# Disinformation/Fake News Detection:

## Detecting Fake News During The Year of COVID-19 and US Presidential Election

INFSCI2160

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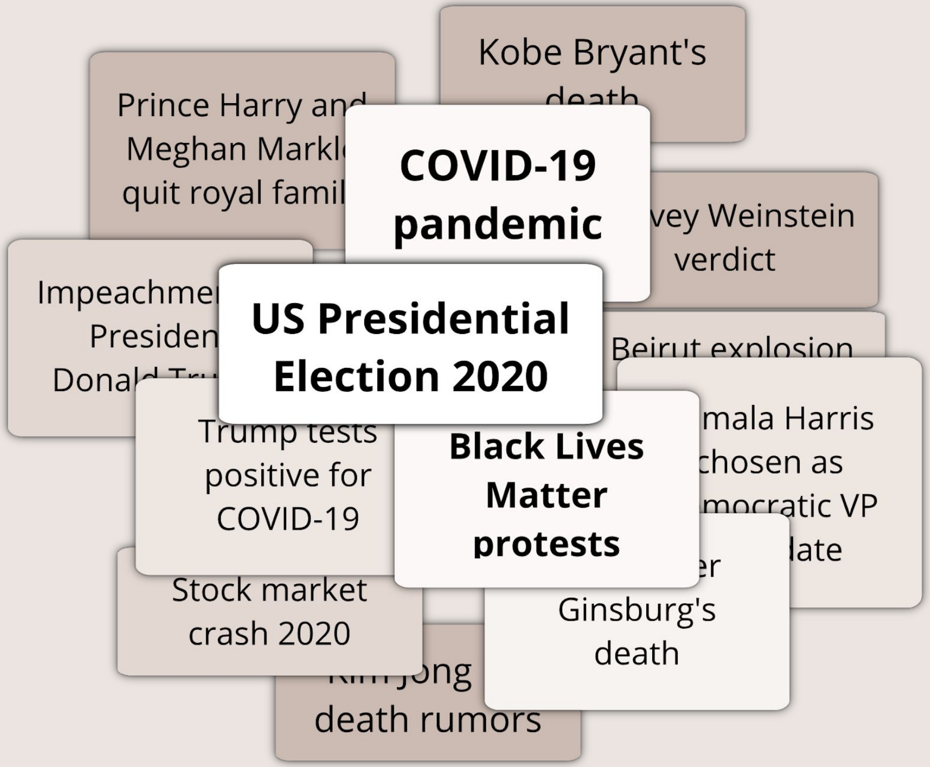
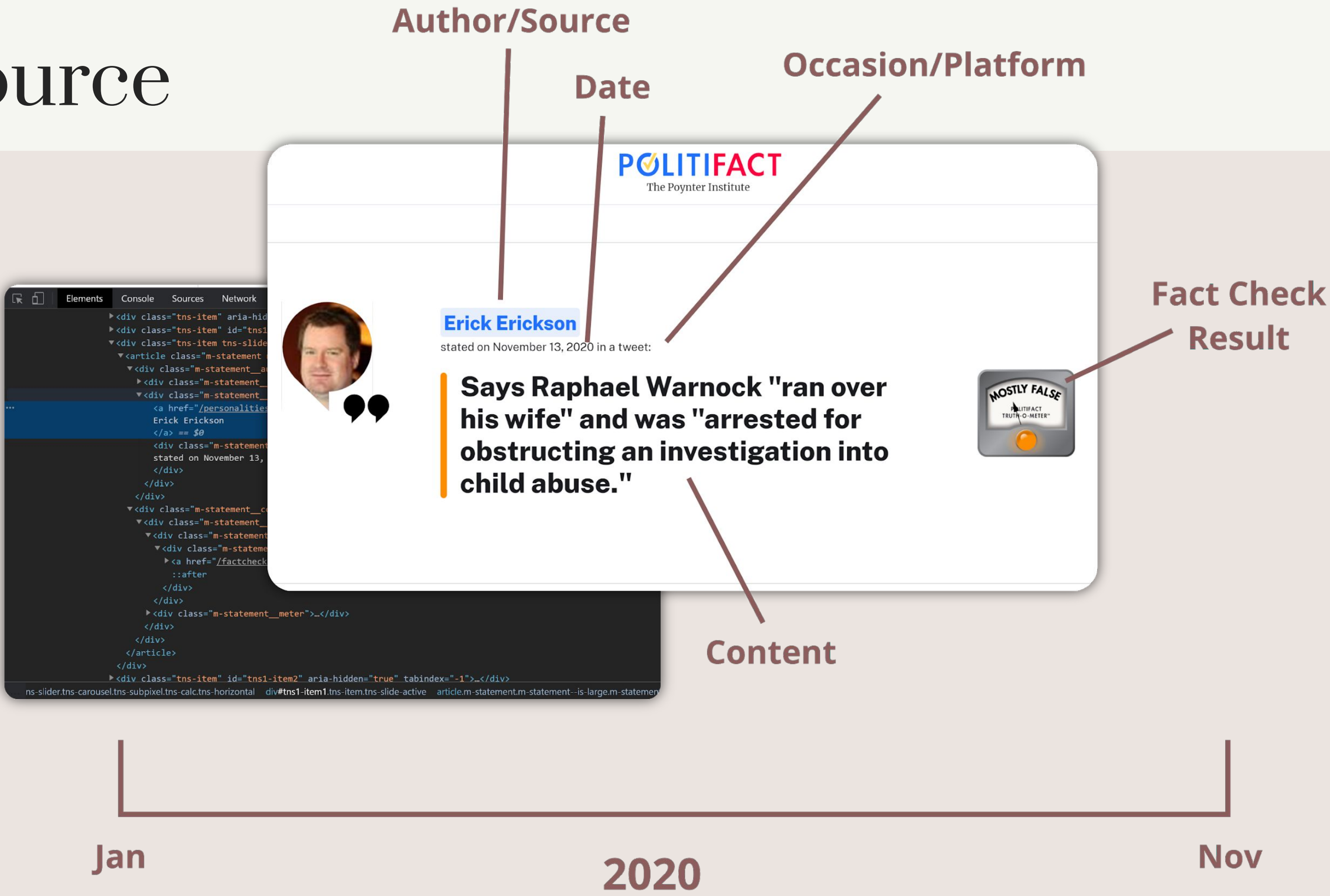
# Background & Aims

