Encouraging Vaccination Compliance: A Model to Target Non-Vaccinators

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Metis Data Science Bootcamp
Project 3 Pressentation
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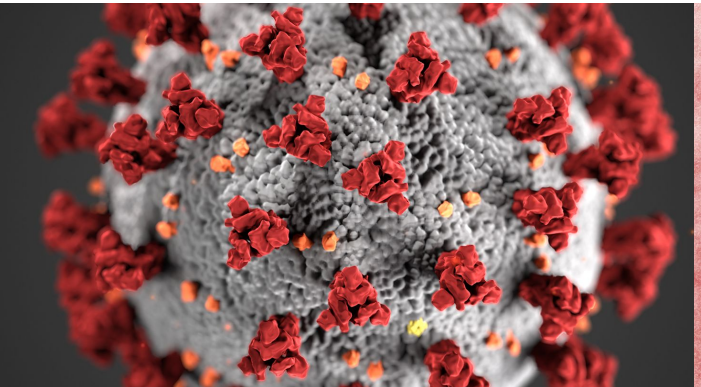
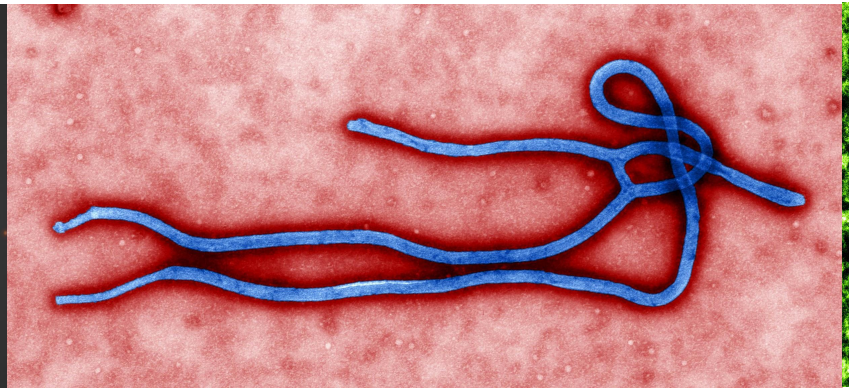
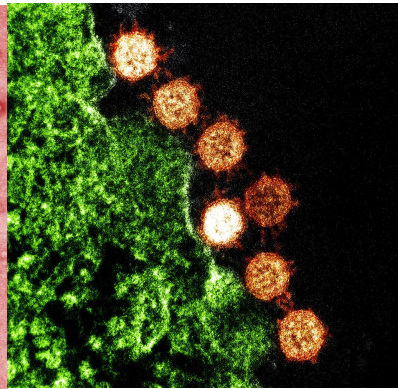
Problem and Approach

- New infectious diseases arise periodically
- Mass vaccination is crucial for controlling the spread of infection
- Improved public health campaign necessary to encourage vaccination

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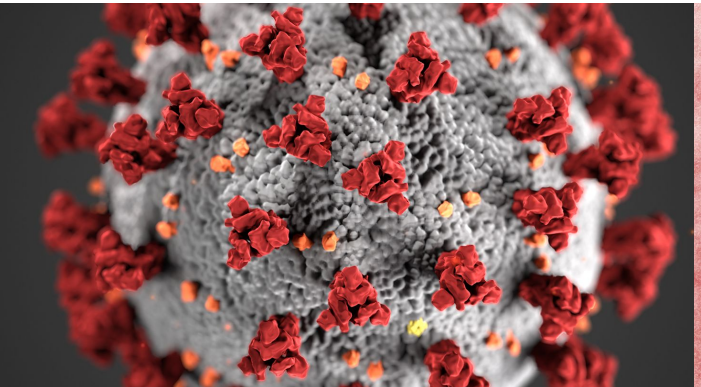
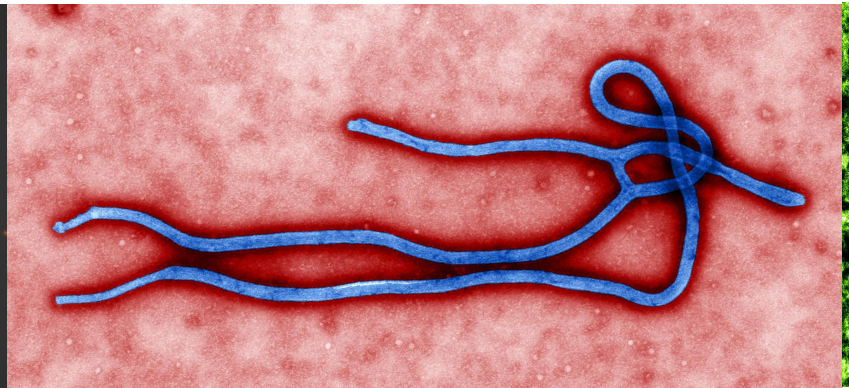
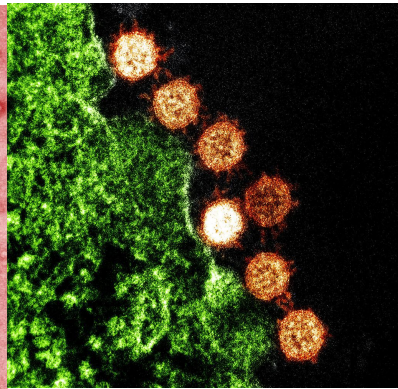
- Improved public health campaign necessary to encourage vaccination

