

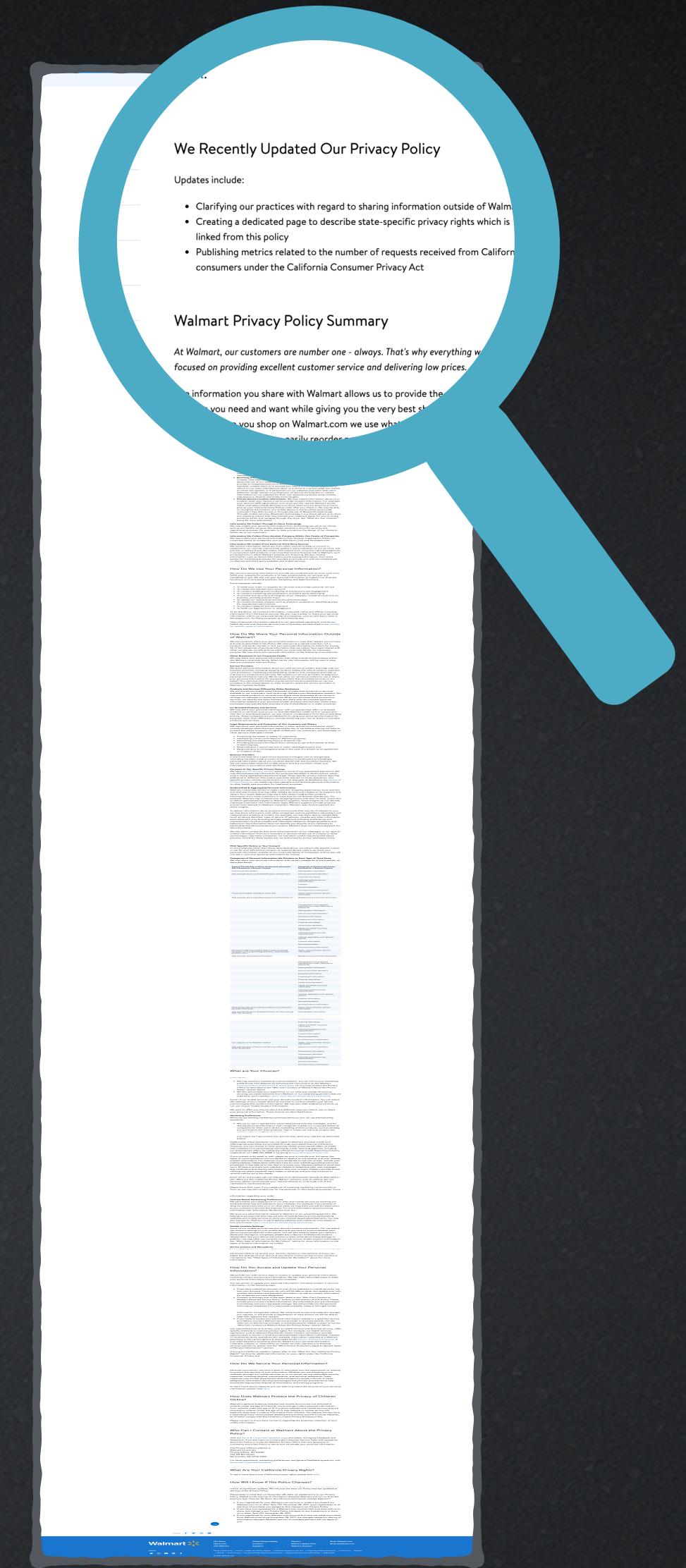
# Detecting Textual Saliency in Privacy Policy

---



Phase-1 Progress Updates

# Recap: A Close Look At Privacy Policy



## Details about

- ? How and why do they collect our information?
- ? Are they sharing this data with third parties?
- ? How long is my data stored?
- ? Can I access my data?
- ? How secure and protected is my data?

# Challenges

## 01 Increase in complexity

More than 85% of privacy policies scraped are at or above college level reading difficulty ([Source](#))

## 02 Increase in length and verbosity

Privacy policies are 1.8x longer than in 2009 ([Source](#))

