SAMUEL SHERMAN

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Congressional Bill Modeling

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Data Collection

- **Congress.gov**
  - Bill text

- **Sunlight Foundation API**
  - Bill data (JSON)
  - Votes data (JSON)

- **MongoDB**

- **Tools**
  - Pandas, pymongo, sklearn, nltk, numpy, scipy, AWS ec2

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Motivations

- **Percent of yes votes for a given party**
  - **Polarization in government**
- **Whether a bill will reach a vote**
  - **Important features in bills**
- **Latent topics in bill text**
  - **Prevalence over time**
  - **Distinguishable characteristics between presidencies**

Natural Language Processing

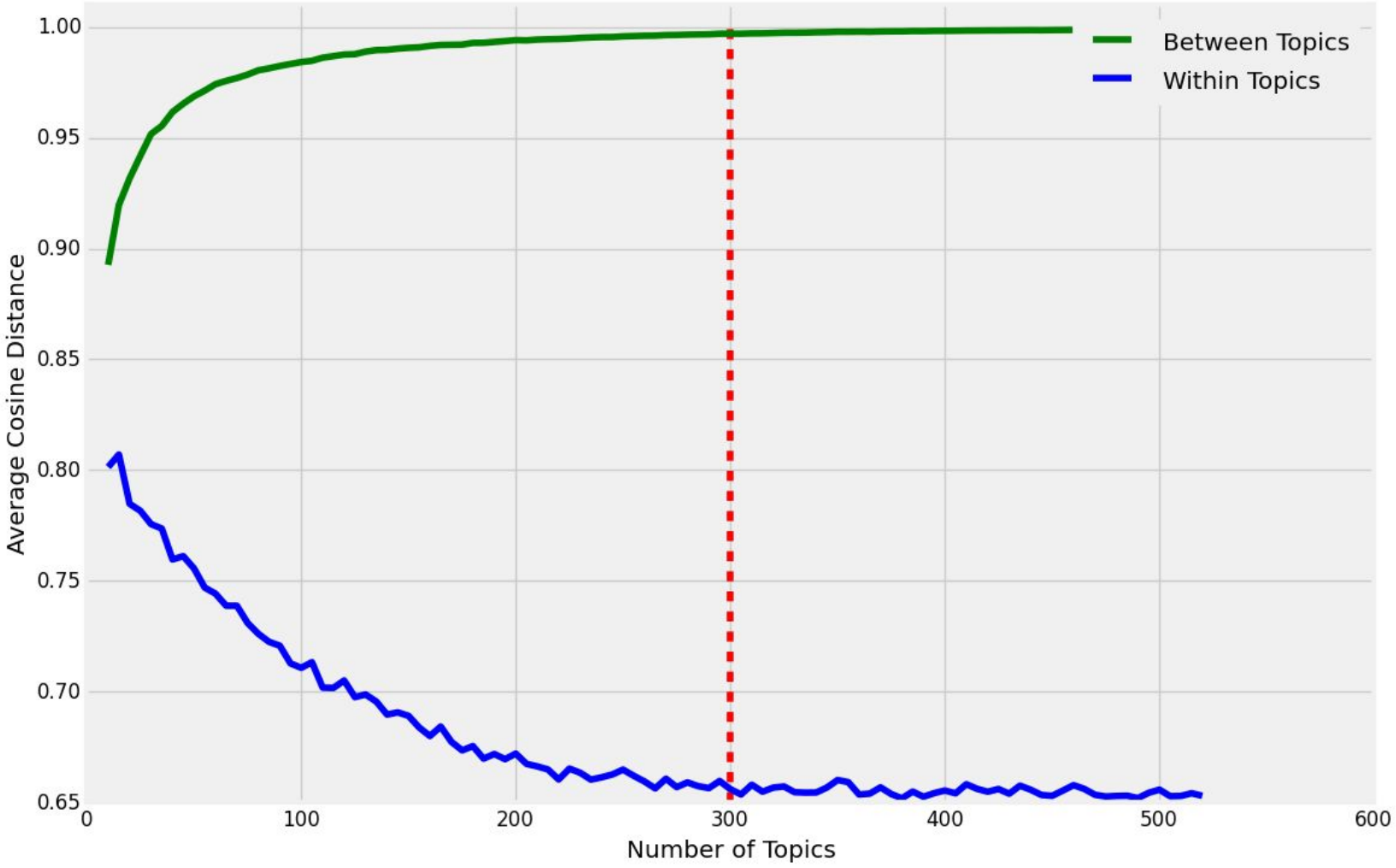
- **Stopwords**
  - Regular words: “and”, “the”, “be”, “it”, “there”
  - Congressional: “amendment”, “bill”, “quorum”, “act”
- **Maximum document frequency**
- **TFIDF**
  - TF: Frequency of words across a single document
  - IDF: Frequency of words across all documents