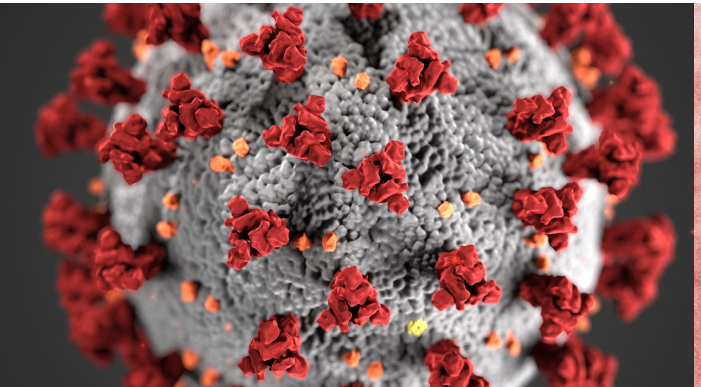
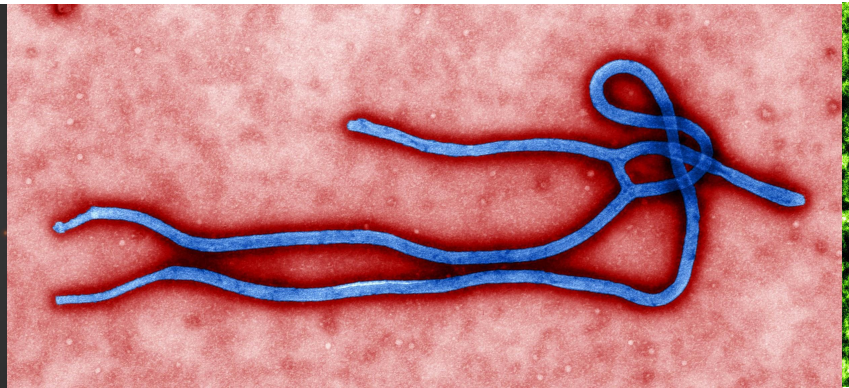
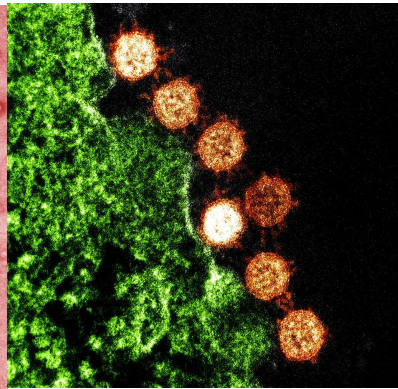
Data-driven approach to target people less likely to vaccinate

Description of Data

Source:

- Data originally from US DHHS National 2009 H1N1 Flu Survey,
- Accessed from DrivenData competition website

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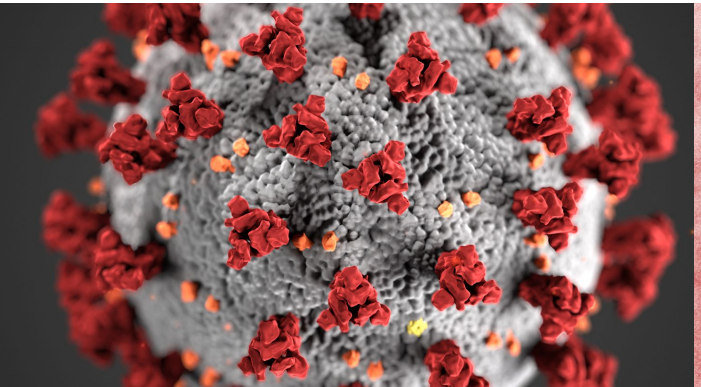
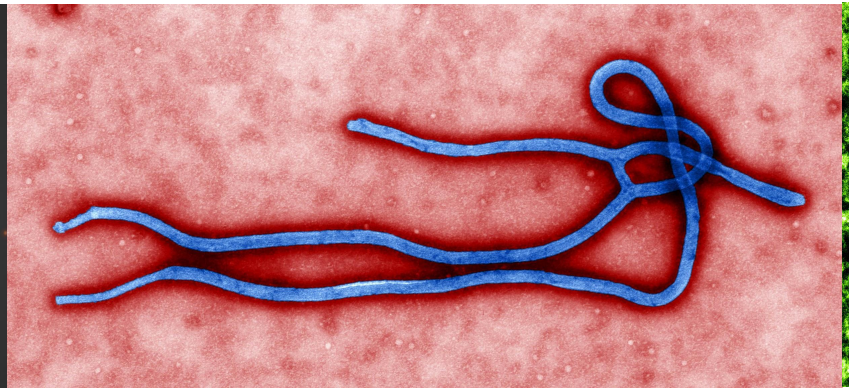
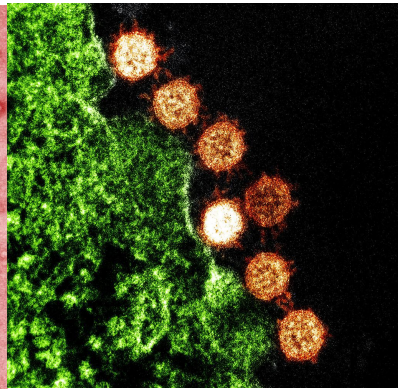
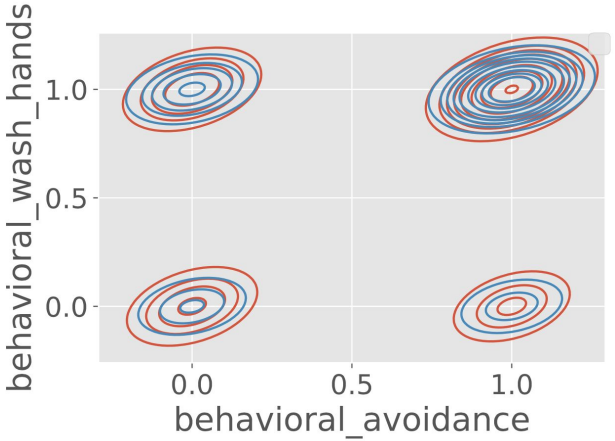
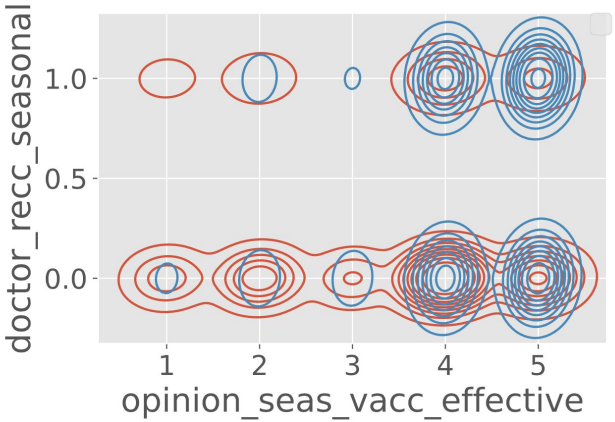
~26K survey respondents answered the y/n target vaccine questions (Training Set)

- 35 features: demographic, health, behavioral factors
- ~12-14K respondents did not answer the Health Insurance or Employment questions; removed these features
- Removed records with NaN values, leaving ~**20K** records in the Training Set
- Categorical features were encoded using dummy variables