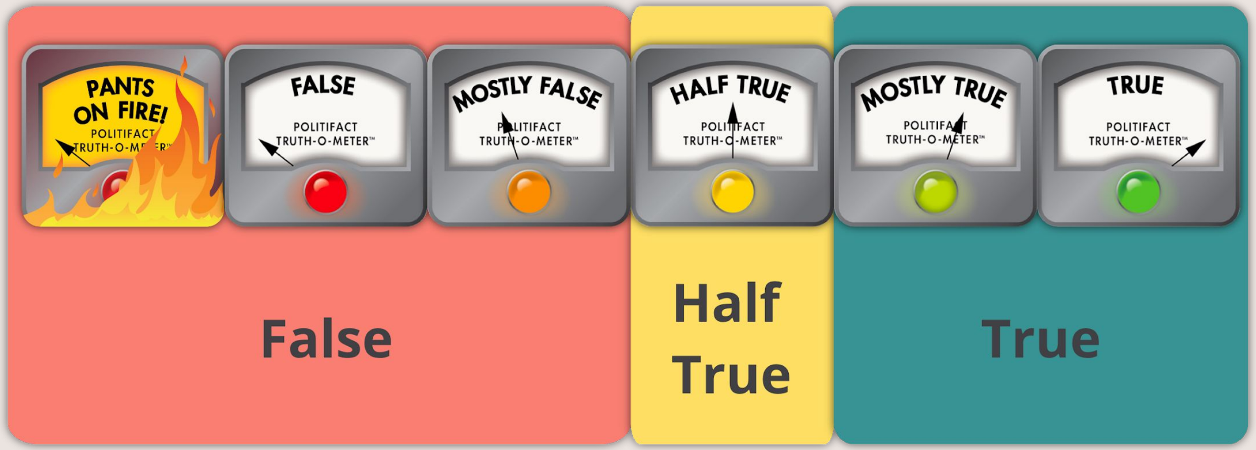


# Data Source



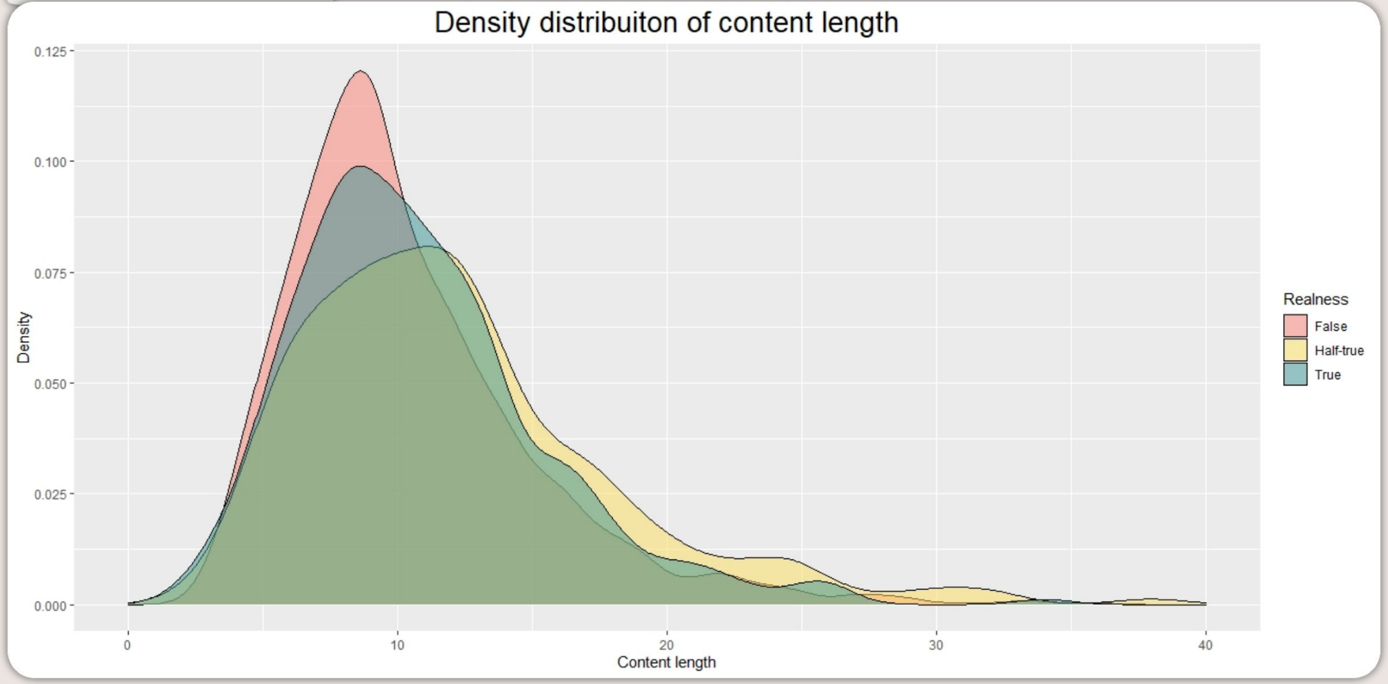
Author/Source
Date
Occasion/Platform
Fact Check
Result
Content
POLITIFACT
The Poynter Institute
Erick Erickson
stated on November 13, 2020 in a tweet:
Says Raphael Warnock "ran over his wife" and was "arrested for obstructing an investigation into child abuse."
MOSTLY FALSE
Elements
Console
Sources
Network
Jan
2020
Nov