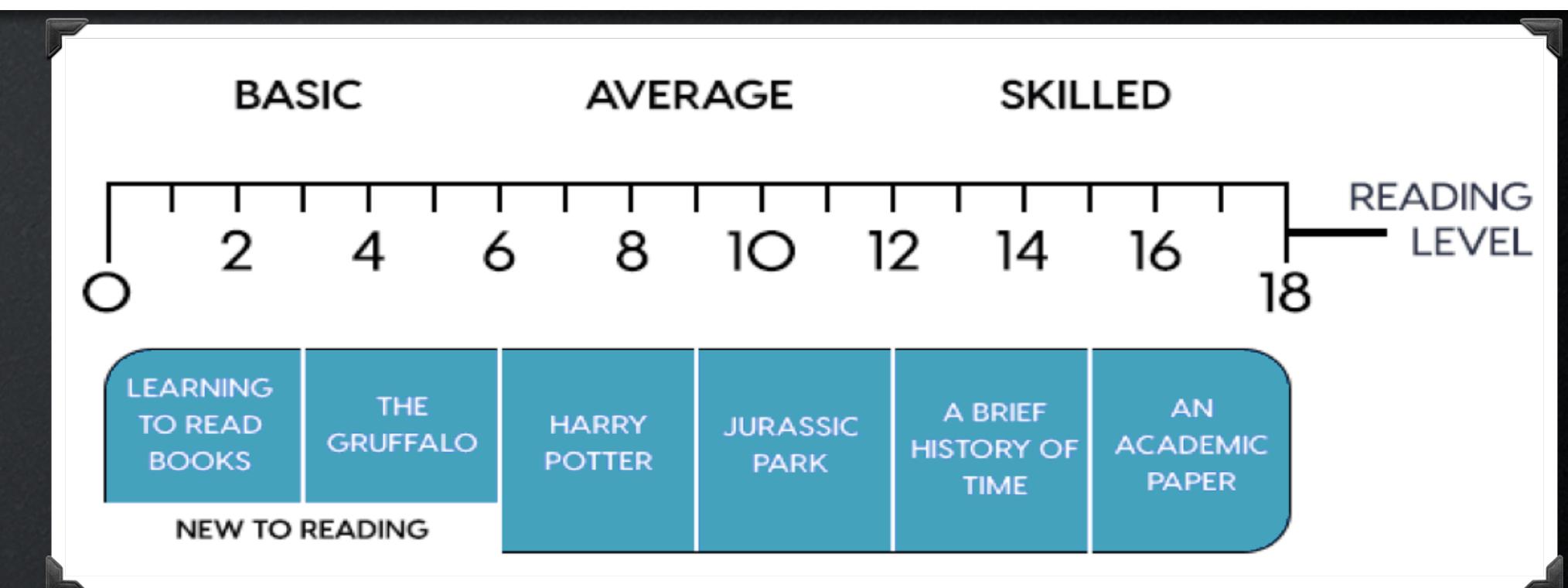