Insights from Exploratory Data Analysis





Blue: Seasonal Flu Vaccine Compliant

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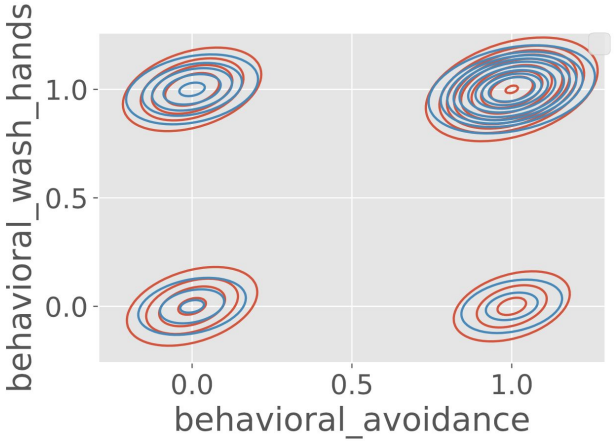
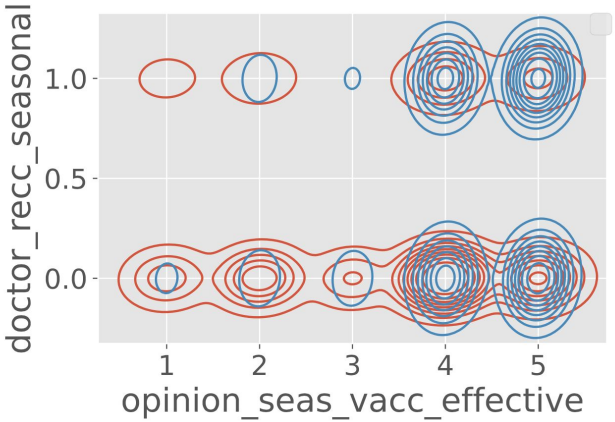




Blue: Seasonal Flu Vaccine Compliant

Features associated with seasonal flu vaccine compliance:

- Frequent hand washing
- Avoiding sick people
- Doctor recommended the seasonal vaccine
- Opinion that the seasonal flu vaccine is effective

Approach

Campaign will target:

- **Non-vaccinators (true negatives)**
- **People “on the fence” (false negatives)**

Approach

Campaign will target:

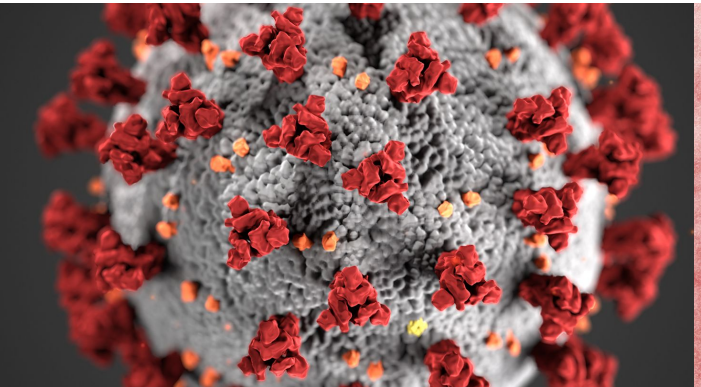
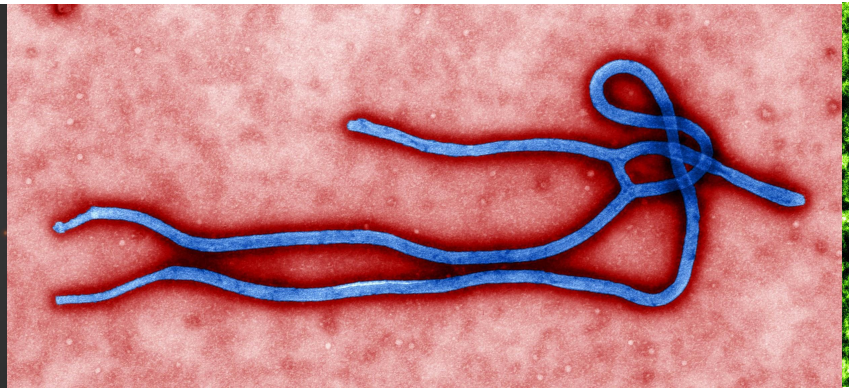
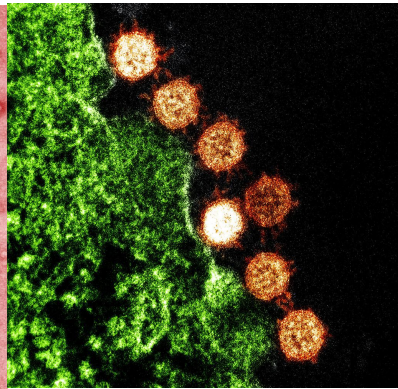
- Non-vaccinators (true negatives)
- People “on the fence” (false negatives)

Therefore:

- Increase precision, so that vaccinators are not targeted
- Predicting false negatives is fine-- may have characteristics of non-vaccinators, targeting may be beneficial
- False positives should be minimized, so these people are properly identified and targeted

Model Exploration

- Decision Tree
- Random Forest
- Naive Bayes Bernoulli
- Logistic Regression

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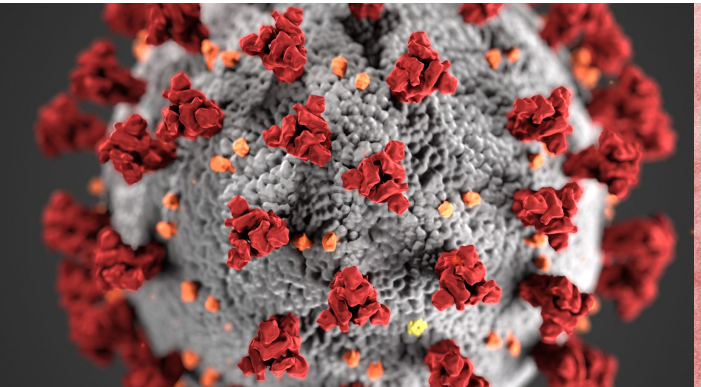
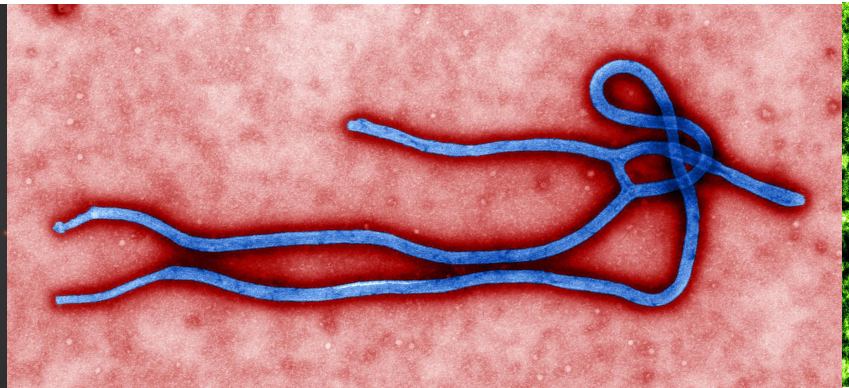
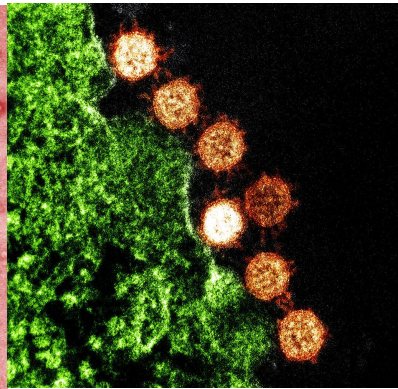
Training data was split into training and validation sets for model exploration

