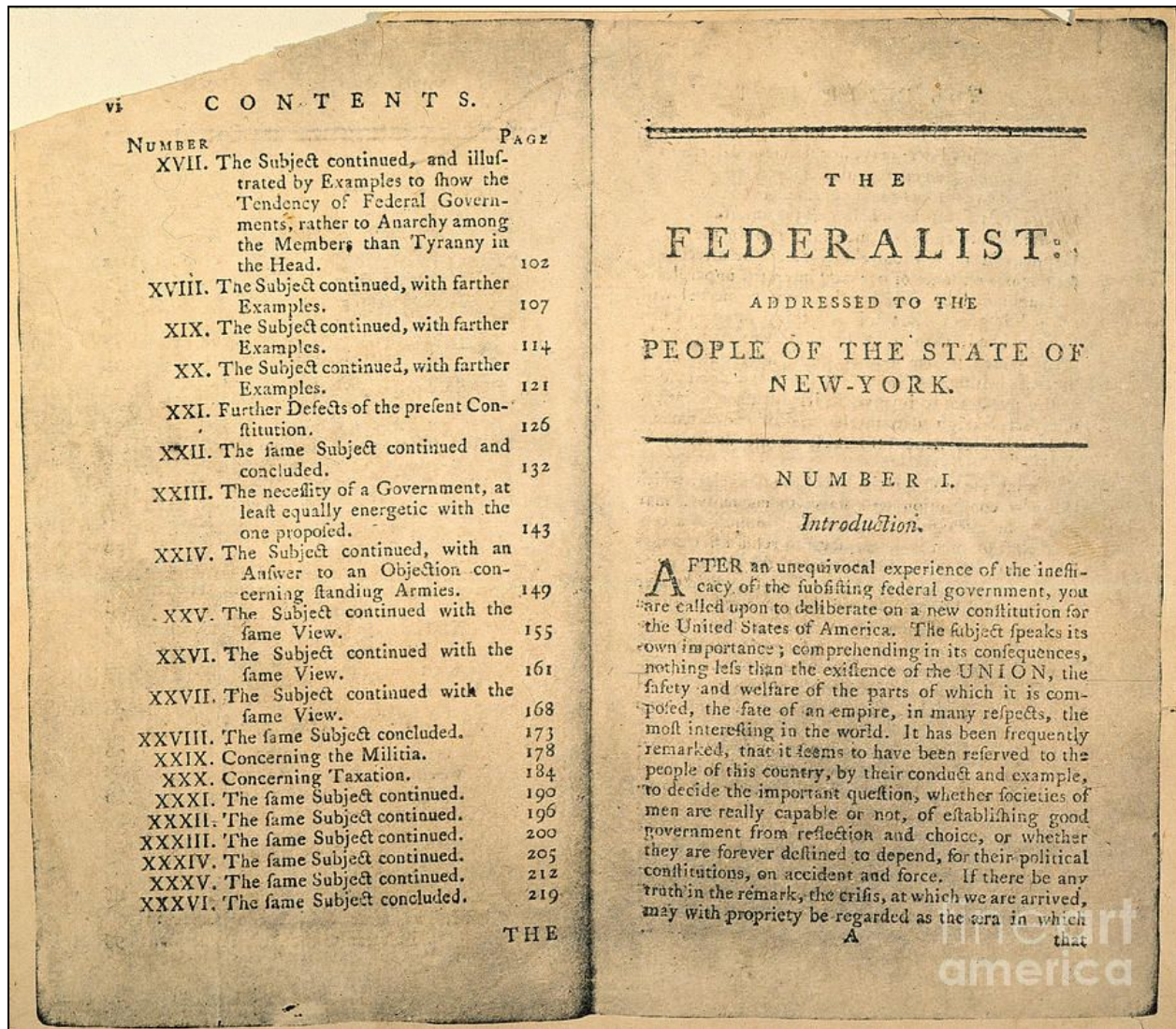


# THE DISPUTED PAPERS

## HAMILTON VS MADISON



## Introduction

The *Federalist Papers* are a collection of essays published between October 1787 and April 1788. They were intended to promote ratification of the then-new U.S. Constitution.

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Following a series of widely disseminated letters criticizing this document, three of its architects set out to defend the Constitution. Alexander Hamilton, James Madison, and John Jay decided to produce anonymously-written articles of their own, responding to popular criticisms and explaining the merits of the new framework. Originally intended to consist of around 25 documents, The Federalist Papers eventually totaled 85. Today, The Federalist Papers remain hugely influential in the field of political scholarship.