# Authenticity Level



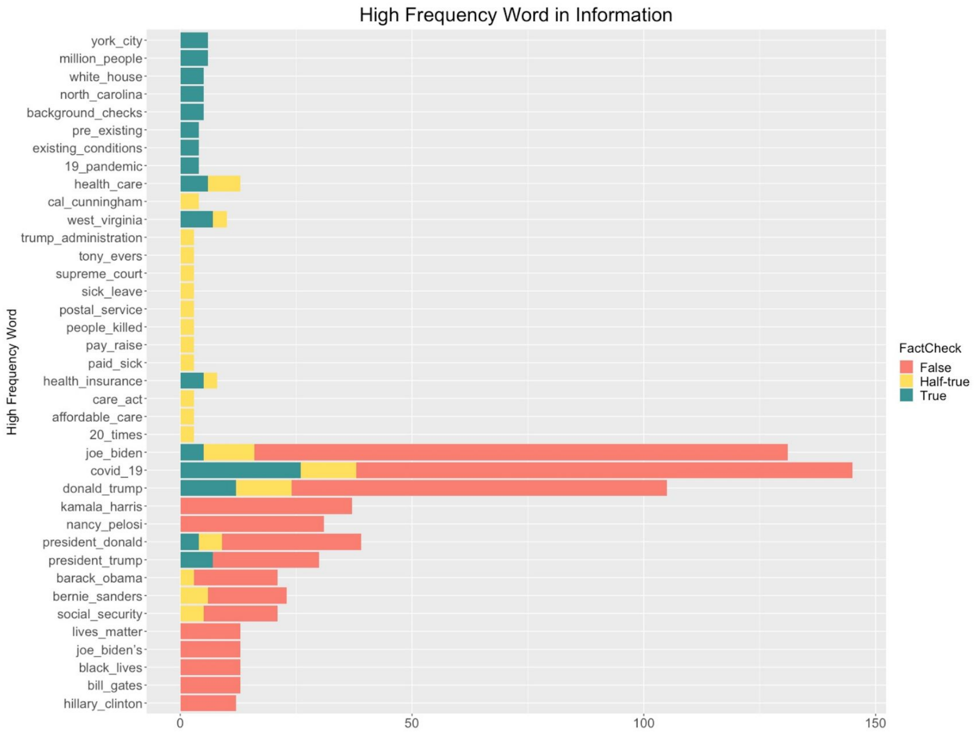
# Exploratory Analysis - Content Length

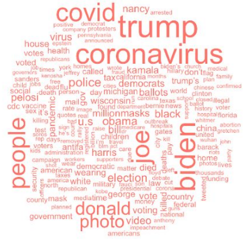
Content Length

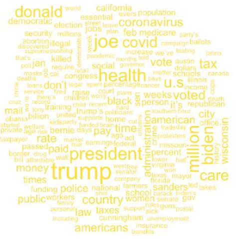


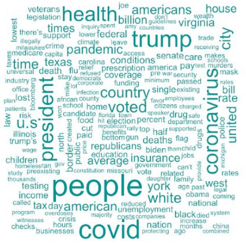
# Exploratory Analysis - Hot Words

Content Length | DTM



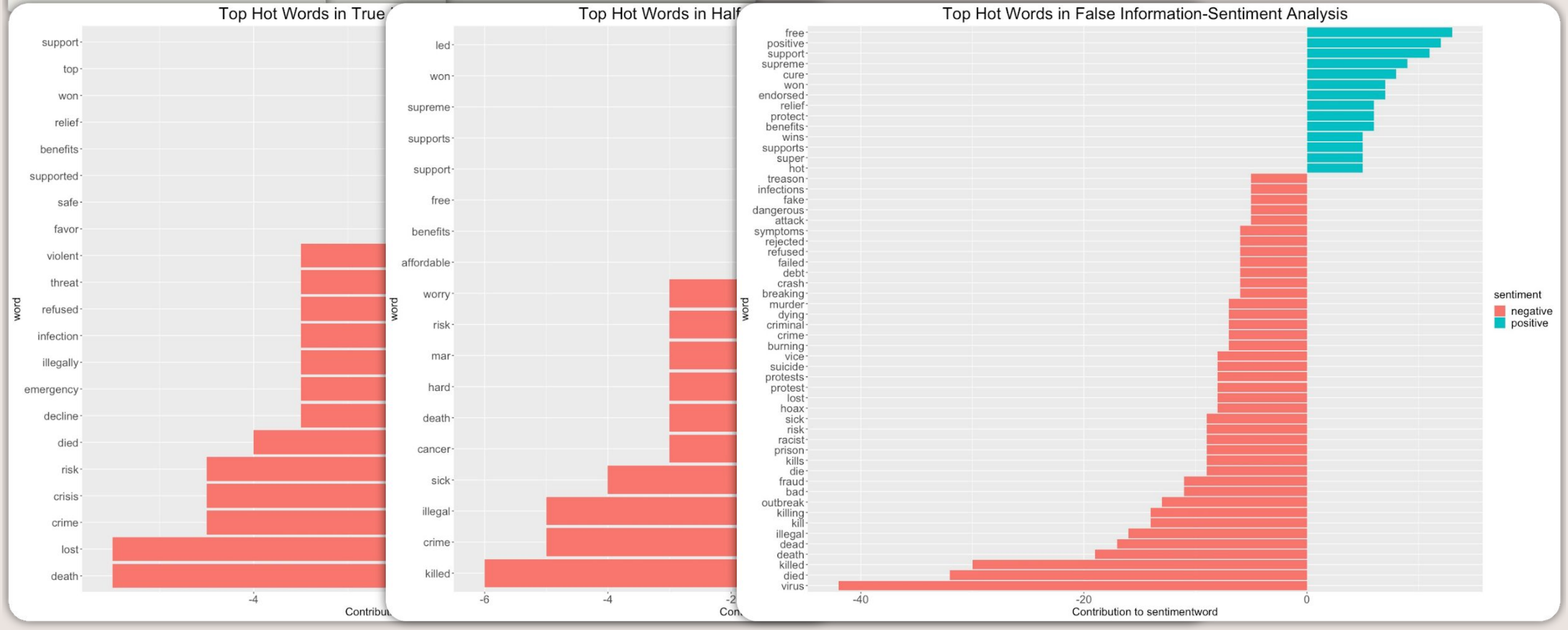