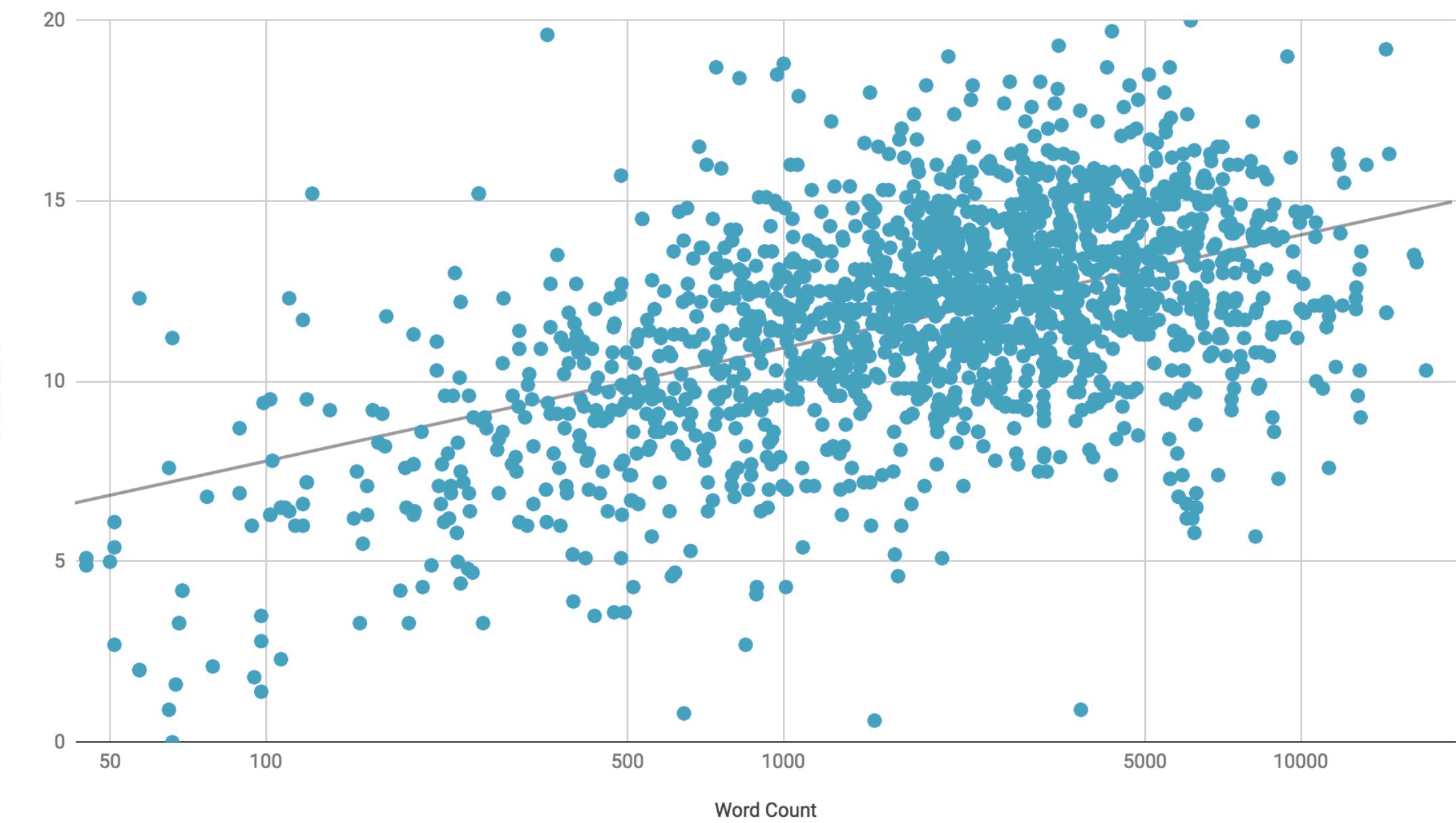