Non-Negative Matrix Factorization

- **Similarity within topics → high**

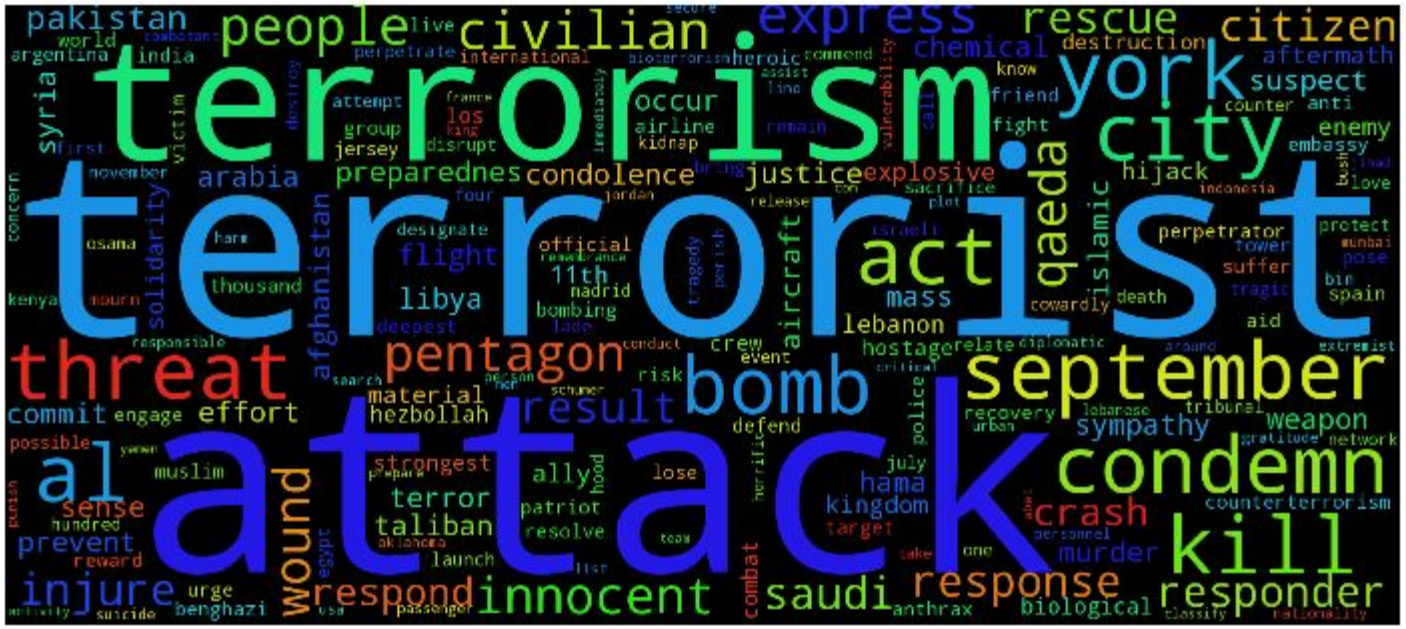
- **Similarity between topics → low**

Choosing K Topics



Measuring Topic Distance

Topic 110



Terrorism

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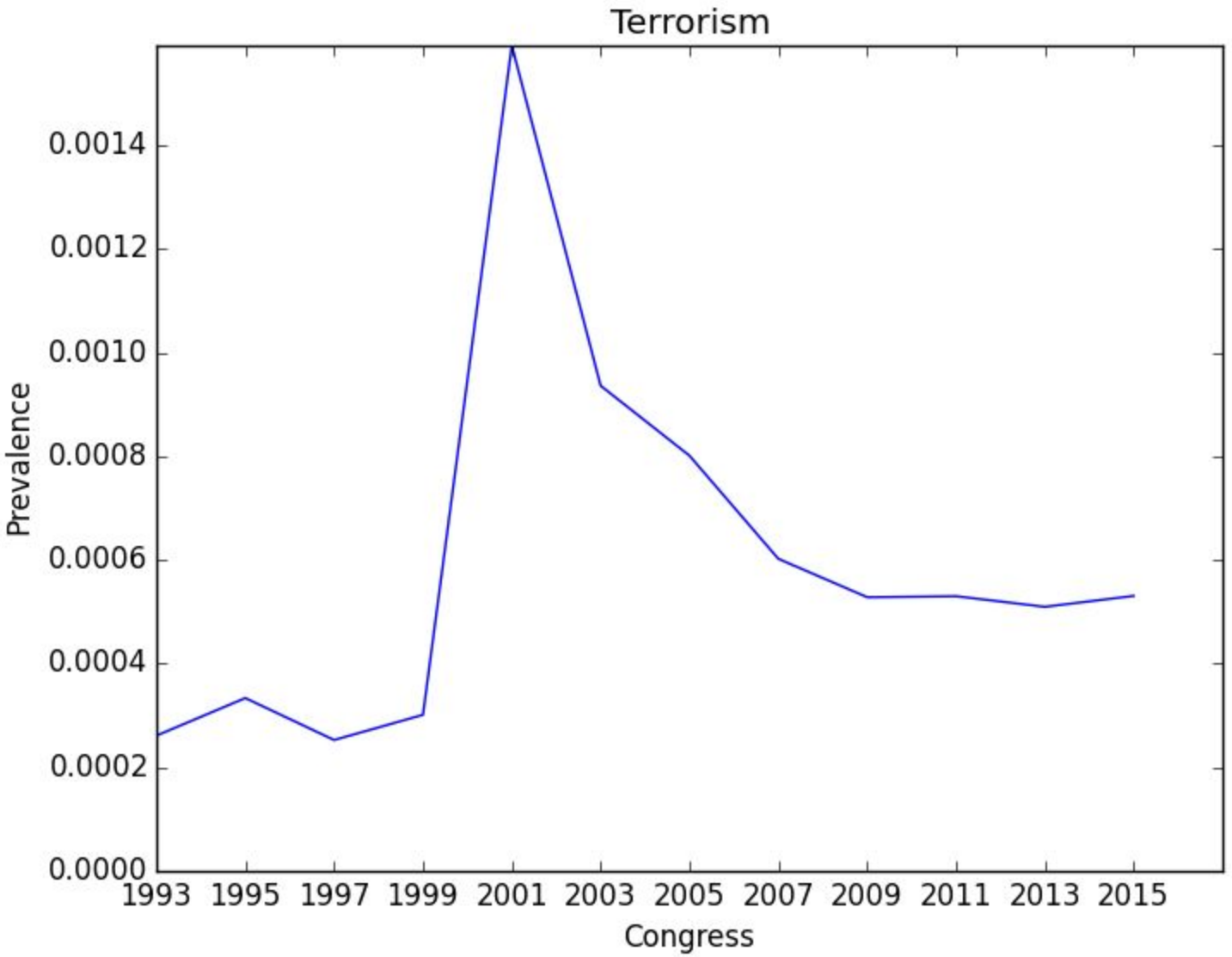
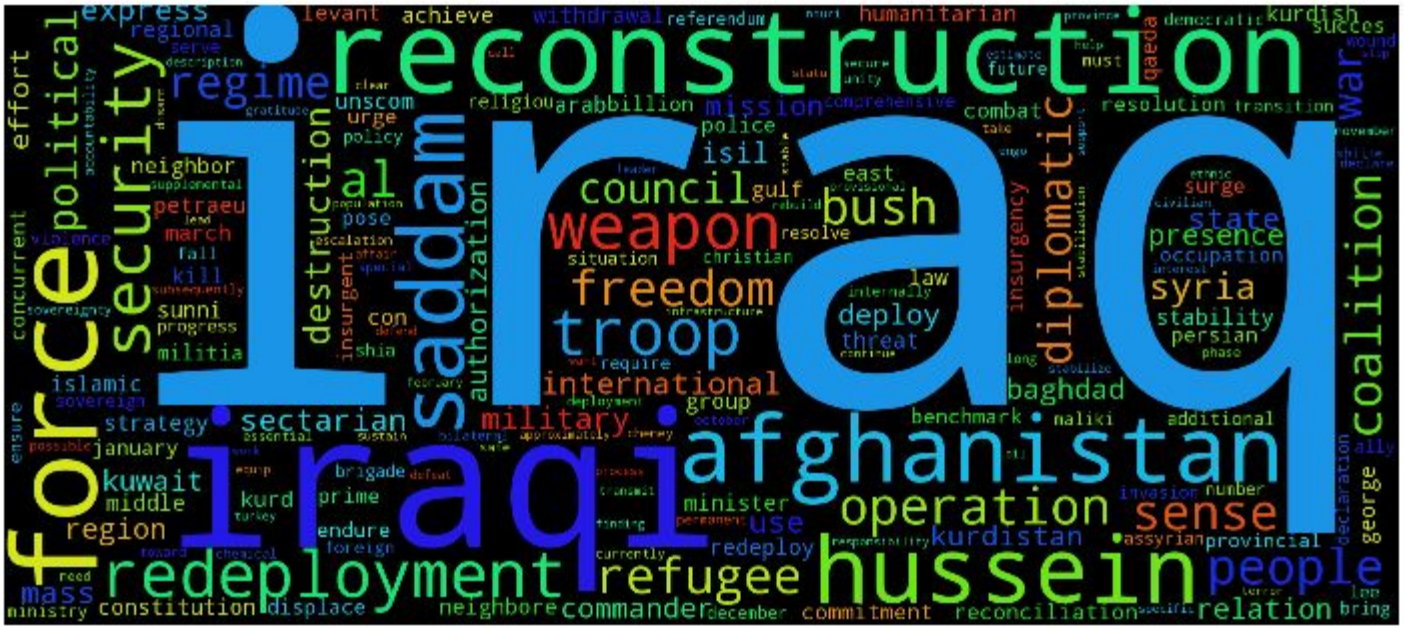


