train feature dataset; **26,707** rows and 36 columns.

 - Target dataset; **26,707** rows and 3 columns

Data preparation

- The project used the data sets below;
  - 1) test_set_features
  - 2) training_set_features
  - 3) training_set_labels

- The files were imported using the appropriate functions in pandas as shown below.

```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt


from sklearn.linear_model import LinearRegression
from sklearn.linear_model import LogisticRegression
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import mean_squared_error
from sklearn.metrics import confusion_matrix
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn.feature_selection import SelectKBest
from sklearn.feature_selection import chi2
from sklearn.metrics import accuracy_score, recall_score, precision_score, f1_score
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import roc_curve, roc_auc_score
from sklearn.dummy import DummyClassifier
from sklearn.ensemble import ExtraTreesClassifier
from xgboost import XGBClassifier
from scipy.stats.mstats import winsorize
import missingno as msno
```

FLU VACCINE Protect yourself. Protect others.

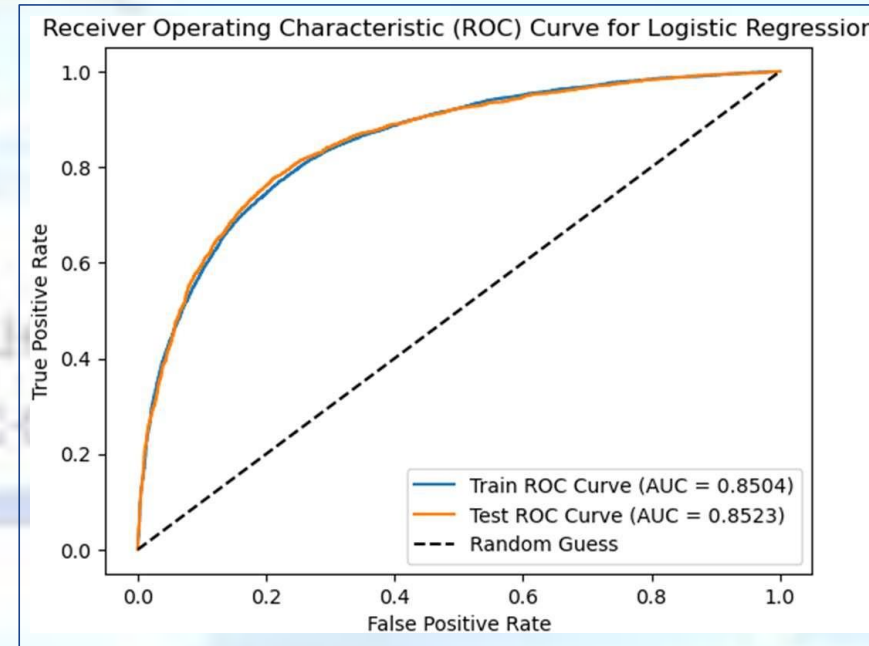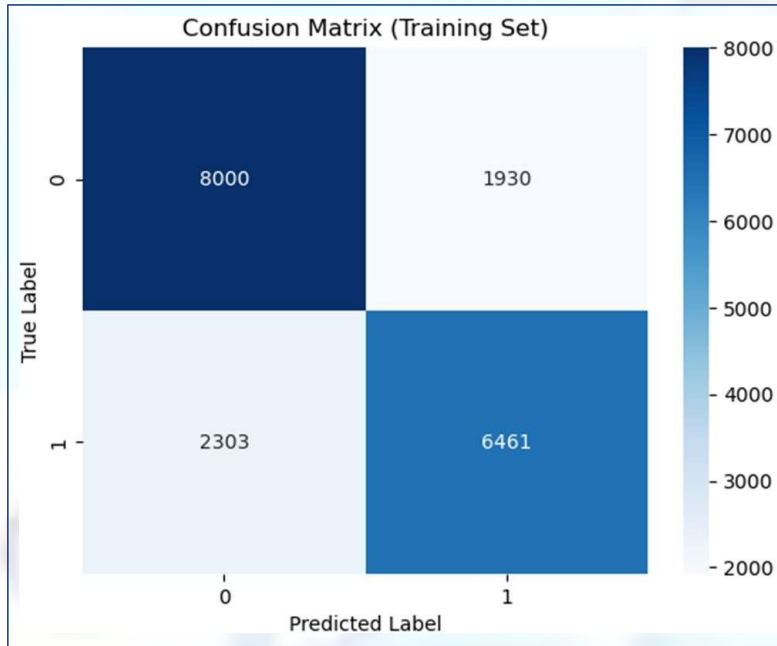# Exploratory Data Analysis
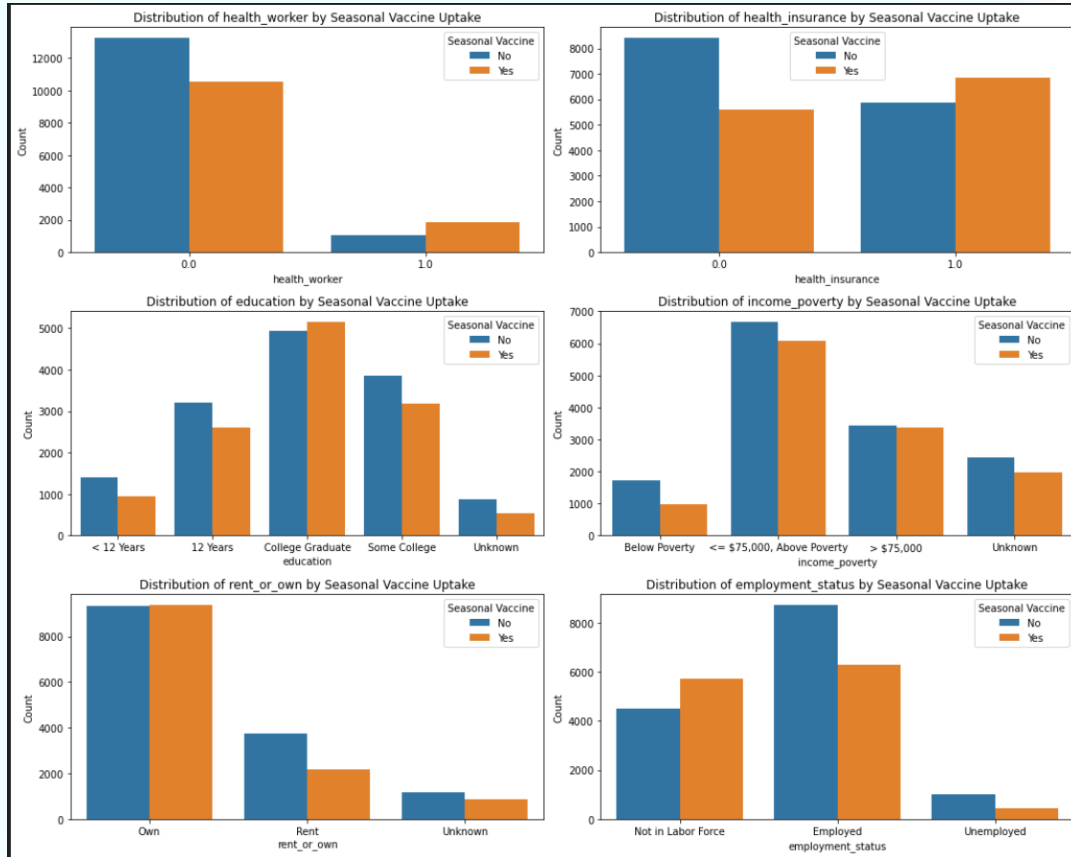
1. socioeconomic factors influencing seasonal flu vaccine uptake
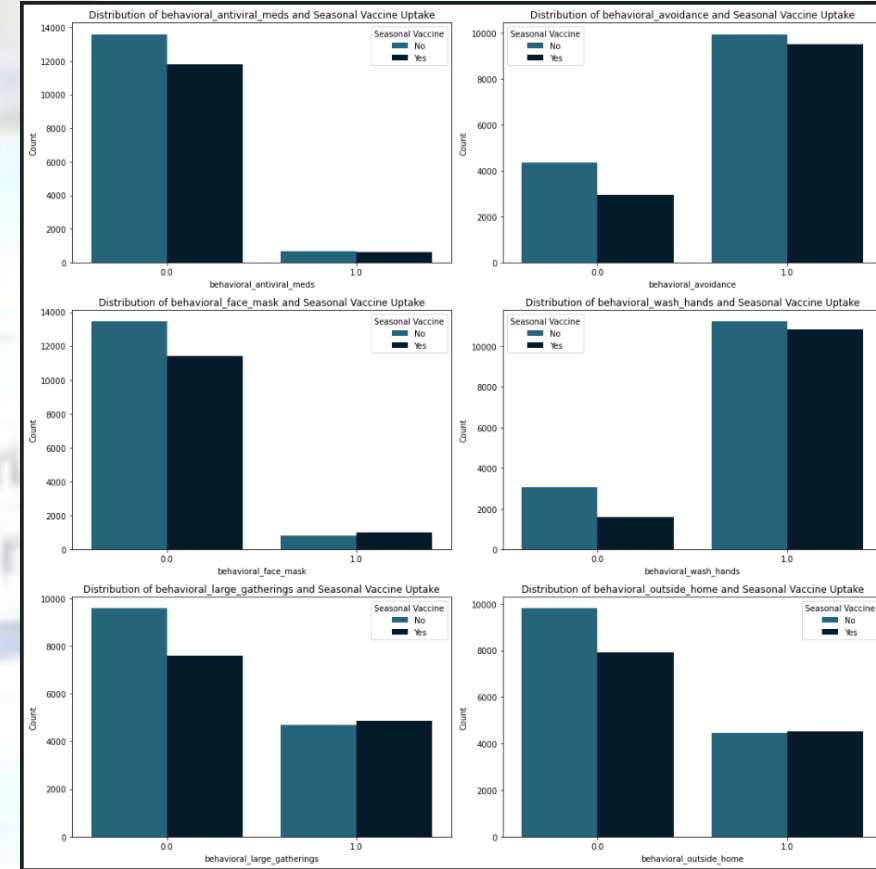
2. Behavioral factors influencing seasonal flu vaccine uptake