While the public eventually uncovered the identities of the three men, the authorship of the individual essays in The Federalist Papers remains a matter of some controversy. Following Hamilton's death, reports suggested that he had written the vast majority of the essays, sparking a debate about each writer's contributions. Years of scholarship led to a general consensus about most of The Federalist Papers, but the authorship of twelve essays remains disputed. Was Hamilton, in fact, the sole author of these essays? Was there another sole author? Or were they the result of collaboration between the three men?

## **Analysis and Models**

### **DATA PREPARATION**

The data was prepared outside of R, in Excel. The author of this paper understands that this is a disadvantage to her future self, however, her current self needed sleep and this was the quickest way she thought to brute force this assignment. In Excel, the papers by John Jay were removed as well as the papers that written collaboratively by both Hamilton and Madison. Then the data was reduced to make an even number of Hamilton papers and Madison papers. Since Madison only wrote fifteen papers definitively, Hamilton's papers were also reduced to fifteen (meaning 36 were removed for the purpose of this analysis). Then, the data was split into "training data" and "testing data." For the training data, ten papers by each author were used. For the training data, five papers by each author were used, in addition to the eleven disputed papers included in this dataset. The training data kept the author's name, the testing data did not.

### **BUILDING THE DECISION TREE MODEL**

First, the data was loaded into R as two separate datasets, "trainingdata" and "testdata." Then, a Weka filter was created (using RWeka) to turn the dataset from numeric to nominal.

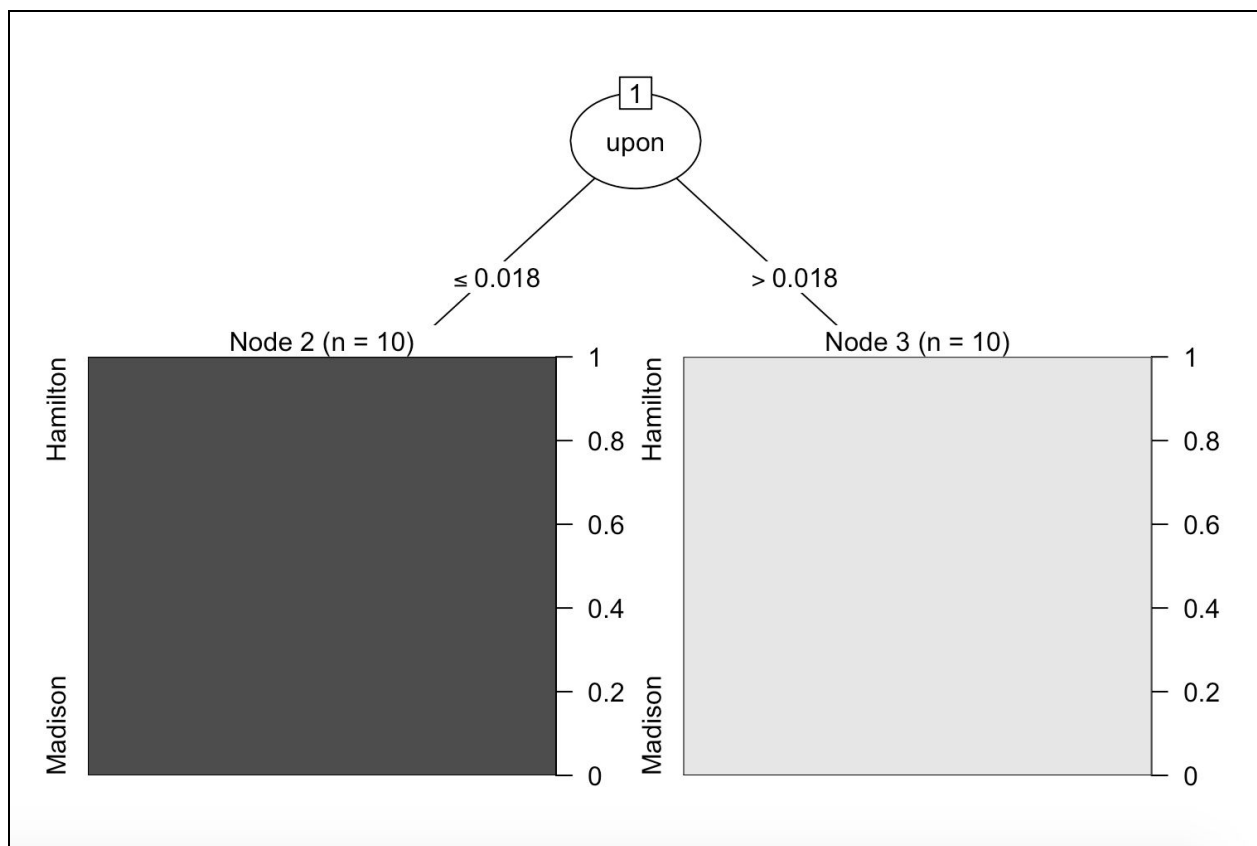
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The filter was applied to both datasets. Another Weka filter was created to replace the missing values. This was also applied to the two datasets. Then, a decision tree model was built using J48. Despite googling and consulting with her classmates, the author continues to be mystified by what the “Weka Control” part of this algorithm means:

```
m = J48(author~., data=trainset, control=Weka_control(U=FALSE, M=2, C=0.5))
```