**Cause:** Increase in data privacy regulations

**Outcome:** Opaqueness in privacy policies

Grade Level vs Word Count

Grade Level vs. Word Count



Flesch-Kincaid Grade Level

([Source](#))

# Goal

Provide key information to end-users using Machine Learning and Natural Language Processing



## INFORM Module

- ★ Visualization
- ★ Annotating policies



## QUERY Module

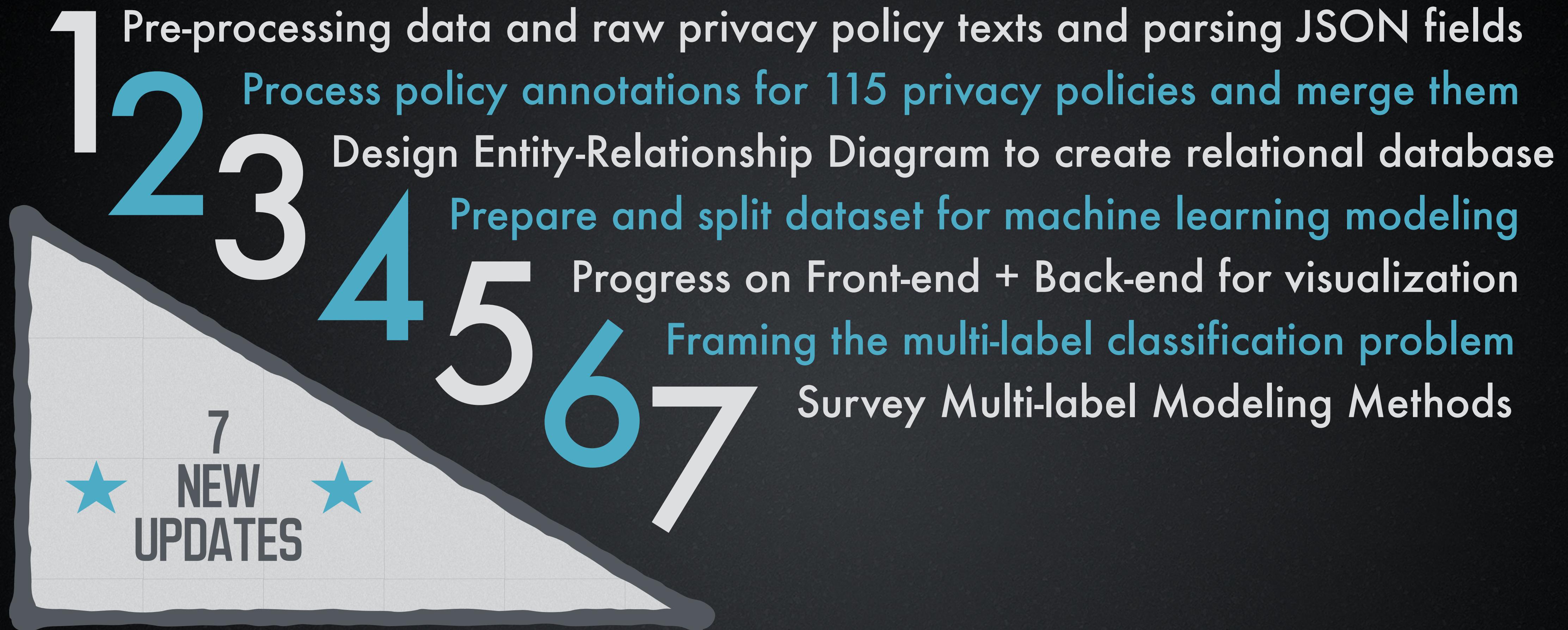
- ★ Enable users to ask policy-related

Interactive

## Web Framework



# Progress Updates



# Data Pre-processing

## Annotation Scheme

- Carefully studied the policy annotation scheme
- Prepare two different gold standard datasets for modeling
  - Union-based dataset
  - Majority-based dataset

Current Policy: a\_98\_neworleansonline.com

First Party Collection/Use      Third Party Sharing/Collection

User Choice/Control      User Access, Edit and Deletion

Data Retention      Data Security      Policy Change      Do Not Track

International and Specific Audiences      Other

7/41      Annotated Practices: 1

Previous      Next

**Information We Collect**

Whether you access our Online Services from **your computer**, smart phone, tablet or other mobile device, NOTMC and its agents **may collect** some information that **identifies you or relates to you as an individual** ("Personal Information"), such as your **name, mailing address, telephone number, e-mail address, user name and password** (for account administration), device ID, including IP address, geolocation (if using a mobile application and you consent to providing it), and additional personal information necessary for the administration of certain promotional events.

**First Party Collection/Use**

- Does/Does Not      Does ▾
- Collection Mode      Unspecified ▾
- Action First-Party \*      Collect on website ▾
- Identifiability      Identifiable ▾
- Personal Information Type \*      Contact ▾
- Purpose \*      Unspecified ▾
- User Type      Unspecified ▾
- Choice Type      Unspecified ▾
- Choice Scope      Unspecified ▾
- References another place in the policy

Save

Documents	115
Words	266,713
Annotated Data Practices	23,194
Annotated Attributes	128,347
Annotated Text Spans	102,576
Annotators Per Document	3
Annotators Total	10

Web-based tool used for annotation ([Source](#))