MODELLING
Logistic Regression Model(Baseline)

- The **ROC curve** above shows an AUC score of **0.8523** on the test set, revealing that the model is quite good at distinguishing between those who received the seasonal flu vaccine or not (positives and negatives).
- The score is close to 1, meaning the model's predictive power can be trusted.
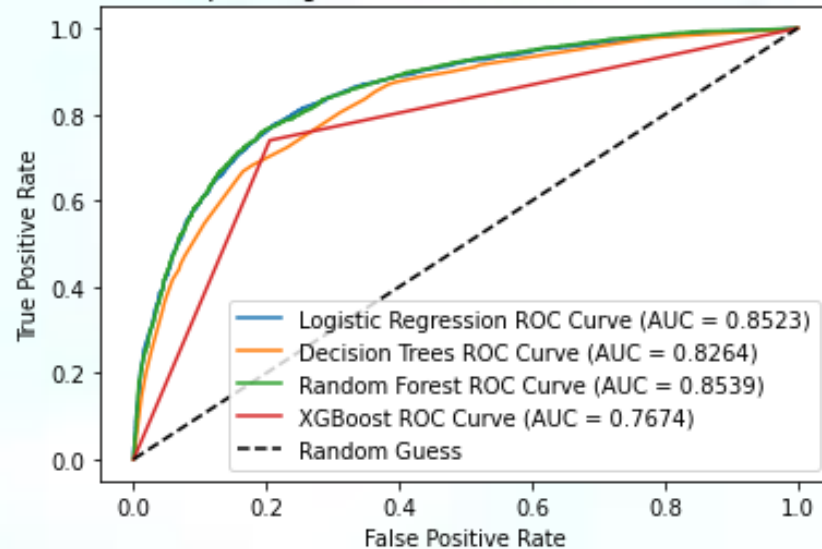
MODELLING

Random Forest Model
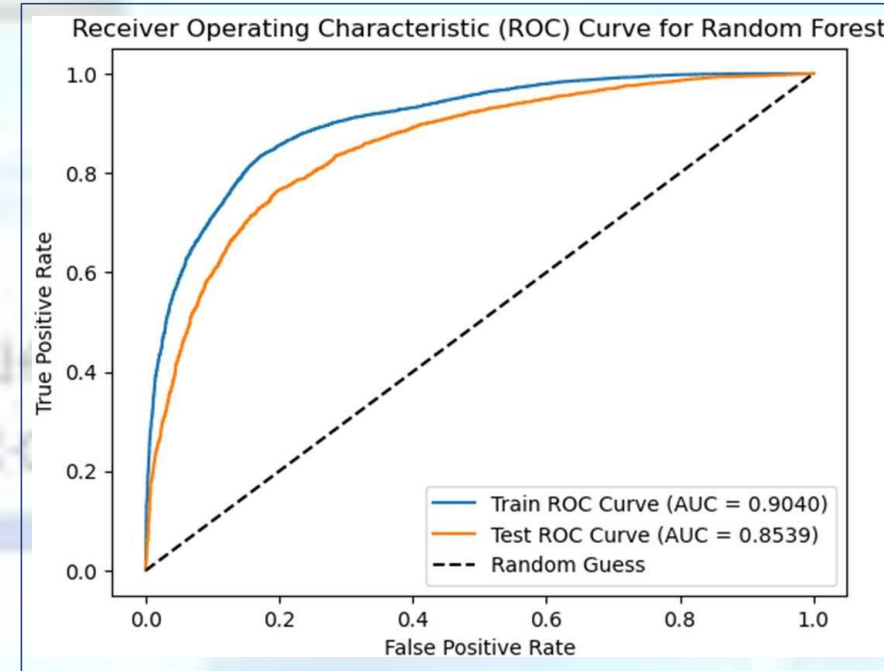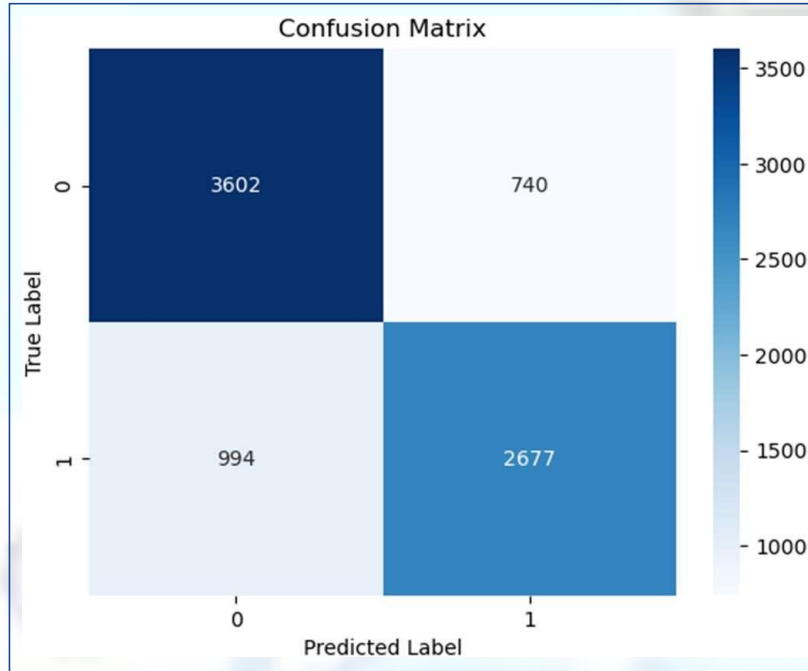
- This model's **ROC curve** shows an AUC of **0.8539**, the highest so far. The model is more effective in predicting the seasonal vaccine uptake based on the provided features. It is able to differentiate between vaccine recipients and non-recipients effectively.