Terrorism in Bills Over Time

Topic 76



Iraq War

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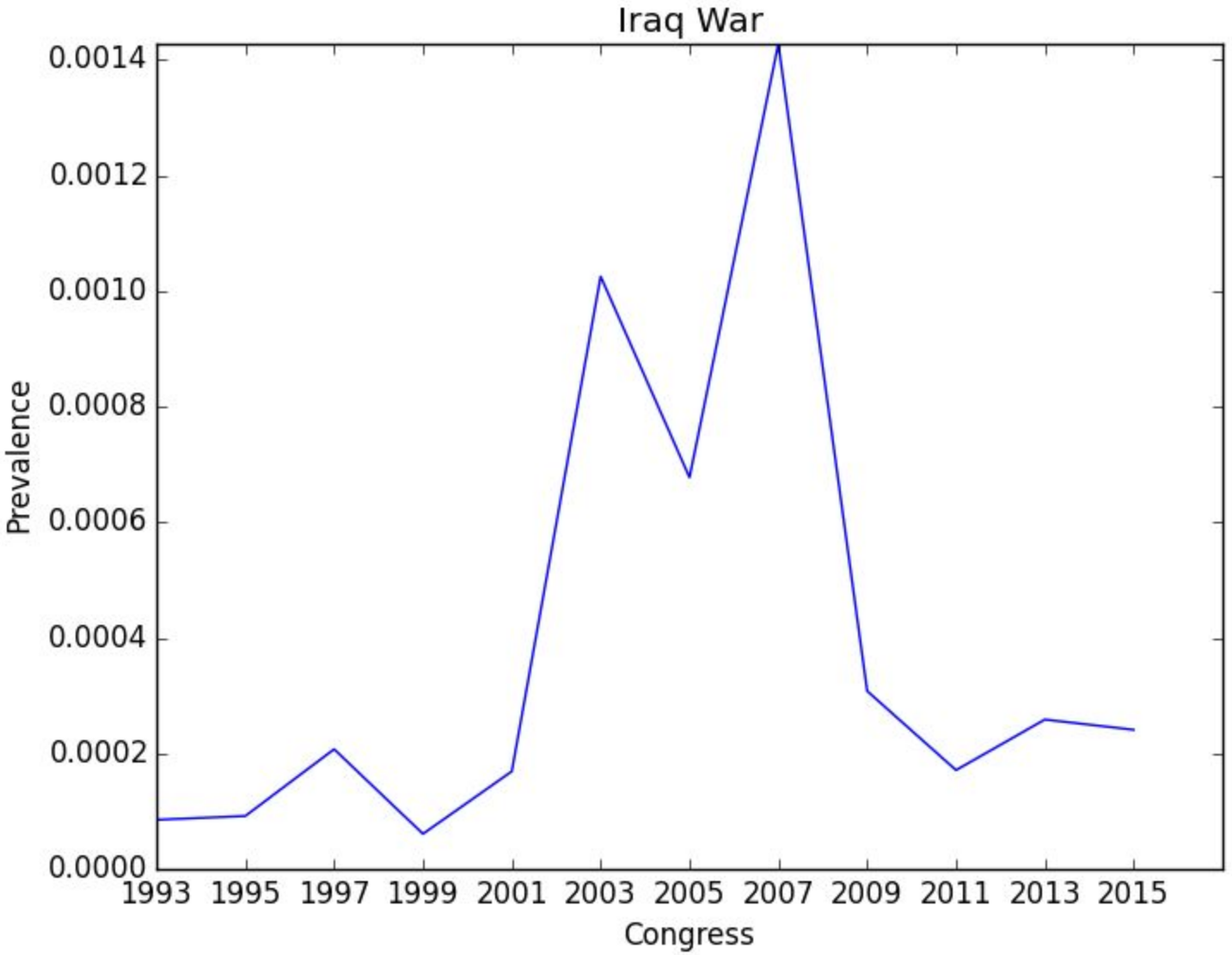
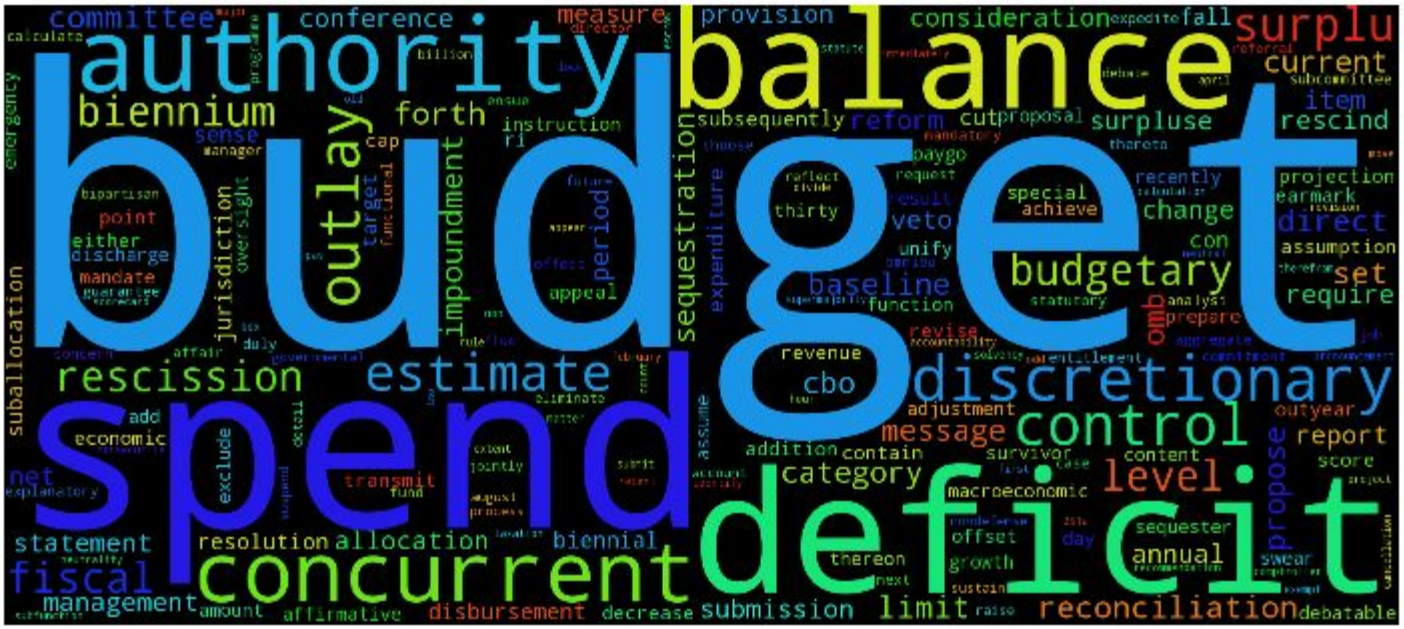
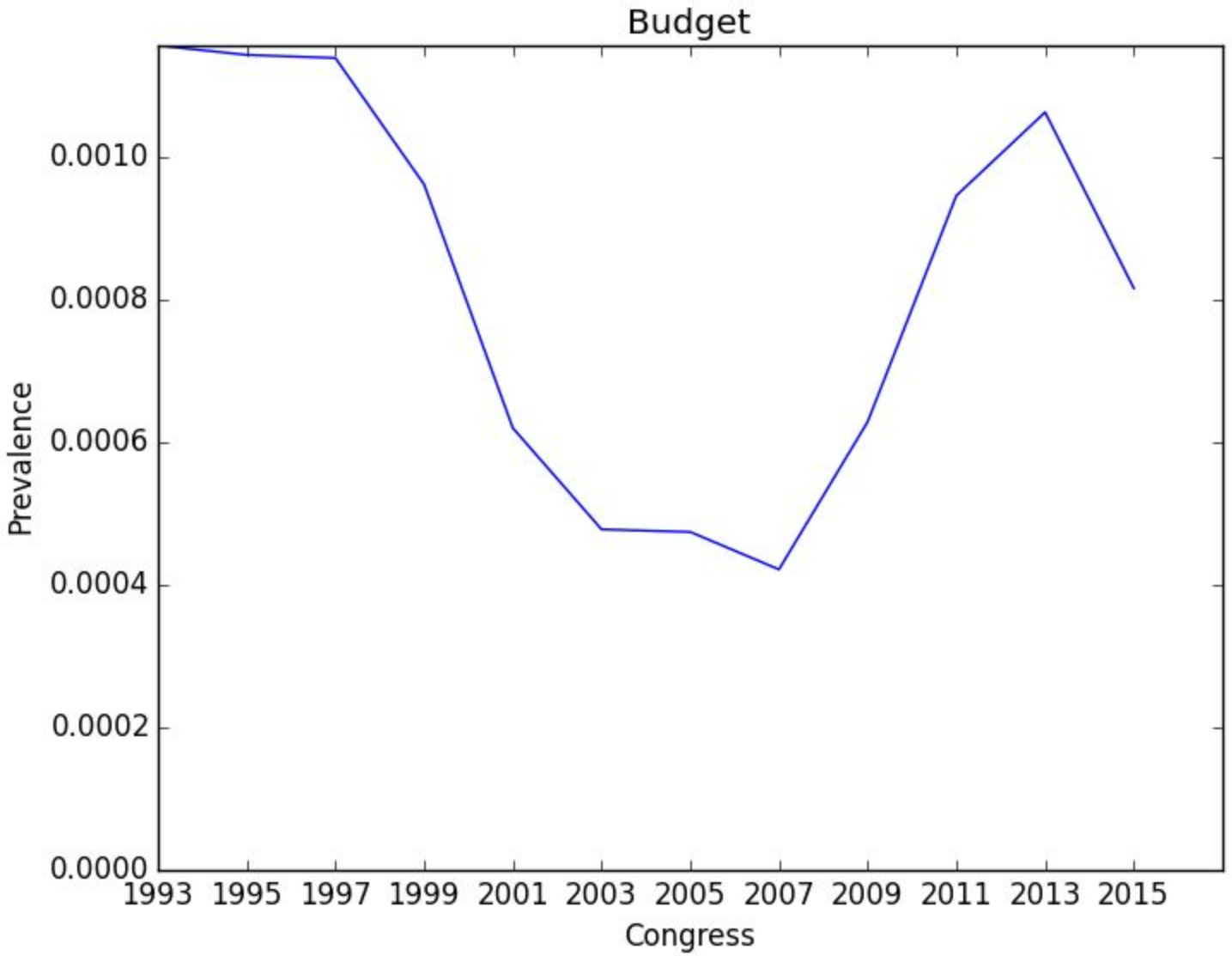


Iraq War in Bills Over Time

Topic 188



Budget



Budget in Bills Over Time

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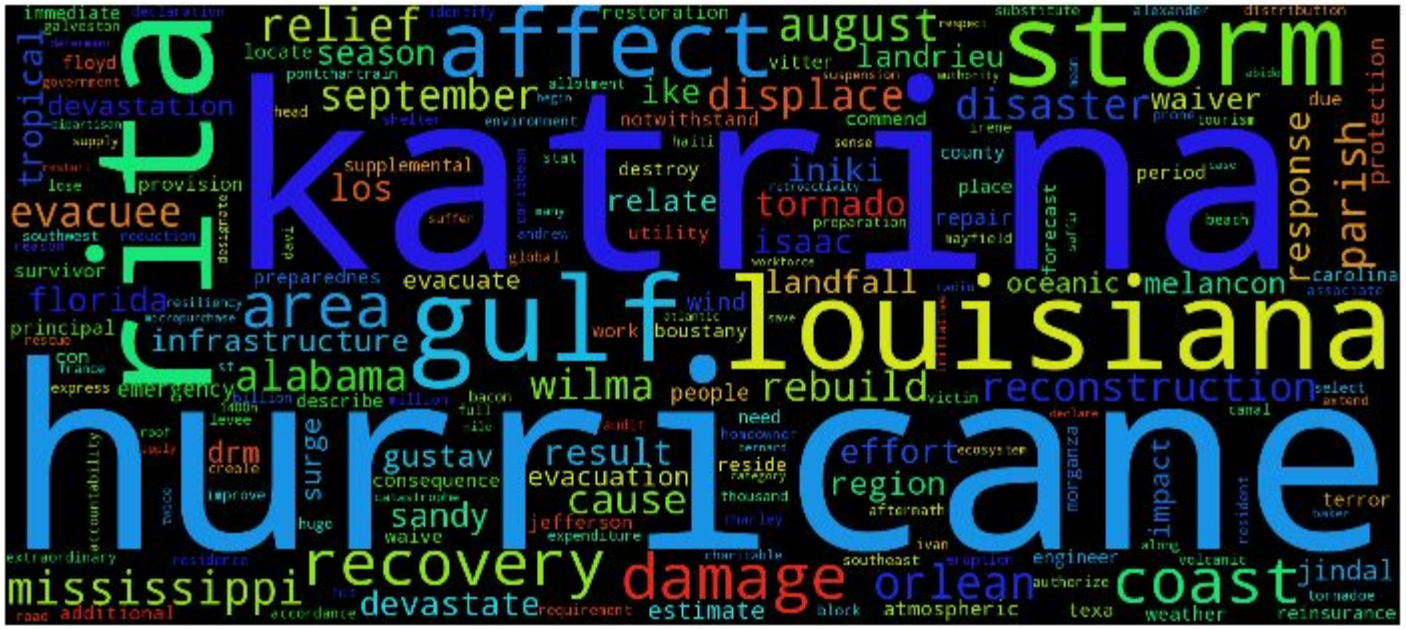
Topic 205