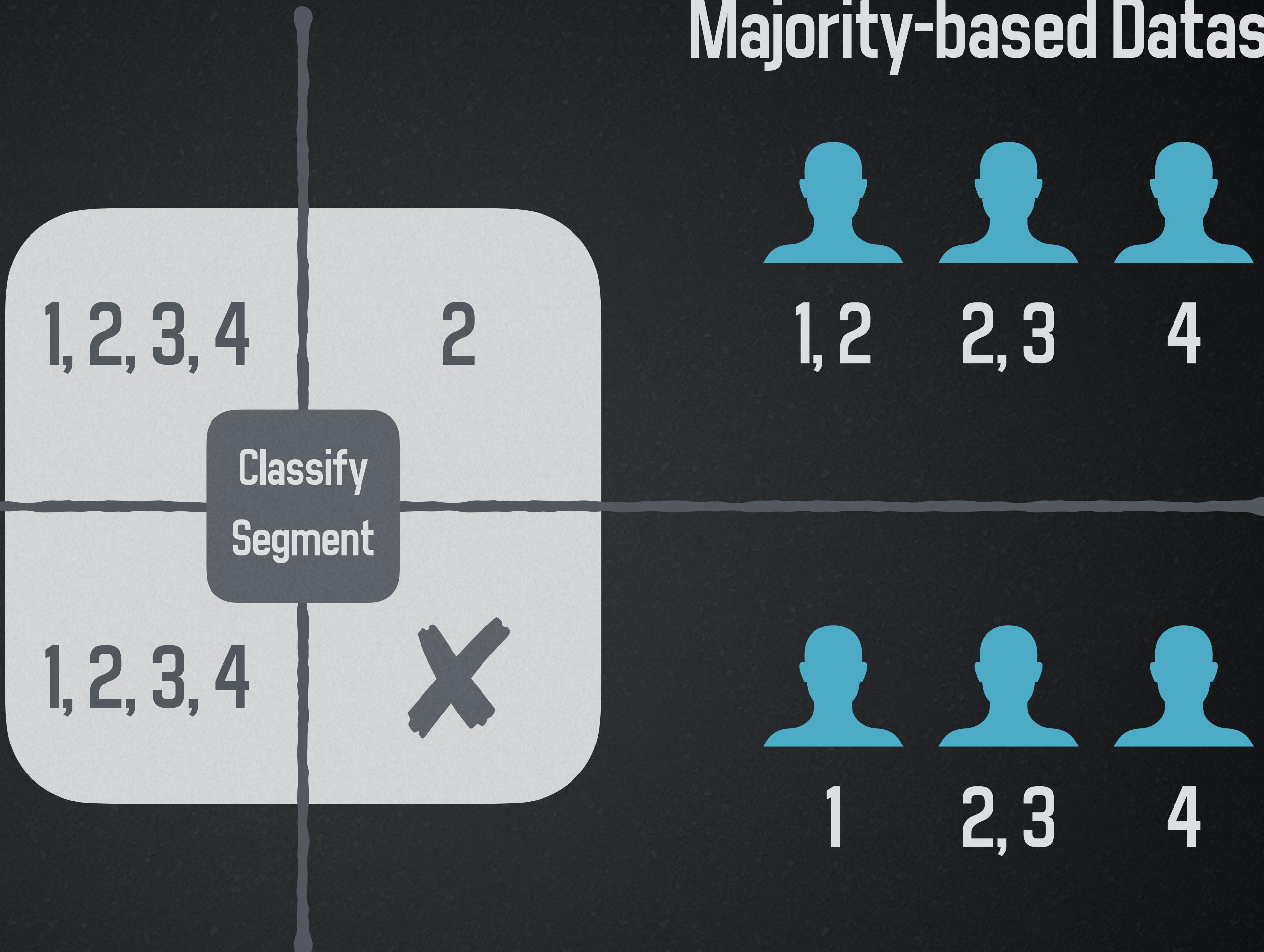
# Data Pre-processing

## Annotation Scheme Example

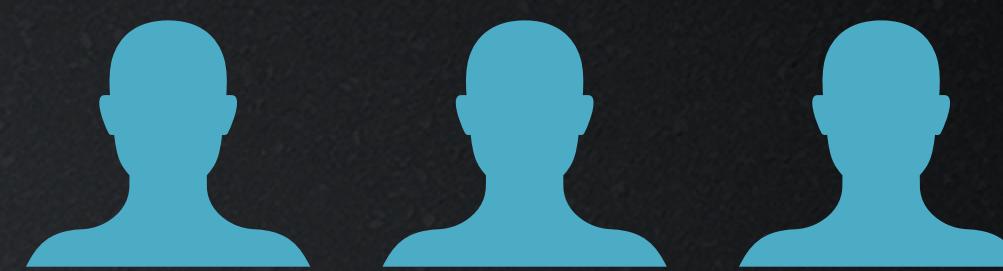