Decision Tree and Random Forest

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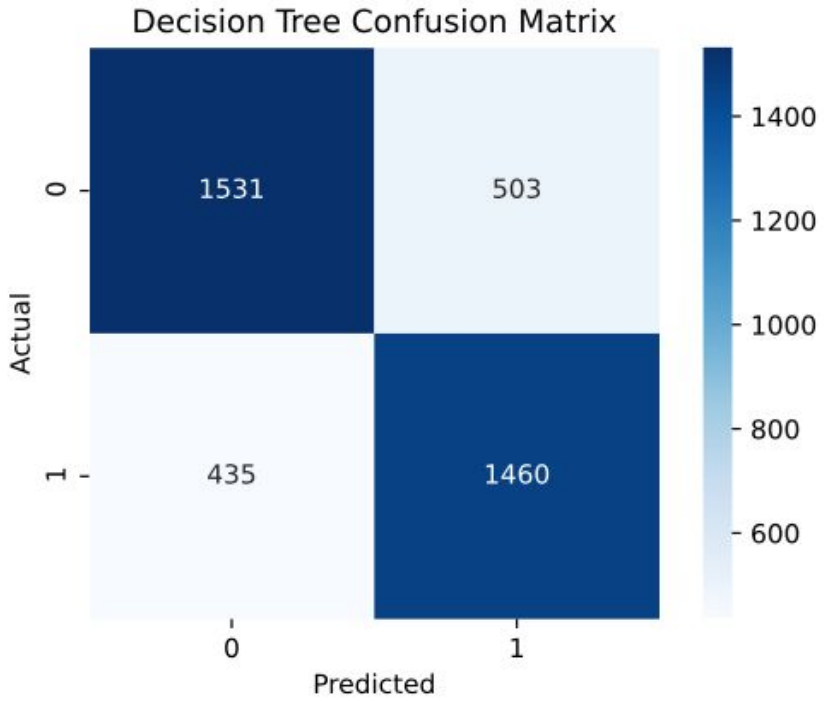

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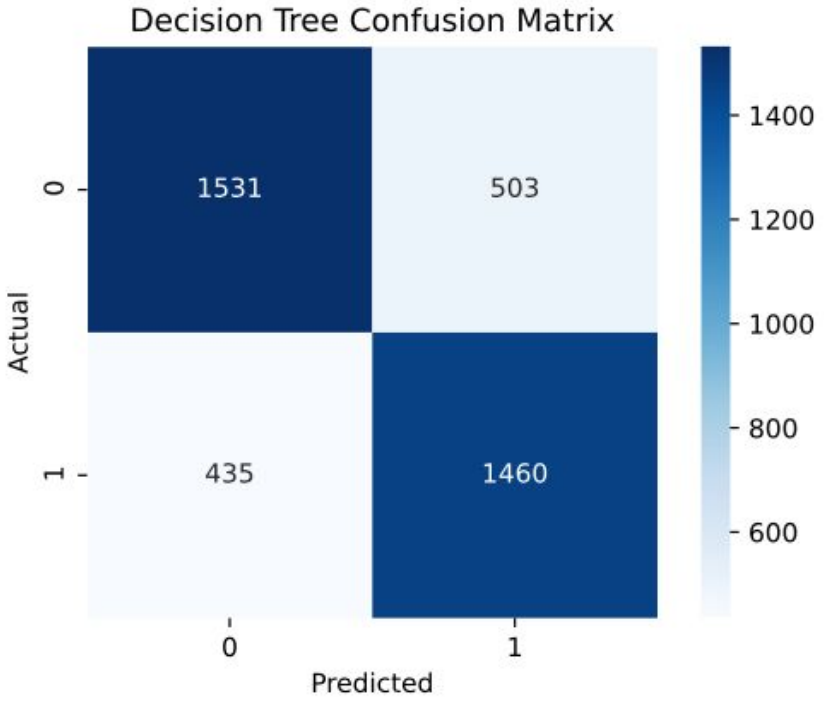