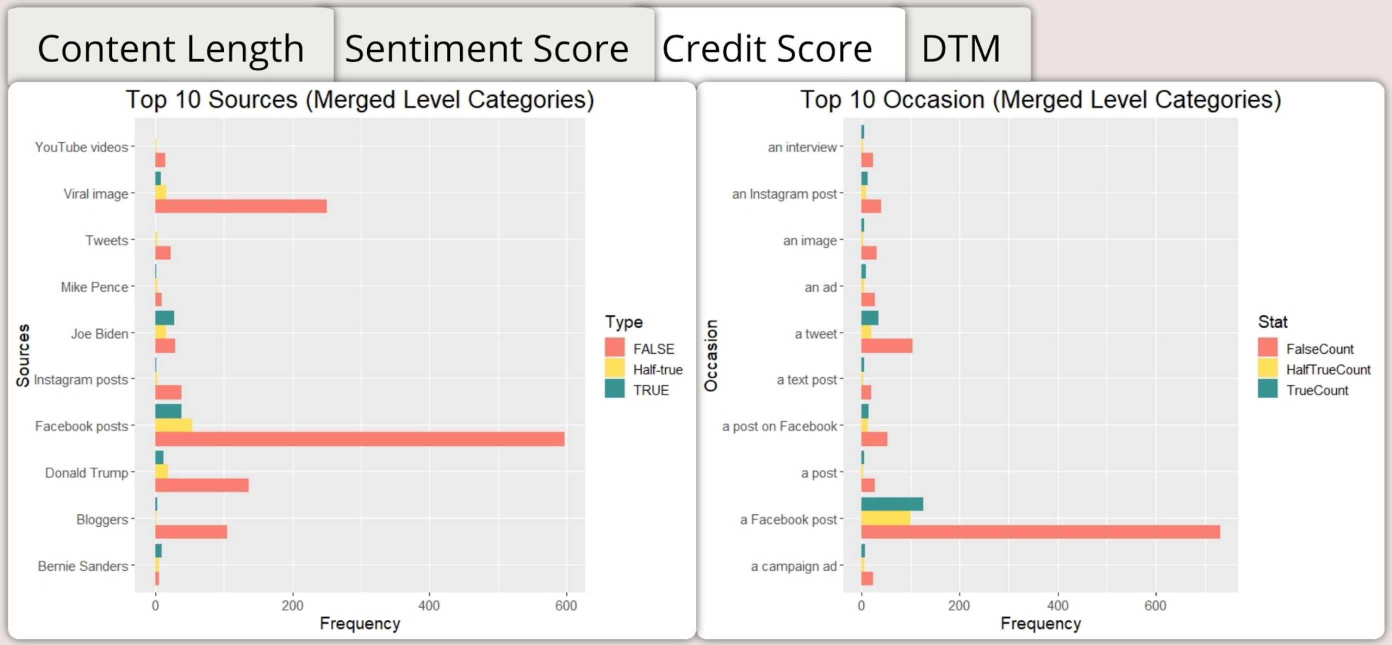
# Exploratory Analysis - Sentiment

Content Length | DTM | Sentiment Score



# Exploratory Analysis - Credit Scores

- **INNOVATION**
- Historical Posts



# Data Cleaning

- Check the dimensions and summary of the dataset
- Remove missing values
- Convert the class of variables