Hurricane Katrina

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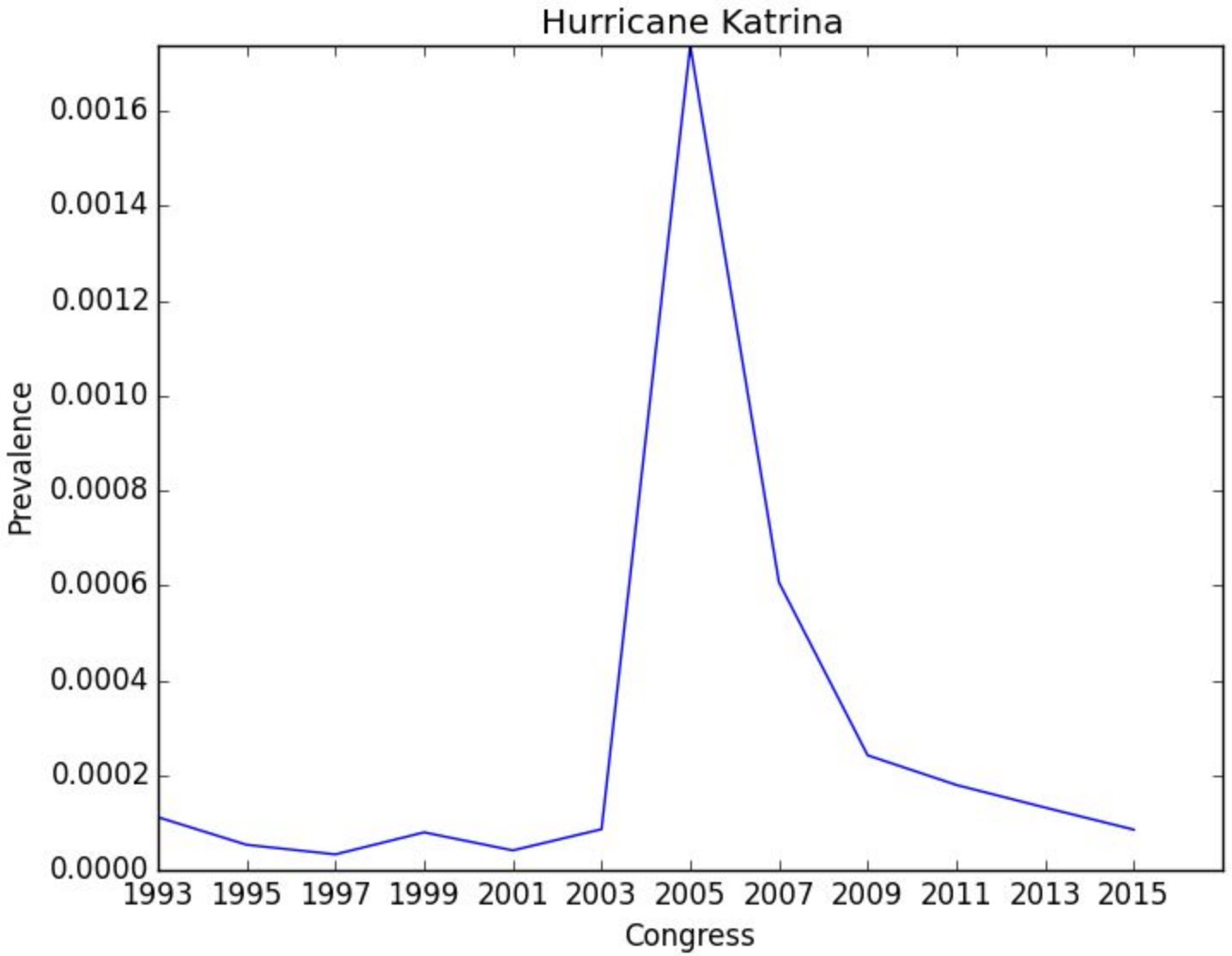
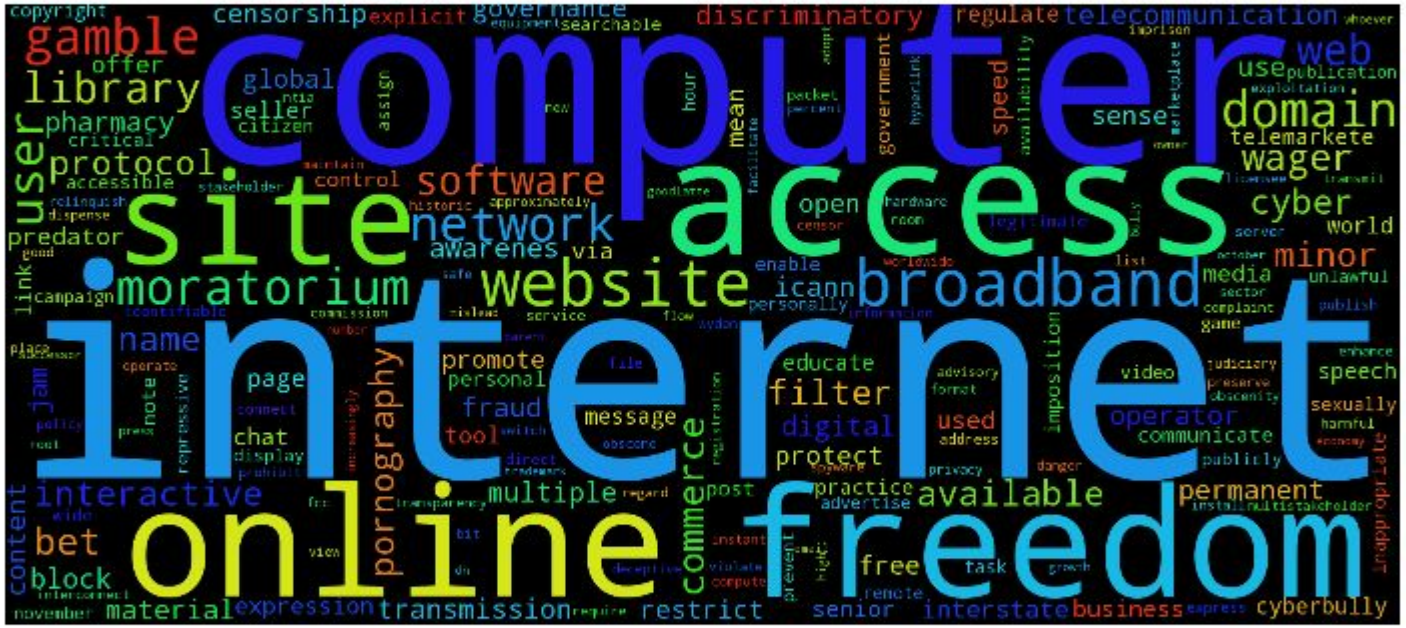


Hurricane Katrina in Bills Over Time

Topic 220



Internet

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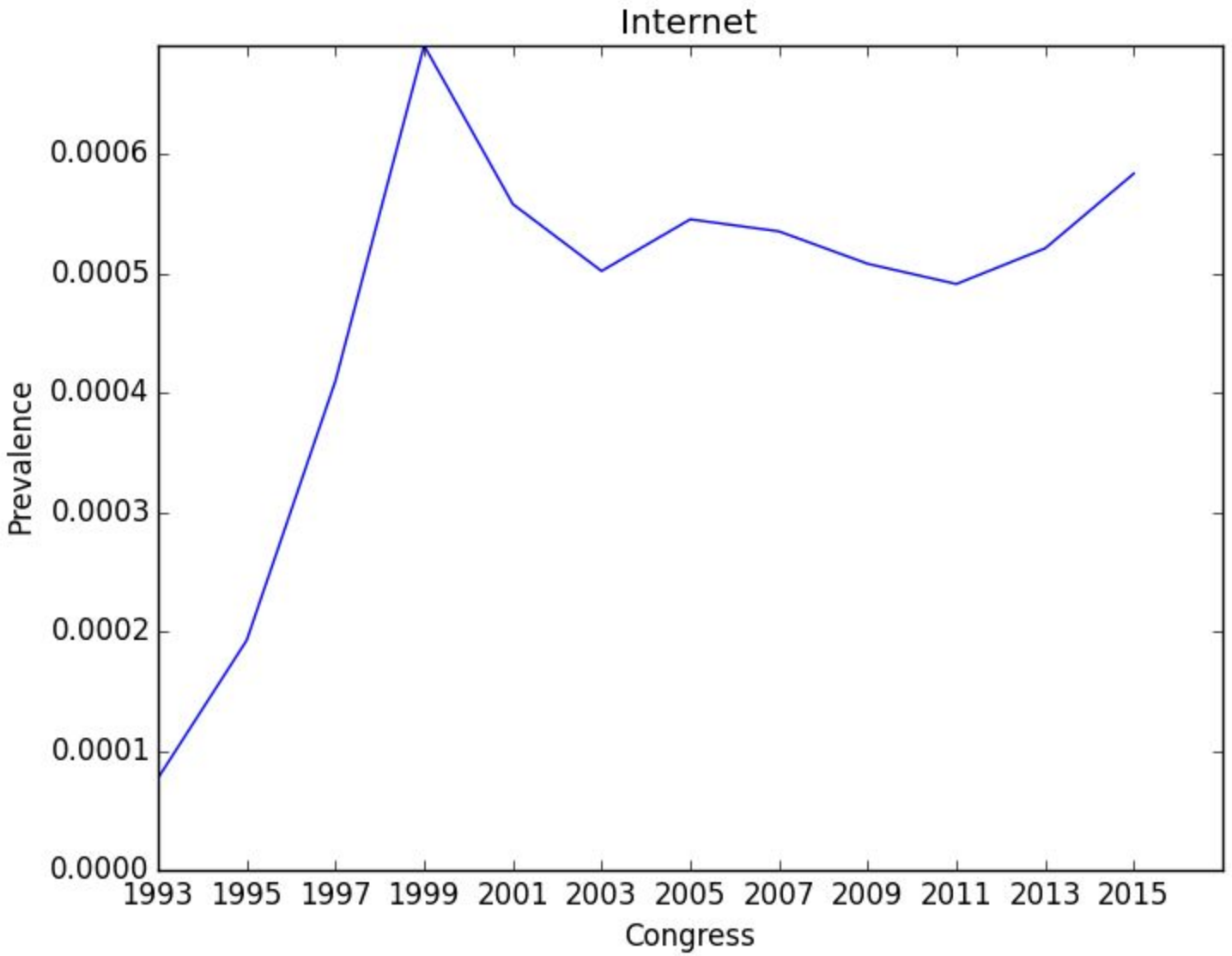