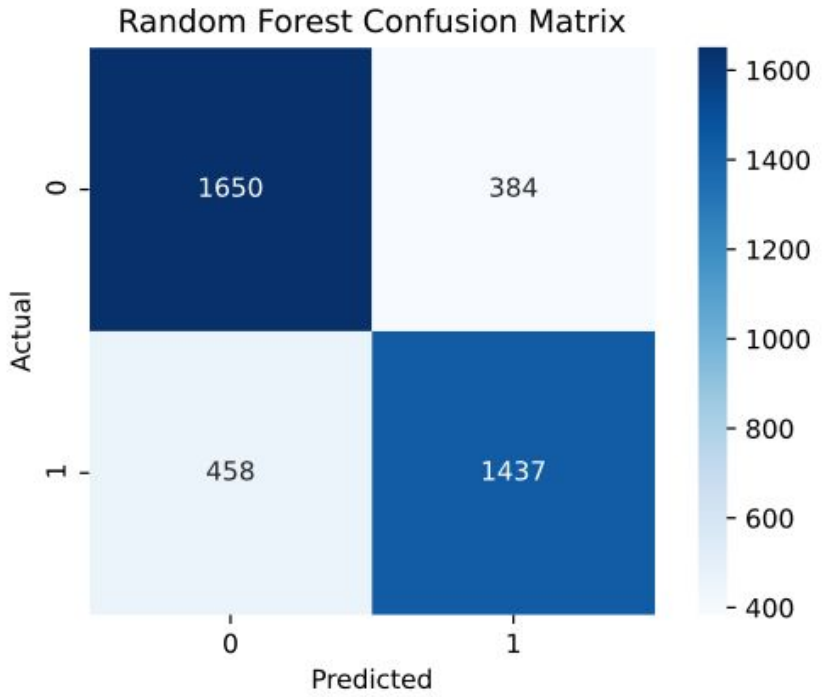

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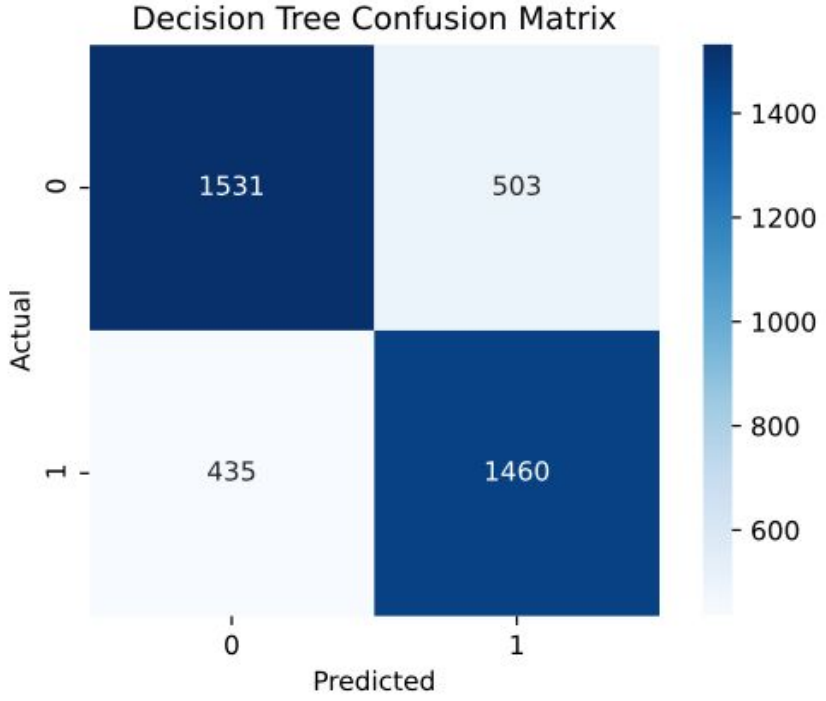

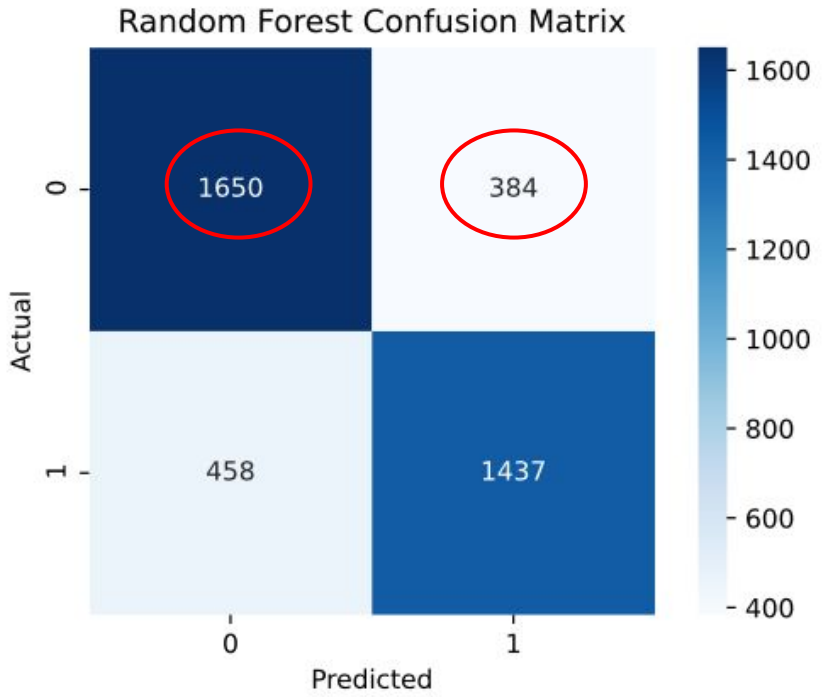

Random Forest performs slightly better than Decision Tree
(fewer false positives, more true negatives)

Naive Bayes (Bernoulli)

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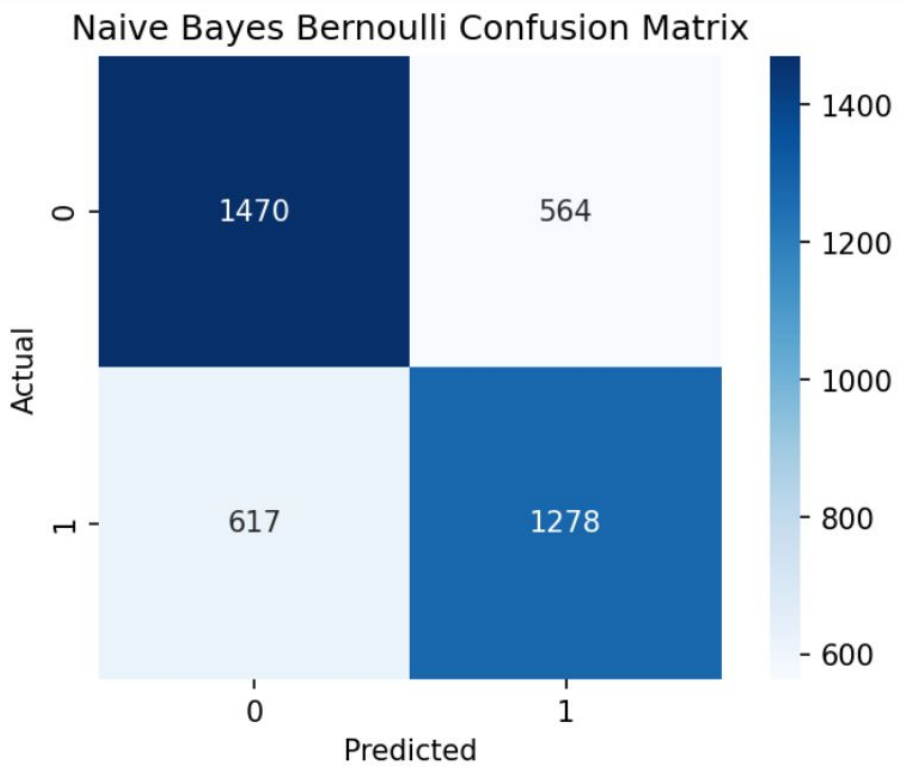