# Data Processing

Document-term Matrix

- Convert all texts to lowercase
- Remove stop words
- Remove numbers
- Remove punctuation
- Remove special characters, like @, ...
- Stem words into roots format

Filter out low frequency words in the document-term matrix

# Data Processing

Calculate the content length:

Content length = rowSums(content_dtm_matrix)

# Data Processing

ANOVA result of the variable content_length:

```
> summary(data1AOV)
                   Df Sum Sq Mean Sq F value   Pr(>F)    
data1$FactCheck     2    669   334.4   14.89 3.79e-07 ***
Residuals        2120  47617    22.5                     
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> 
```

```
> TukeyHSD(data1AOV)
  Tukey multiple comparisons of means
    95% family-wise confidence level

Fit: aov(formula = data1$content_length ~ data1$FactCheck)

$`data1$FactCheck`
                      diff        lwr        upr     p adj
Half-true-FALSE  1.7795262  1.0072595  2.5517928 0.0000002
TRUE-FALSE       0.4518946 -0.2226296  1.1264187 0.2583586
TRUE-Half-true  -1.3276316 -2.2723393 -0.3829239 0.0028642
```

# Data Processing

Calculate the sentiment score:

- Get sentiment dictionary by get_sentiments("afinn")
- Join the term and scientiment list
- Multiply the frequency of terms by its sentiment score
- Use rowSums() to get the sentiment score of every document

# Classification

- First, the data was split into training and testing groups then resampled using 10-fold Cross Validation

- Three classification models were trained on the training set:
  - Random Forest
  - K-Nearest Neighbor
  - Support Vector Machine
    - Caret package was used to train the models

# Evaluation

- Predictions were made using each model on the testing data set

- Each model was evaluated using a confusion matrix
    - Used to assess accuracy, specificity & sensitivity

- This process remained identical for all datasets (1-4)

# Evaluation Results (Dataset 1)
## 3 - level with credit score

### Random Forest

**Sensitivity:**
False - 0.9894
Half-true- 0.27273
True - 0.52874

**Specificity:**
False - 0.4837
Half-true- 1.00000
True - 0.96840

**Accuracy:**
False - 0.7365
Half-true- 0.63636
True - 0.74857

Overall accuracy: 0.8245

### KNN

**Sensitivity:**
False - 0.9257
Half-true-0.15152
True - 0.4368

**Specificity:**
False - 0.4967
Half-true- 0.96552
True -0.9097

**Accuracy:**
False - 0.7112
Half-true- 0.55852
True -0.6732

Overall accuracy: 0.7491

### SVM

**Sensitivity:**
False - 0.8621
Half-true- 0.18182
True - 0.36782

**Specificity:**
False - 0.4706
Half-true- 0.93750
True - 0.88488

**Accuracy:**
False - 0.6663
Half-true- 0.55966
True - 0.62635

Overall accuracy: 0.6962

# Evaluation Results (Dataset 3)
## 3 - level without credit score

### Random Forest

**Sensitivity:**
False - 1.0000
Half-true-0.0000
True -0.0000

**Specificity:**
False - 0.0000
Half-true-1.0000
True -1.0000

**Accuracy:**
False - 0.5000
Half-true-0.5000
True -0.5000

Overall accuracy: 0.7113

### KNN

**Sensitivity:**
False - 0.93899
Half-true-0.0000
True - 0.057471

**Specificity:**
False - 0.05882
Half-true-0.991379
True -0.948081

**Accuracy:**
False - 0.49891
Half-true-0.495690
True -0.502776

Overall accuracy: 0.6774

### SVM

**Sensitivity:**
False - 0.8488
Half-true- 0.13636
True -0.32184

**Specificity:**
False - 0.3987
Half-true-0.94181
True -0.87810

**Accuracy:**
False - 0.6237
Half-true-0.53909
True -0.59997

Overall accuracy:  0.6736

# Evaluation Results (Dataset 2)
## 6 - level with credit score

### Random Forest

**Sensitivity:**
False -0.9636
Half-true-0.3939
Mostly-False- 0.33333
Mostly-True-0.41667
Pants-Fire-0.34146
True- 0.58974