Internet in Bills Over Time

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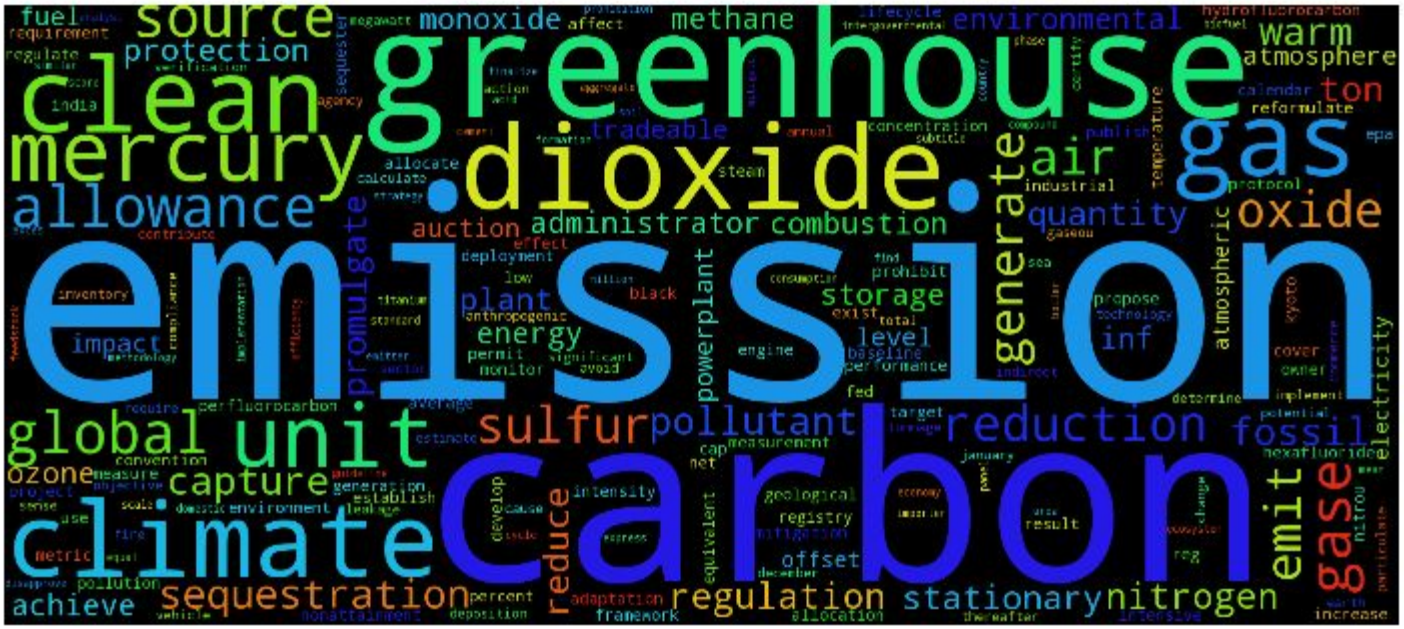
Topic 277



Greenhouse Gases

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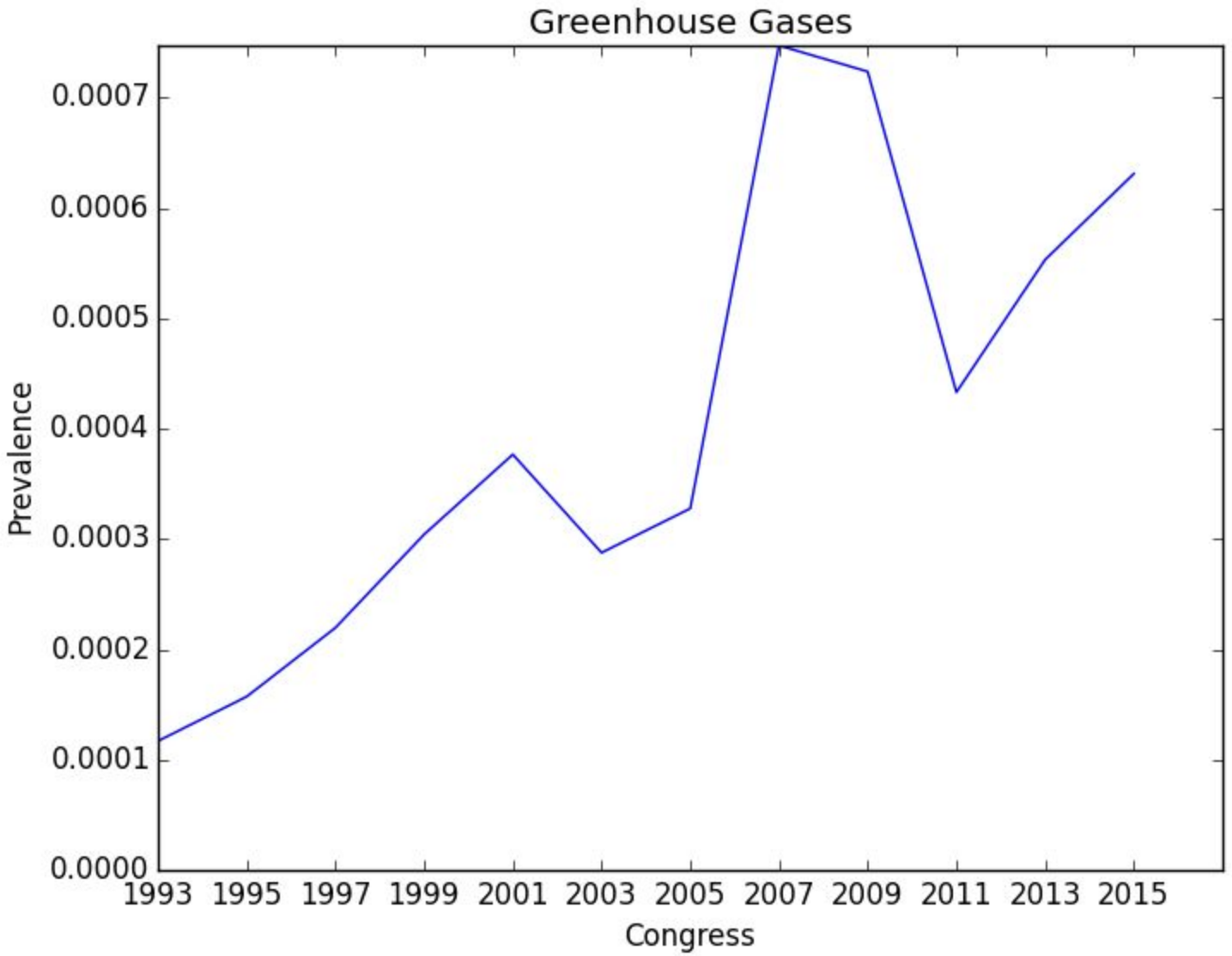