The author then tried to plot **m** and got the unhelpful visualization seen in **FIGURE 1**. The author is unsure why she did this or why she bothered to include this “tree” in her paper, other than the fact that it made her laugh for more reasons she doesn’t understand.

**FIGURE 1: Unhelpful “upon” tree**



Then, 10 fold cross validation was used to evaluate the model.

```
e <- evaluate_Weka_classifier(m, numFolds = 10, seed = 1, class = TRUE)
```

Results are shown in **FIGURE 2**.

**FIGURE 2: 10 Fold Cross Validation Results**

```
=== 10 Fold Cross Validation ===

=== Summary ===

Correctly Classified Instances      19          95    %
Incorrectly Classified Instances    1           5    %
Kappa statistic                    0.9
Mean absolute error                0.05
Root mean squared error            0.2236
Relative absolute error            10         %
Root relative squared error        44.7214 %
Total Number of Instances          20

=== Detailed Accuracy By Class ===

                TP Rate  FP Rate  Precision  Recall  F-Measure  MCC      ROC Area  PRC Area  Class
                1.000   0.100   0.909     1.000   0.952     0.905   0.950    0.909    Hamilton
                0.900   0.000   1.000     0.900   0.947     0.905   0.950    0.950    Madison
Weighted Avg.   0.950   0.050   0.955     0.950   0.950     0.905   0.950    0.930

=== Confusion Matrix ===

 a  b  <-- classified as
10  0 | a = Hamilton
 1  9 | b = Madison
```

The only part of this that the author really understands enough to speak intelligently about is the “Correctly Classified Instances” and the “Incorrectly Classified Instances.” Also, the Confusion Matrix as she is relating heavily to the word right before “Matrix.” From these mysterious results, the validation can be seen as being 95% accurate with only one mis-classified instance. Unlike with p-value, the author is unclear if 95% accuracy with only 20 instances is a strong enough parameter within which to make a case, but (spoiler alert!) when she applied this same model to the testing data, it correctly predicted and confirmed the story told by the clustering algorithms.

## PREDICTION

The penultimate step was to run the aforementioned algorithm against the test data. FIGURE 3 is the prediction results. The final step was to put the predictions alongside what we knew to be true, as seen in FIGURE 4.