Union-based Dataset



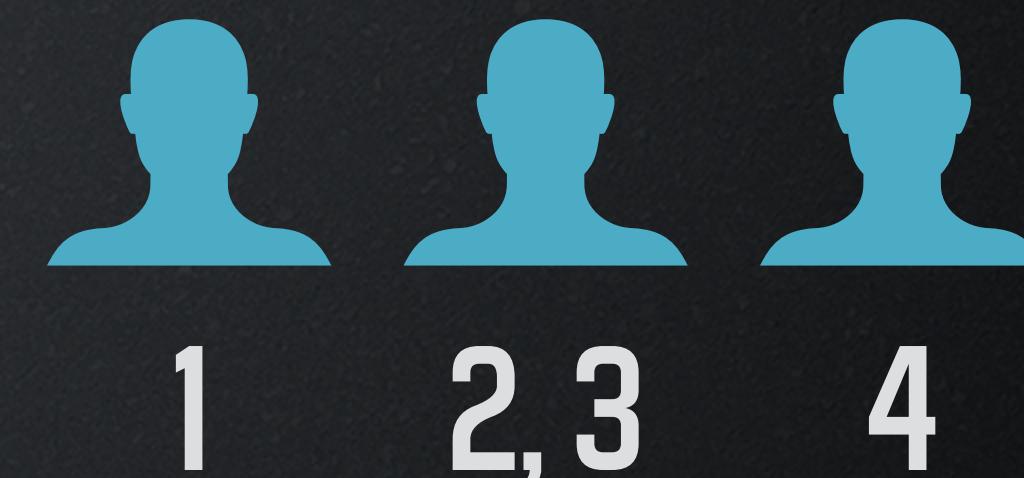
1, 2    2, 3    4



Majority-based Dataset