Greenhouse Gases in Bills Over Time

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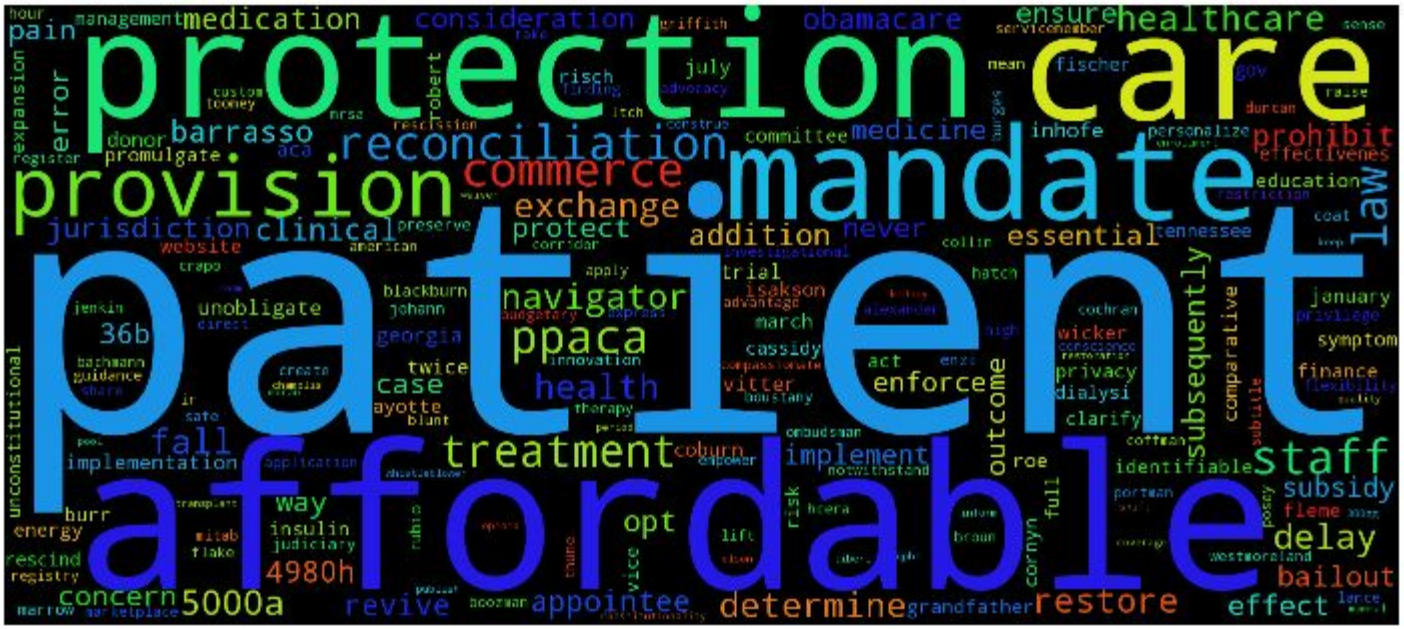
Topic 286



Affordable Care Act

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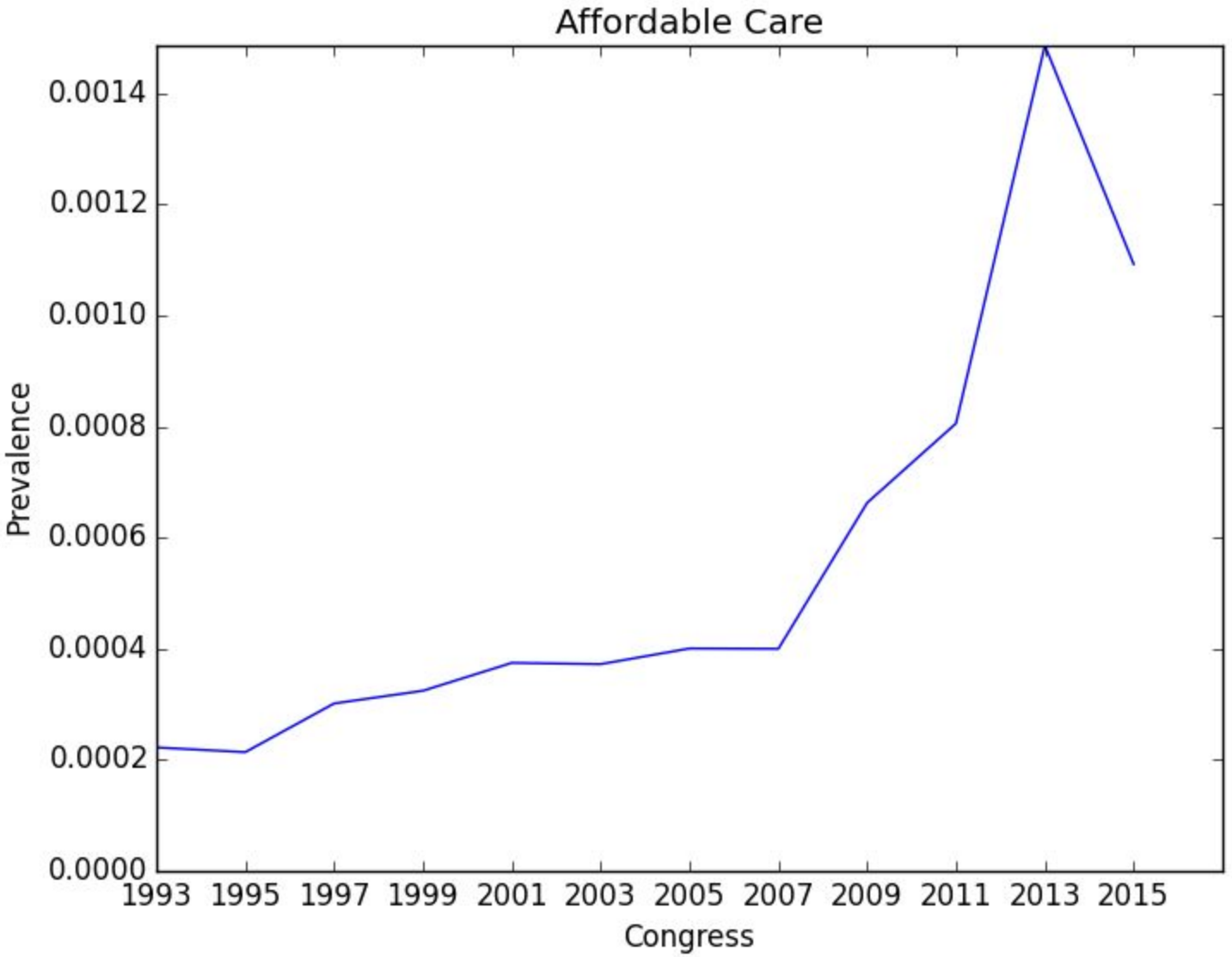

Affordable Care in Bills Over Time

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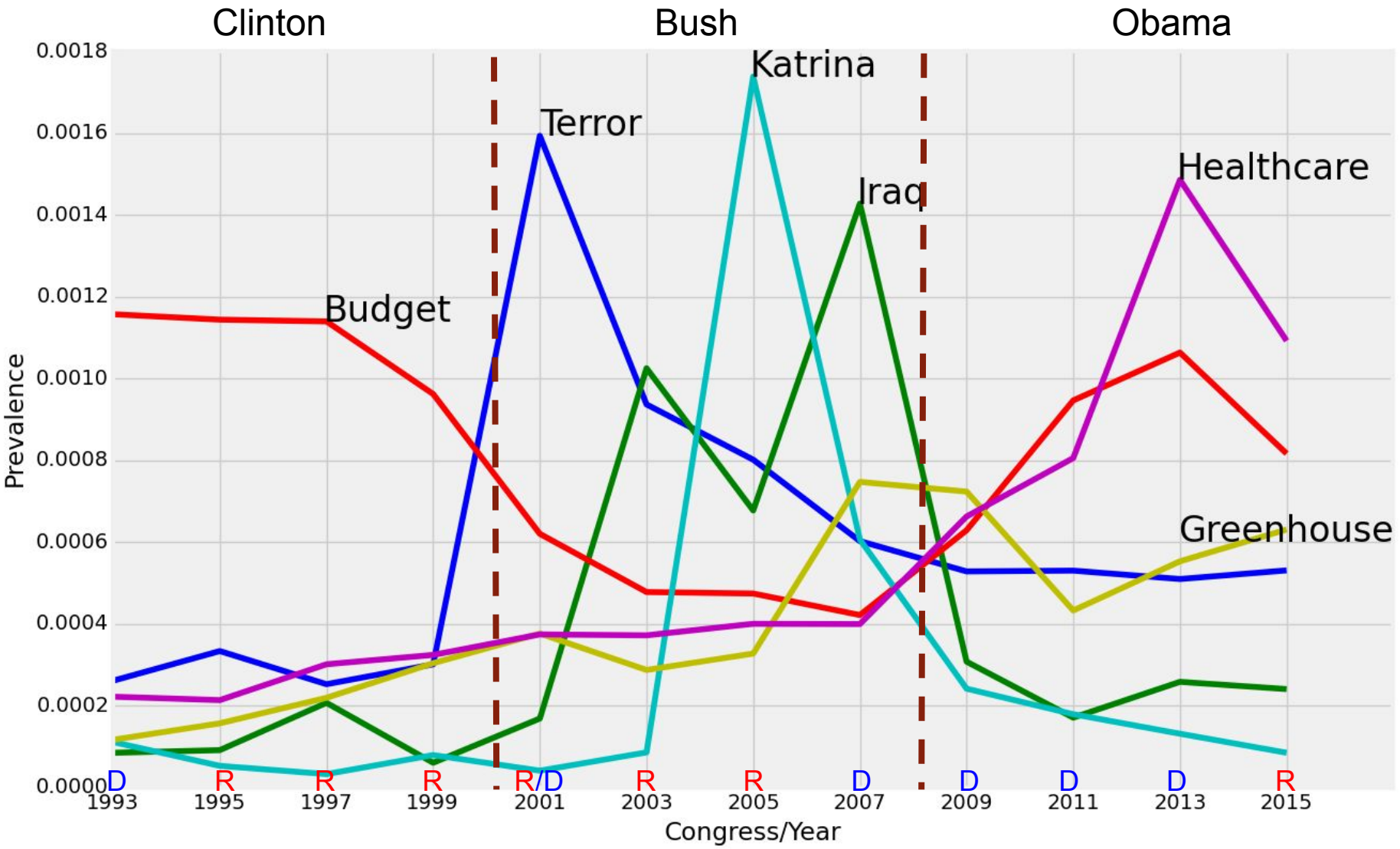

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Thanks!

