

# Flu Shot Learning: Predicting H1N1 and Seasonal Flu Vaccination

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## Abstract—

### I. INTRODUCTION

Pandemics have rarely taken center stage in the way they have recently with COVID-19 in 2020. Vaccines are a key public health measure used to fight infectious diseases like COVID-19. They provide immunization for individuals, and enough immunization in a community can further reduce the spread of diseases through "herd immunity." We will look at a recent historical pandemic, also of a highly infectious respiratory disease: the 2009 H1N1 influenza pandemic. In 2009, the H1N1 influenza virus, also known as swine flu, caused a global pandemic that was estimated to have resulted in 150,000 to 600,000 deaths worldwide. A vaccine for H1N1 became available in October of that year. In this study, we developed a machine learning model to help estimate the probability of a person receiving seasonal and H1N1 vaccines. The model was developed using data from the National 2009 H1N1 Flu Survey (NHFS) in the United States, which included 36 attributes and was collected through telephone interviews. The model used in this study was a gradient boosting classifier, which was evaluated on separate test data provided by the NHFS using the area under the Receiver Operating Characteristic (ROC) curve as a performance metric. After necessary parameter tuning, the model was able to achieve a score of 0.8415.

### II. DATA SET ANALYSIS

#### A. Class Balance

#### B. Feature Correlation

### III. MODEL PIPELINE

### IV. PERFORMANCE METRICS

### V. MODELS

### VI. RESULTS

### VII. CONCLUSION

### VIII. REFERENCE EXAMPLES

- *Basic format for books:*  
J. K. Author, "Title of chapter in the book," in *Title of His Published Book*, xth ed. City of Publisher, (only U.S. State), Country: Abbrev. of Publisher, year, ch. x, sec. x, pp. xxx–xxx.  
See [1], [2].
- *Basic format for periodicals:*  
J. K. Author, "Name of brief," *Abbrev. Title of Periodical*, vol. x, no. x, pp. xxx–xxx, Abbrev. Month, year, DOI. 10.1109.XXX.123456.  
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- *Basic format for reports:*  
J. K. Author, "Title of report," Abbrev. Name of Co., City of Co., Abbrev. State, Country, Rep. xxx, year.  
See [6], [7].
- *Basic format for handbooks:*  
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See [10]– [13].
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See [14]– [16].
- *Basic format for briefs presented at conferences (when available online):*  
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- *Basic format for reports and handbooks (when available online):*  
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- *Basic format for patents:*  
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  - 1) J. K. Author, "Title of thesis," M.S. thesis, Abbrev. Dept., Abbrev. Univ., City of Univ., Abbrev. State, year.
  - 2) J. K. Author, "Title of dissertation," Ph.D. dissertation, Abbrev. Dept., Abbrev. Univ., City of Univ., Abbrev. State, year.

See [25], [26].
- *Basic format for the most common types of unpublished references:*
  - 1) J. K. Author, private communication, Abbrev. Month, year.
  - 2) J. K. Author, "Title of brief," unpublished.
  - 3) J. K. Author, "Title of brief," to be published.

See [27]–[29].
- *Basic formats for standards:*
  - 1) *Title of Standard*, Standard number, date.
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See [30], [31].
- *Article number in reference examples:*  
See [32], [33].
- *Example when using et al.:*  
See [34].

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