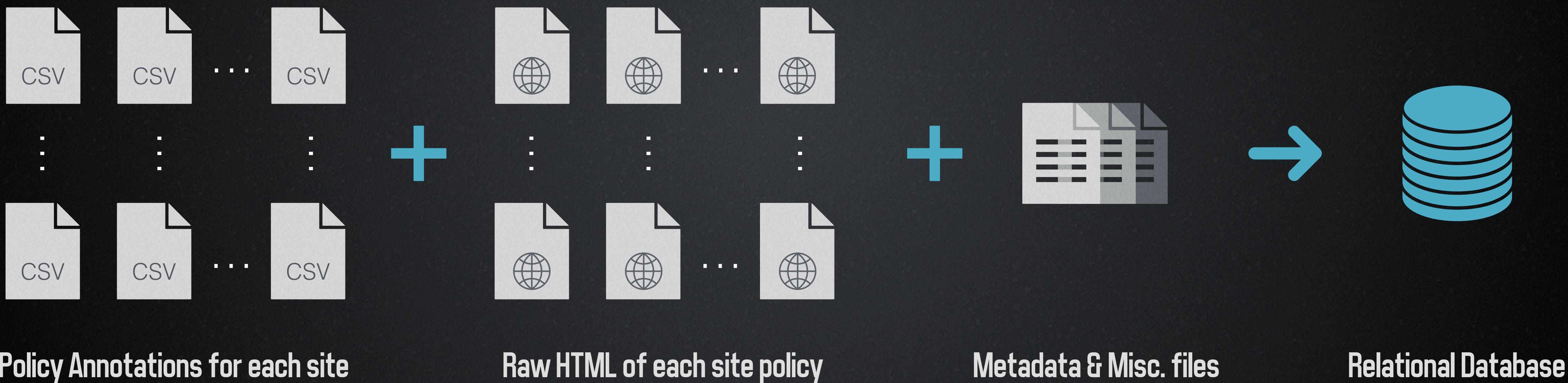
1, 2    2, 3    4



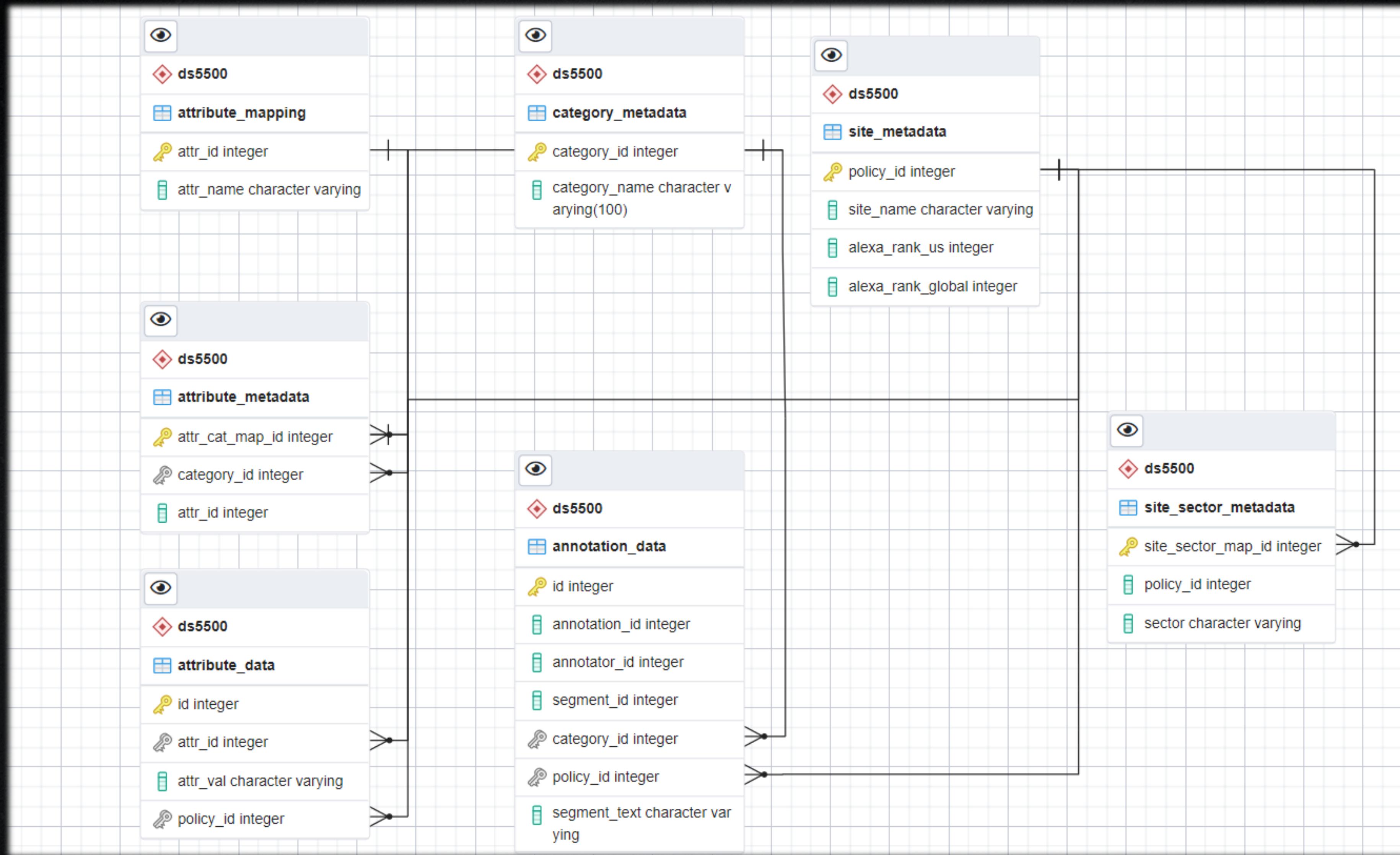