**Specificity:**
False 0.6258-
Half-true-0.97629
Mostly-False-0.96703
Mostly-True-0.97925
Pants-Fire-0.93973
True-0.96538

**Accuracy:**
False - 0.7947
Half-true-0.68512
Mostly-False-0.65018
Mostly-True-0.69796
Pants-Fire-0.64060
True-0.77756

Overall accuracy: 0.6302

### KNN

**Sensitivity:**
False - 0.8682
Half-true-0.21212
Mostly-False-0.14667
Mostly-True-0.14583
Pants-Fire-0.32927
True- 0.30769

**Specificity:**
False - 0.6323
Half-true-0.92888
Mostly-False-0.92747
Mostly-True-0.96473
Pants-Fire-0.90625
True-0.94094

**Accuracy:**
False -0.7502
Half-true-0.57050
Mostly-False-0.53707
Mostly-True-0.55528
Pants-Fire-0.61776
True-0.62431

Overall accuracy: 0.4943

### SVM

**Sensitivity:**
False - 0.6409
Half-true-0.16667
Mostly-False-0.14667
Mostly-True-0.20833
Pants-Fire-0.21951
True:0.23077

**Specificity:**
False - 0.4516
Half-true-0.91810
Mostly-False-0.94286
Mostly-True-0.93154
Pants-Fire-0.89732
True-0.96538

**Accuracy:**
False - 0.5463
Half-true-0.54239
Mostly-False-0.54476
Mostly-True-0.56993
Pants-Fire-0.55842
True-0.59807

Overall accuracy: 0.3774

# Evaluation Results (Dataset 4)
## 6 - level without credit score

### Random Forest

**Sensitivity:**
False -1.0000
Half-true-0.0000
Mostly-False-0.0000
Mostly-True-0.0000
Pants-Fire-0.0000
True- 0.0000

**Specificity:**
False - 0.0000
Half-true-1.0000
Mostly-False-1.0000
Mostly-True-1.0000
Pants-Fire-1.0000
True-1.0000

**Accuracy:**
False - 0.5000
Half-true- 0.5000
Mostly-False- 0.5000
Mostly-True- 0.5000
Pants-Fire- 0.5000
True- 0.5000

Overall accuracy: 0.4151

### KNN

**Sensitivity:**
False - 0.5682
Half-true-0.03030
Mostly-False-0.08000
Mostly-True-0.04166
Pants-Fire-0.41463
True-0.025641

**Specificity:**
False -0.4806
Half-true-0.976293
Mostly-False-0.94066
Mostly-True-0.94398
Pants-Fire-0.72098
True-0.981670

**Accuracy:**
False - 0.5244
Half-true-0.503298
Mostly-False-0.51033
Mostly-True-0.49282
Pants-Fire-0.56781
True- 0.503656

Overall accuracy: 0.3208

### SVM

**Sensitivity:**
False - 0.6409
Half-true-0.16667
Mostly-False-0.14667
Mostly-True-0.20833
Pants-Fire- 0.21951
True-0.23077

**Specificity:**
False - 0.4516
Half-true-0.91810
Mostly-False-0.94286
Mostly-True-0.93154
Pants-Fire-0.89732
True-0.96538

**Accuracy:**
False - 0.5463
Half-true-0.54239
Mostly-False-0.54476
Mostly-True-0.56993
Pants-Fire-0.55842
True-0.59807

Overall accuracy: 0.3774

# Results Summary

- Best model was random forest using dataset 1 (3 - level with credit score)
    - Best performance across all models in datasets that included credit score (both 3-level and 6-level)

- Worst performance was KNN using dataset 4 (6 - level without credit score)
    - Models using datasets that included 6-levels performed worse than datasets that included 3-levels
    - Random forest likely had issues in datasets without credit score (scores of 0 and 1 in sensitivity and specificity is unlikely)