ANY QUESTIONS?

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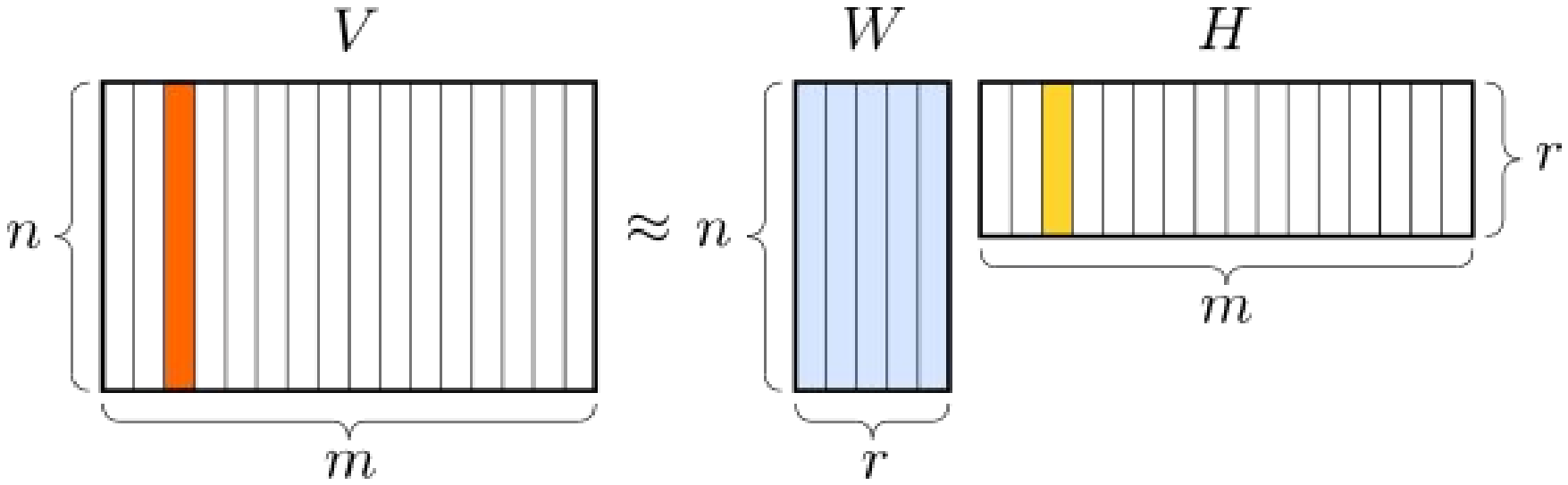
Appendix

Non-Negative Matrix Factorization

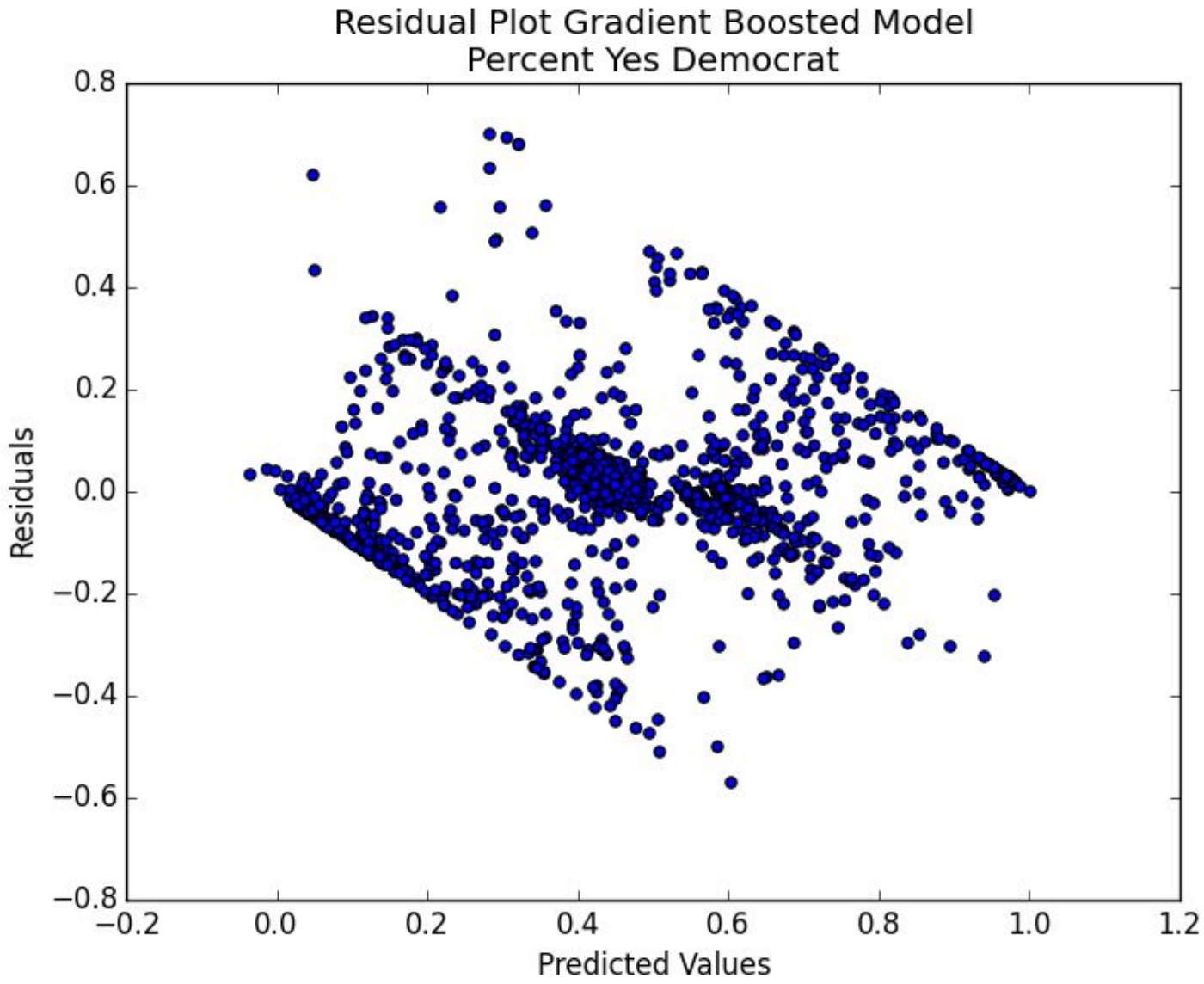


- Recommendation Systems
  - Null space
- Trend modeling/finance/stocks
  - Social Media
- Even Image Processing
  - Pattern/facial recognition