MODEL EVALUATION SUMMARY

	Model	Accuracy	Recall	Precision	Training AUC Score	Test AUC Score
0	Logistic Regression	78.2	73.9	77.4	85.0	85.2
1	Random Forest	78.4	72.9	78.3	90.4	85.4
2	Decision Tree	75.8	67.5	76.9	83.1	82.6
3	XGBoost	77.0	74.0	75.3	87.5	76.7

Receiver Operating Characteristic (ROC) Curve for All Models

- Logistic Regression ROC Curve (AUC = 0.8523)
- Decision Trees ROC Curve (AUC = 0.8264)
- Random Forest ROC Curve (AUC = 0.8539)
- XGBoost ROC Curve (AUC = 0.7674)
- Random Guess

- The **Random Forest Model** (best_model3) Has demonstrated commendable performance in predicting the uptake of the seasonal flu vaccine.

- It has **strong evaluation metrics** and an ROC curve with **strong discriminatory power.**

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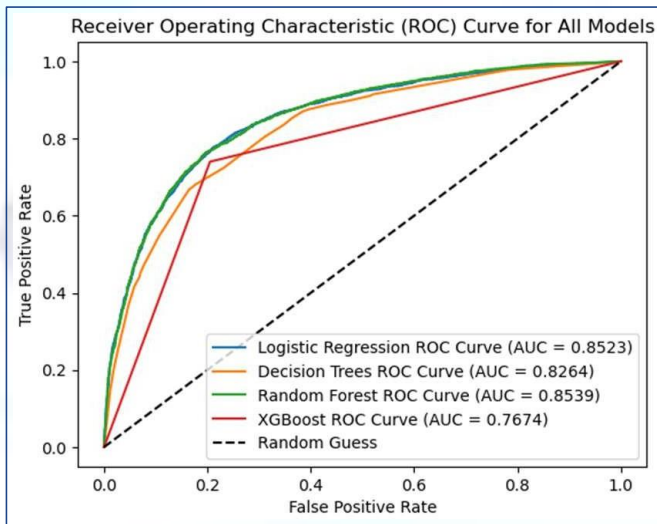
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CONCLUSION

- The role of healthcare professionals can never be overemphasized as evidenced by the fact that a doctor's recommendation to get the flu vaccine played a big role.

- How people view and feel about vaccines is a big influence on vaccine uptake.

- Older people tend to get the seasonal flu vaccine more than younger people.

RECOMMENDATIONS

1. Embrace personalized outreach as a campaign tool to target individuals and mould their perception towards immunization.

2. Public campaigns should be geared towards bringing onboard more younger people as it seems that they are less likely to get the seasonal flu vaccines.

3. The public health sector should continue encouraging doctors to recommend suitable vaccines to their clients. This modeling and analysis process has shown that people are highly likely to listen to their doctor's advice.

Thank you!

For further information contact:

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