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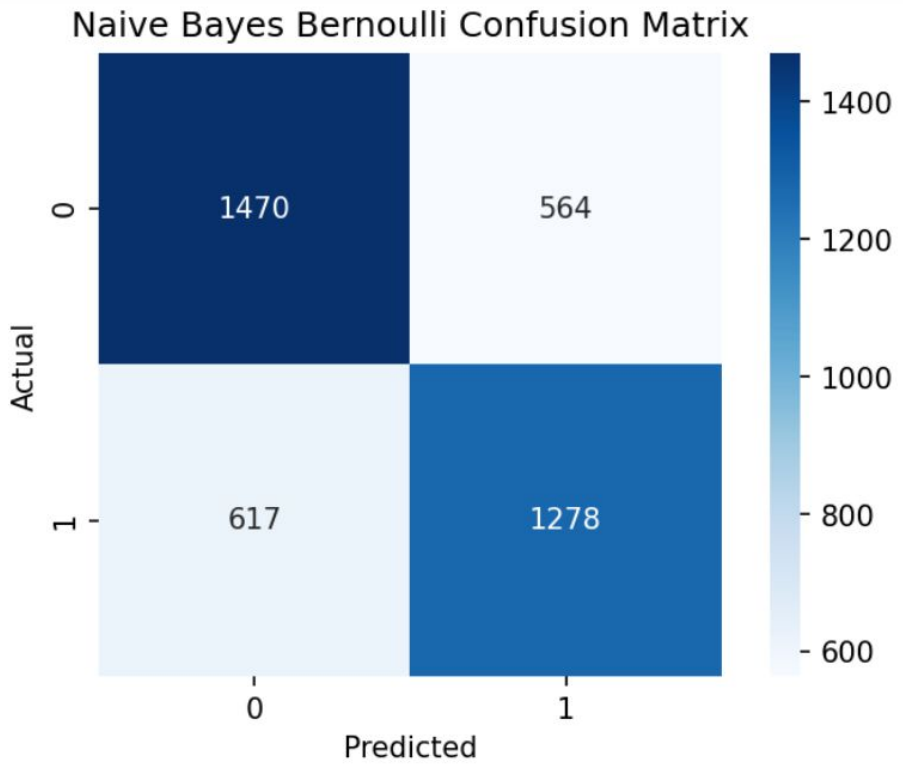

Naive Bayes (Bernoulli) performs slightly worse than Random Forest

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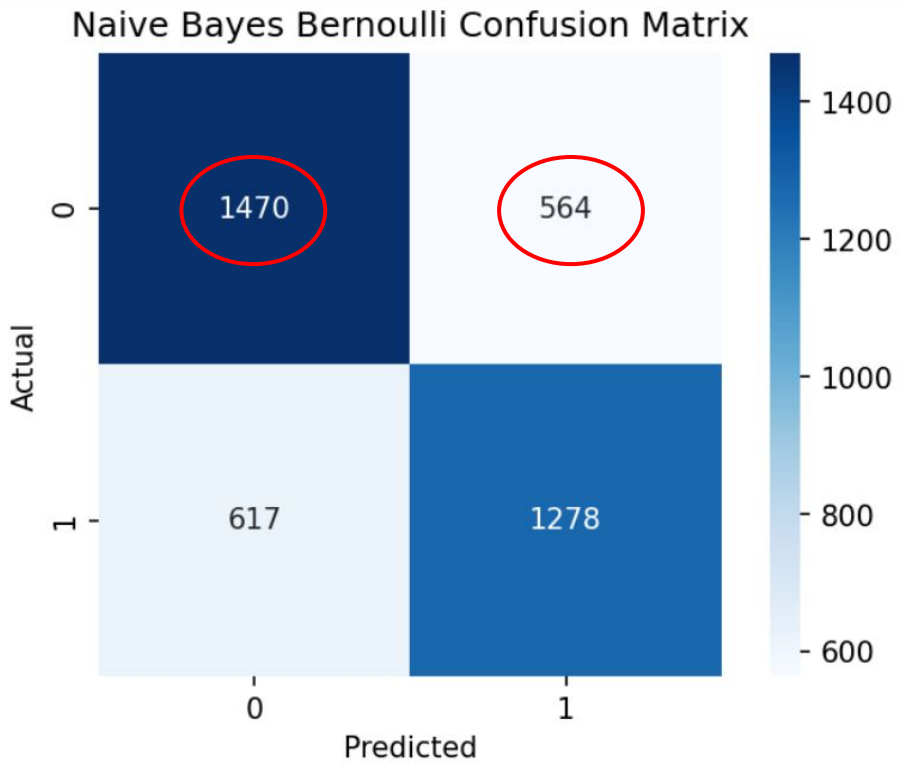

Naive Bayes (Bernoulli) performs slightly worse than Random Forest (more false positives, fewer true negatives)

Logistic Regression

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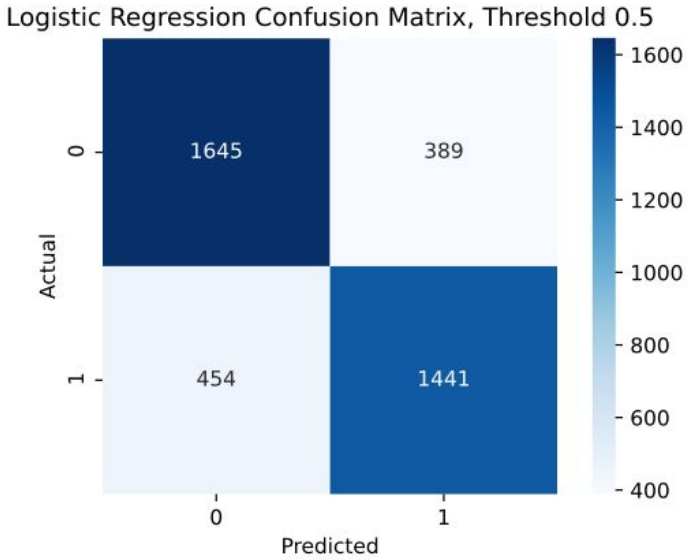