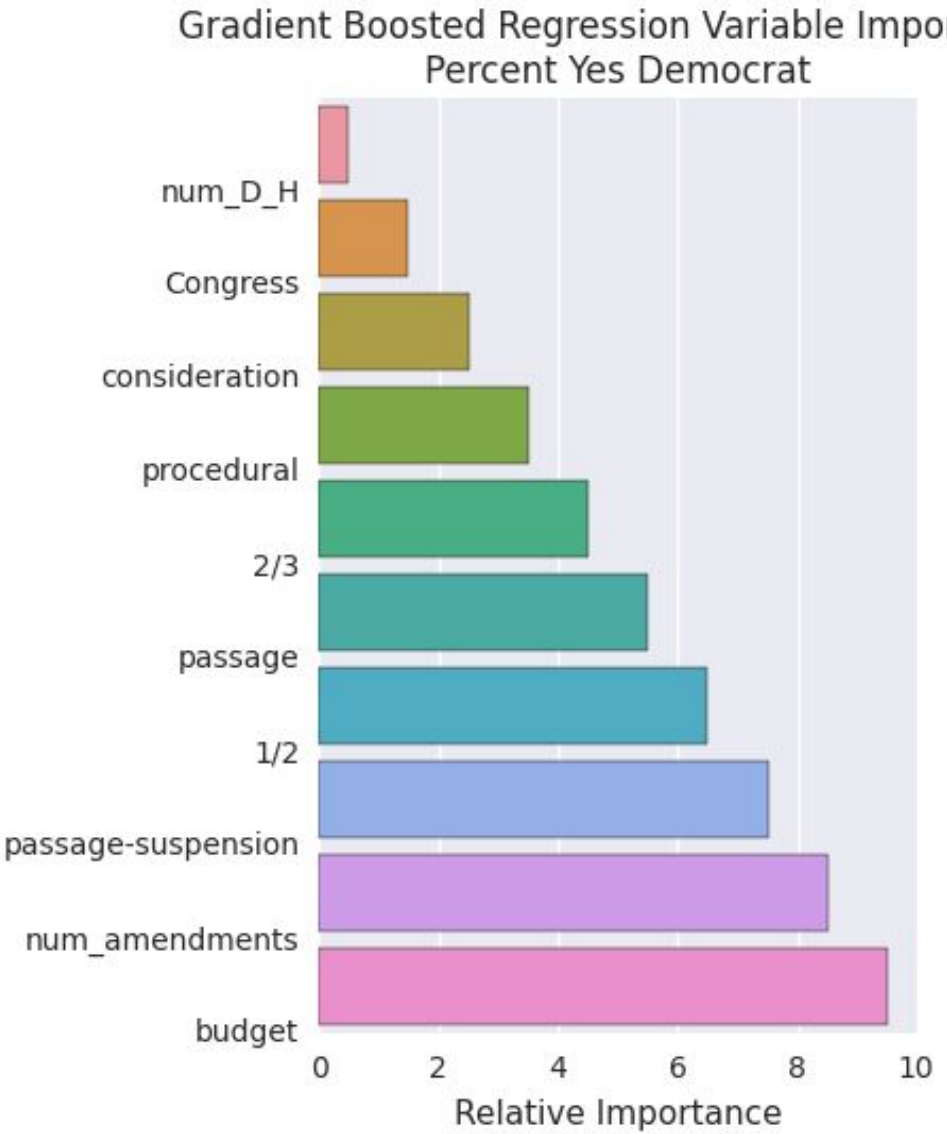
Regression

Percent Yes Democrat

	Mean Squared Error	Root Mean Squared Error	R^2 score
Random Forest	**0.0205**	**0.143**	**0.740**
Bagging	**0.0207**	**0.144**	**0.737**
Linear	**0.0417**	**0.204**	**0.417**
Gradient Boosted	**0.0203**	**0.143**	**0.743**


Residual Plot Gradient Boosted Model
Percent Yes Democrat
Residuals
Predicted Values
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
1.2

Residuals



Feature Importances

Classifier

130,000 Bills

Since 1993

6% voted on

7,600

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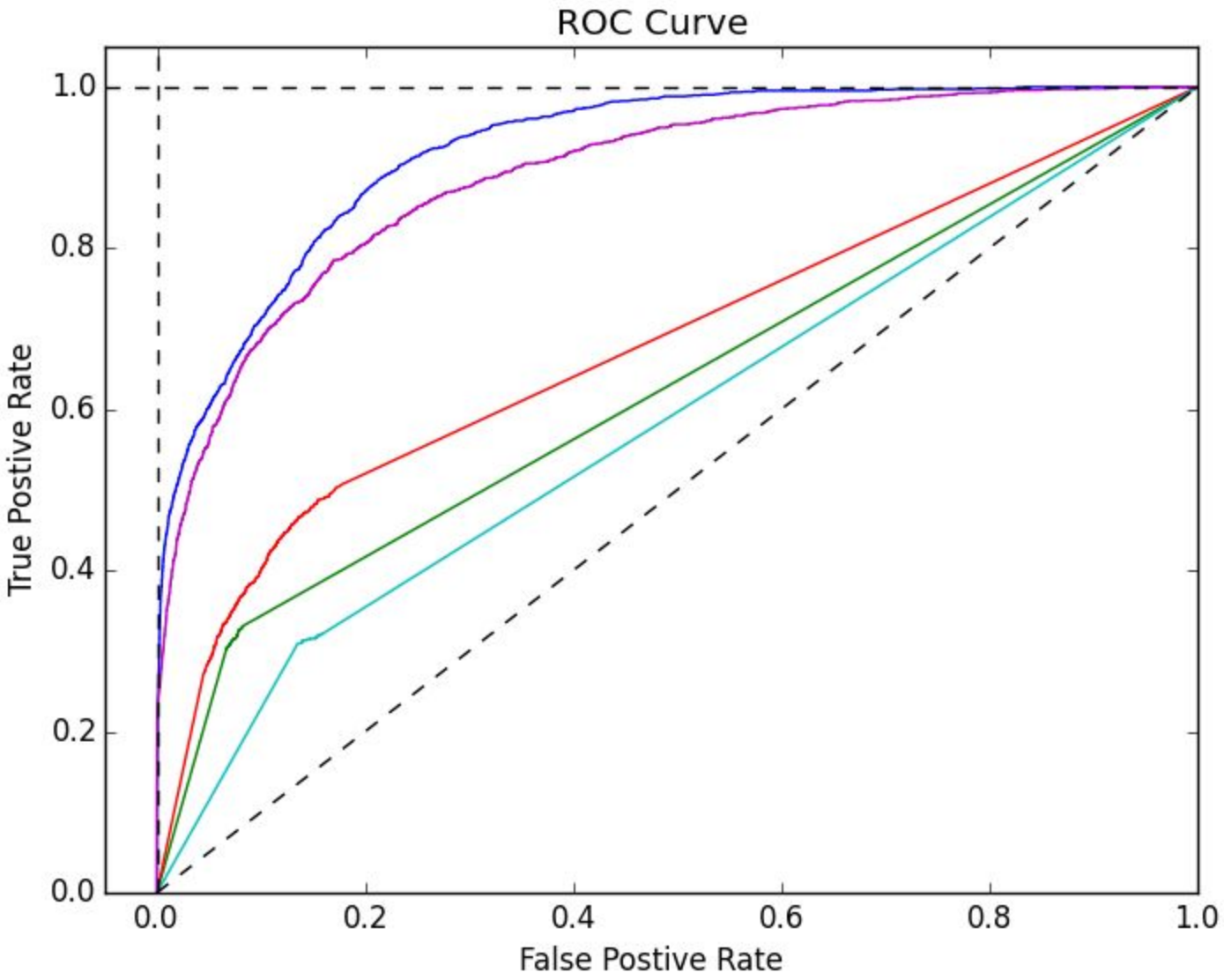
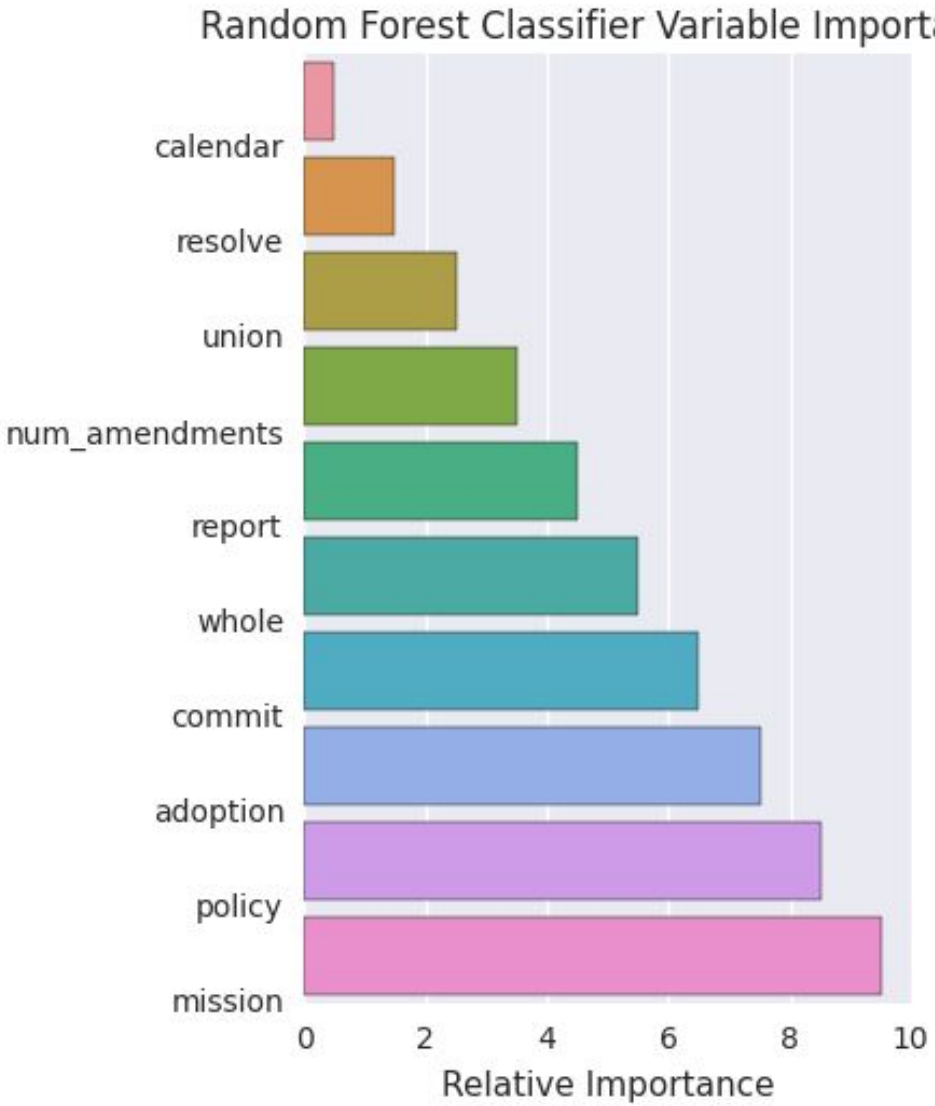


RFC AUC = 0.921
GNB AUC = 0.626
MNB AUC = 0.681
BNB AUC = 0.584
logr AUC = 0.89

- **Oversampling**
  - **SMOTE**
- **Undersampling**
- **Recall/Precision**



Feature Importances