**FIGURE 3: Results from R**

**FIGURE 4: Comparison of Results**

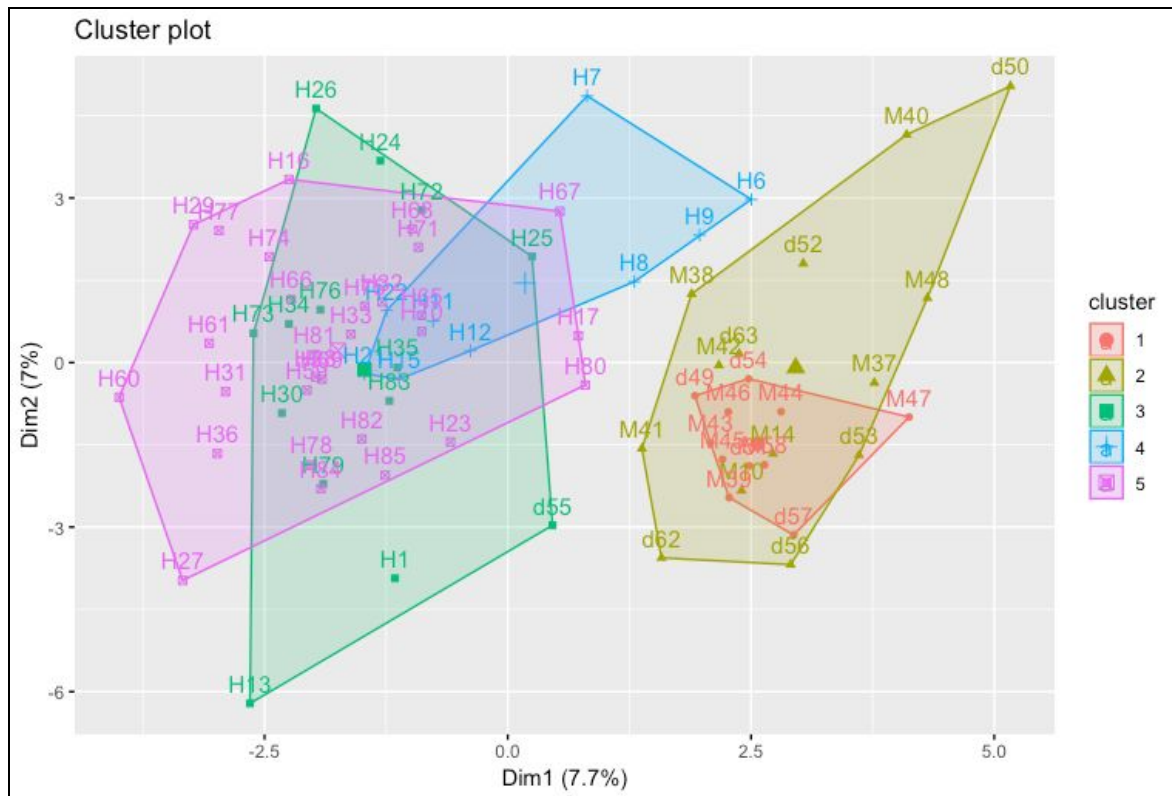
1	Madison
2	Madison
3	Madison
4	Madison
5	Madison
6	Madison
7	Madison
8	Madison
9	Madison
10	Madison
11	Madison
12	Madison
13	Madison
14	Madison
15	Madison
16	Madison
17	Hamilton
18	Hamilton
19	Hamilton
20	Hamilton
21	Hamilton

INPUT	OUTPUT	(CHECK)
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	dispt
?	Madison	Madison
?	Madison	Madison
?	Madison	Madison
?	Madison	Madison
?	Madison	Madison
?	Hamilton	Hamilton
?	Hamilton	Hamilton
?	Hamilton	Hamilton
?	Hamilton	Hamilton
?	Hamilton	Hamilton

**COMPARISON**

The results from the decision tree line up almost exactly with the results from the cluster analysis (FIGURE 5) further lending to the prediction algorithm’s credibility and accuracy.

**FIGURE 5: Cluster Plot from K-means Cluster Analysis**



## Results

From the decision tree results alone, it appears that Madison wrote the disputed papers. Looking at the decision tree prediction results alongside the cluster algorithm is further confirmation that Madison is most likely the author of the disputed papers. However, further study and additional analysis is encouraged. No one is surprised that author of this paper had very big plans for this decision tree analysis, however, due either to poorly managing her time or simply having far too much to do in far too few hours, she went with this MVP (minimum viable product).

## Conclusion

After analyzing the results gathered, the data suggests that Madison was, in fact, the author of the twelve disputed papers. This brings Madison's total to 29 essays. Hamilton, in turn, wrote 51, with Jay providing the remaining five. Though Hamilton remains the most prolific

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of the three authors, this conclusion greatly expands Madison's contribution to the documents and, therefore, this important moment in history.

This is not the first time The Federalist Papers have been analyzed in the hopes of uncovering this mystery. It's a popular subject in data analysis for good reason: The essays are a seminal part of American culture, both in the past and today. By identifying the authors of each of these influential works, we can reveal important truths about the beliefs and accomplishments of our founding fathers. In addition, the world can rest easy knowing Lin-Manuel Miranda was correct in his representation of Alexander Hamilton in his musical of the same name.