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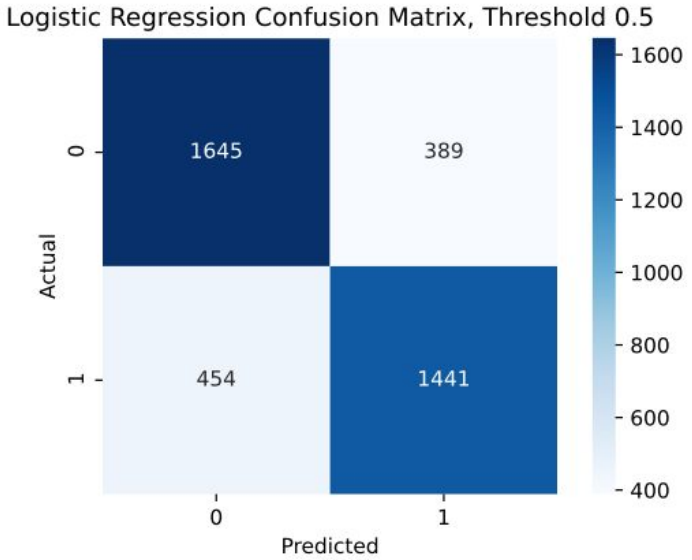

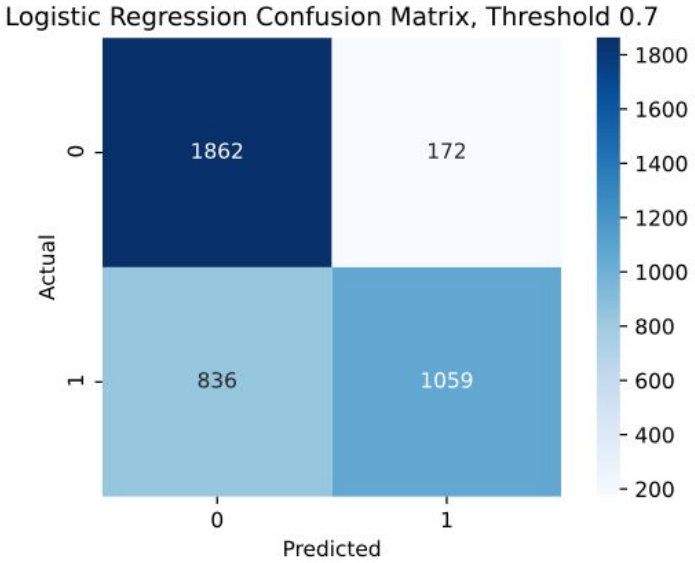

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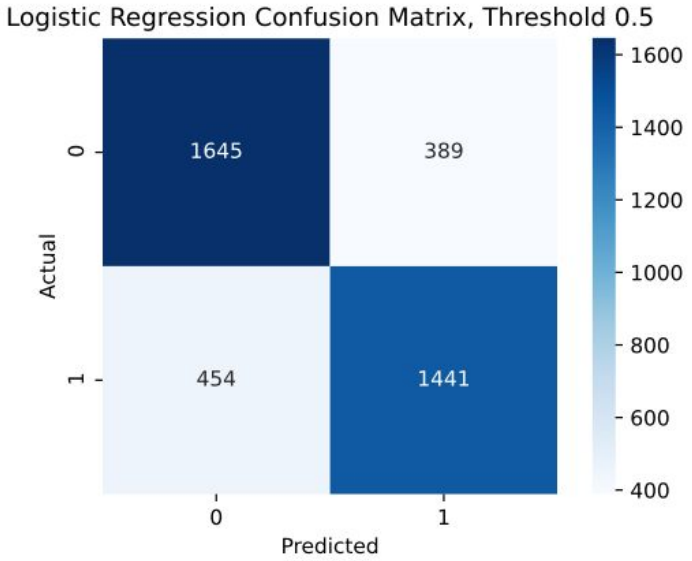
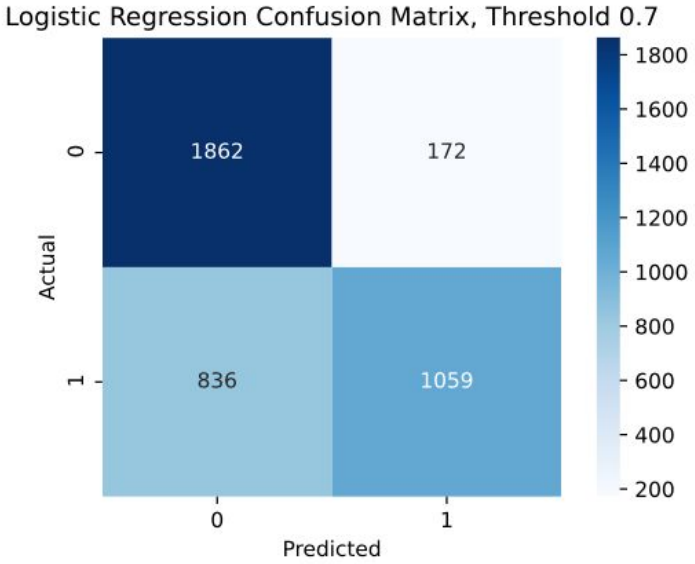
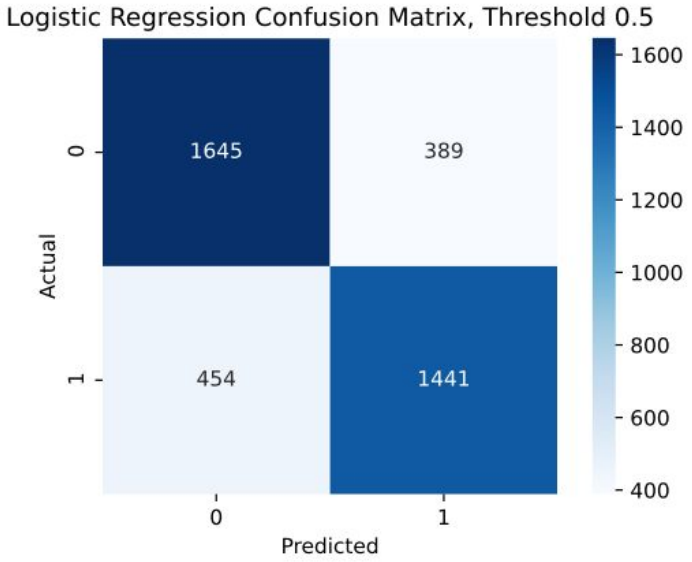


Precision: 0.7874



Precision: 0.8603

Logistic Regression



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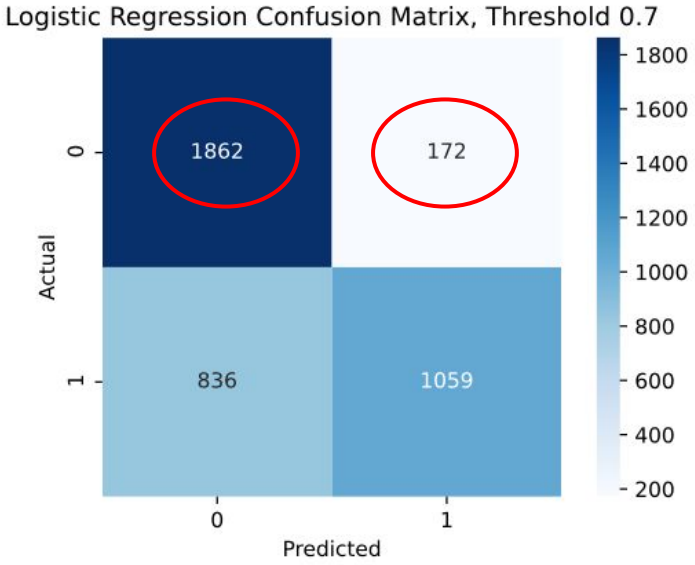
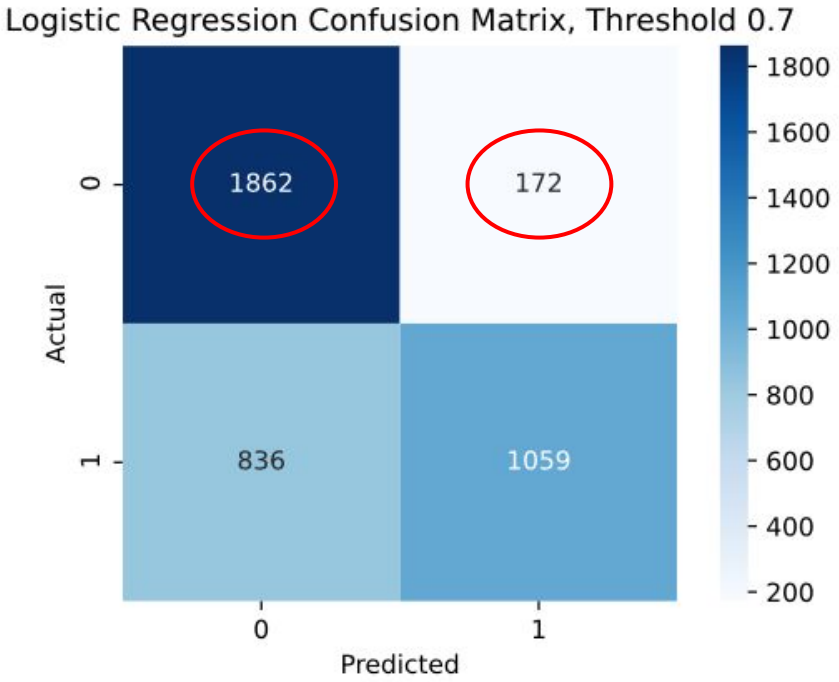


Precision: 0.8603

Logistic Regression Model, Threshold 0.7
(fewest false positives, more true negatives)

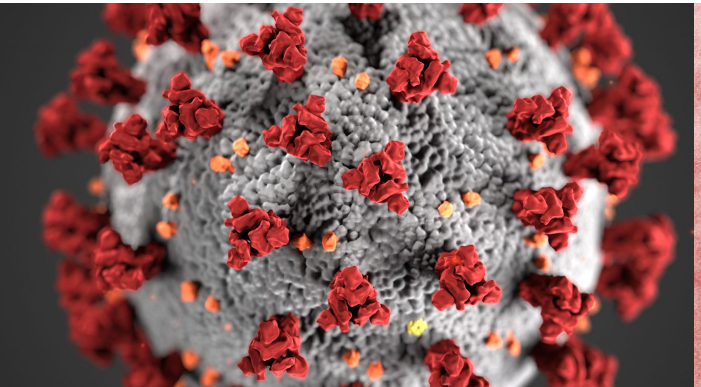
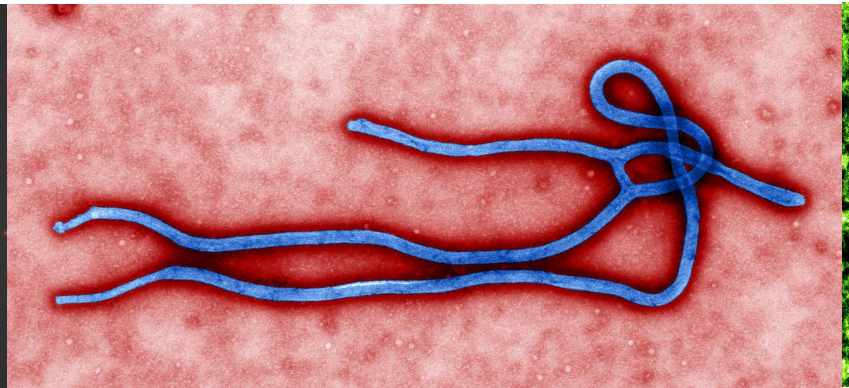
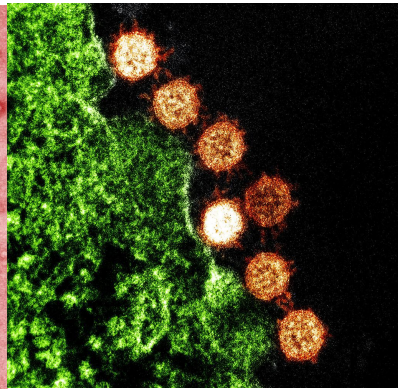
Top Candidate: Logistic Regression, Threshold 0.7



Predicts more true negatives to focus campaign on, minimizes false positives

Next Steps

- Further refine model; decrease false positives even more?
- Apply refined model to test data set

Thank you!
(and please wash your hands!)