# Data Pre-processing

## (Continued)

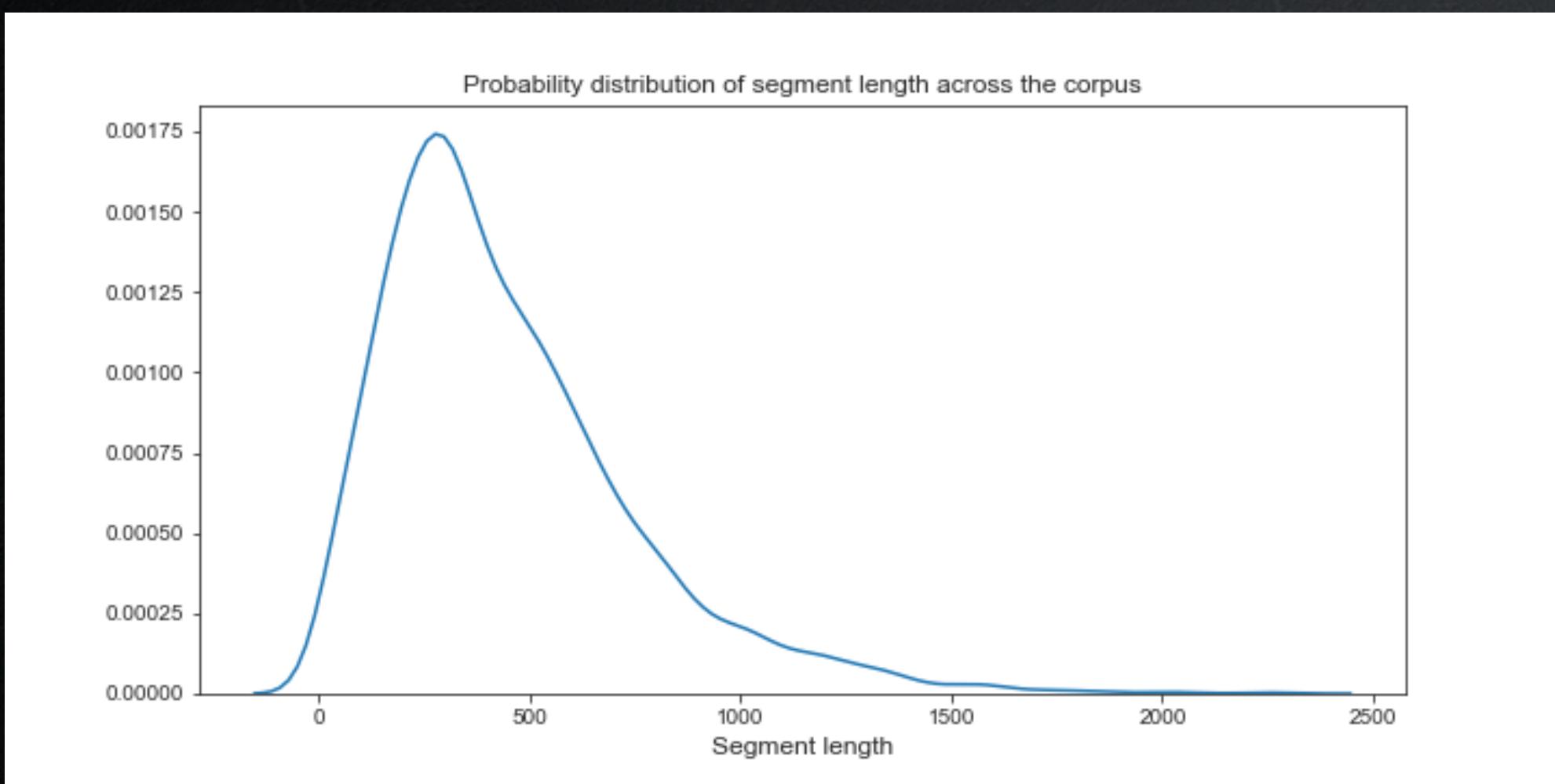
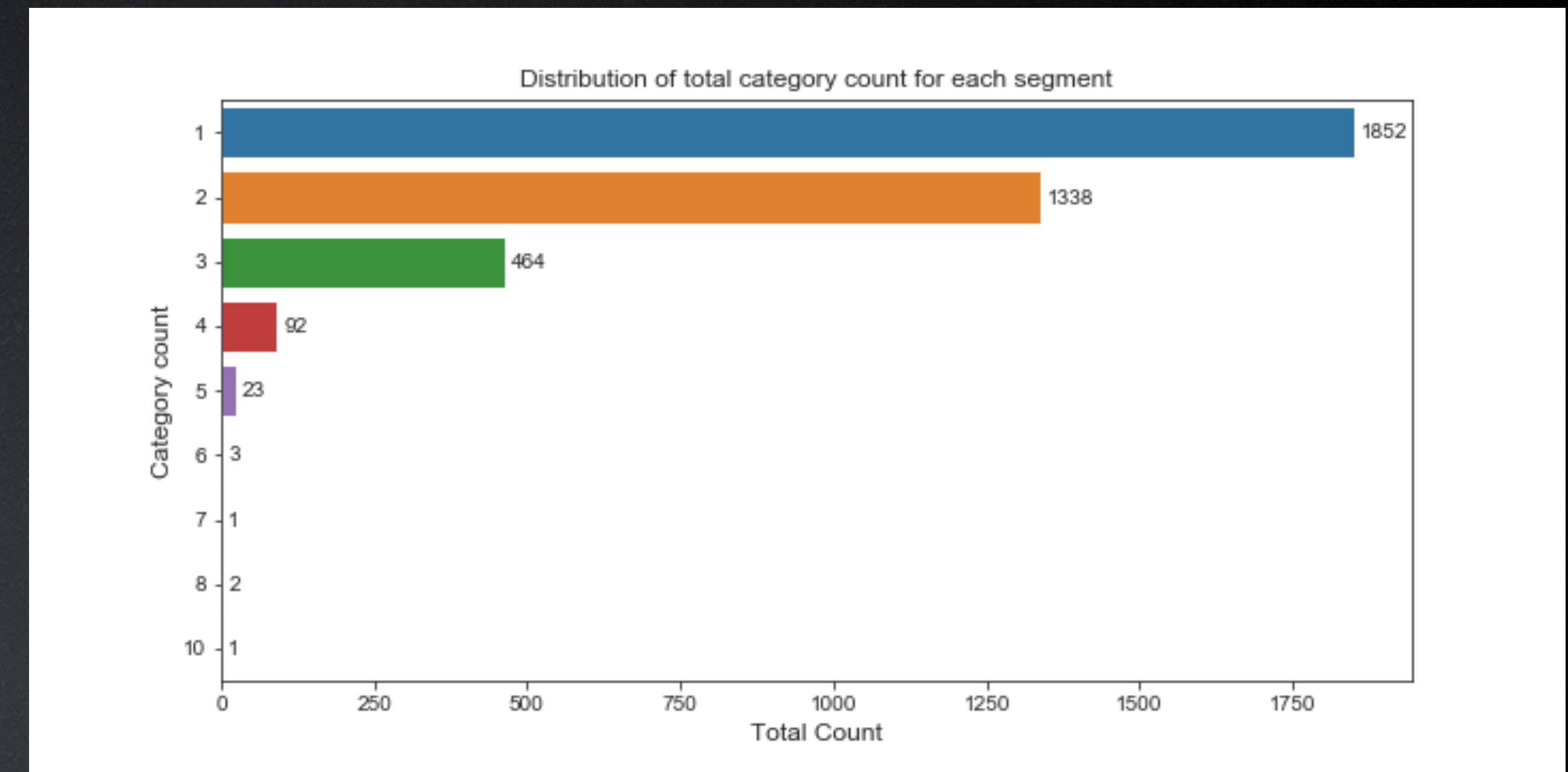
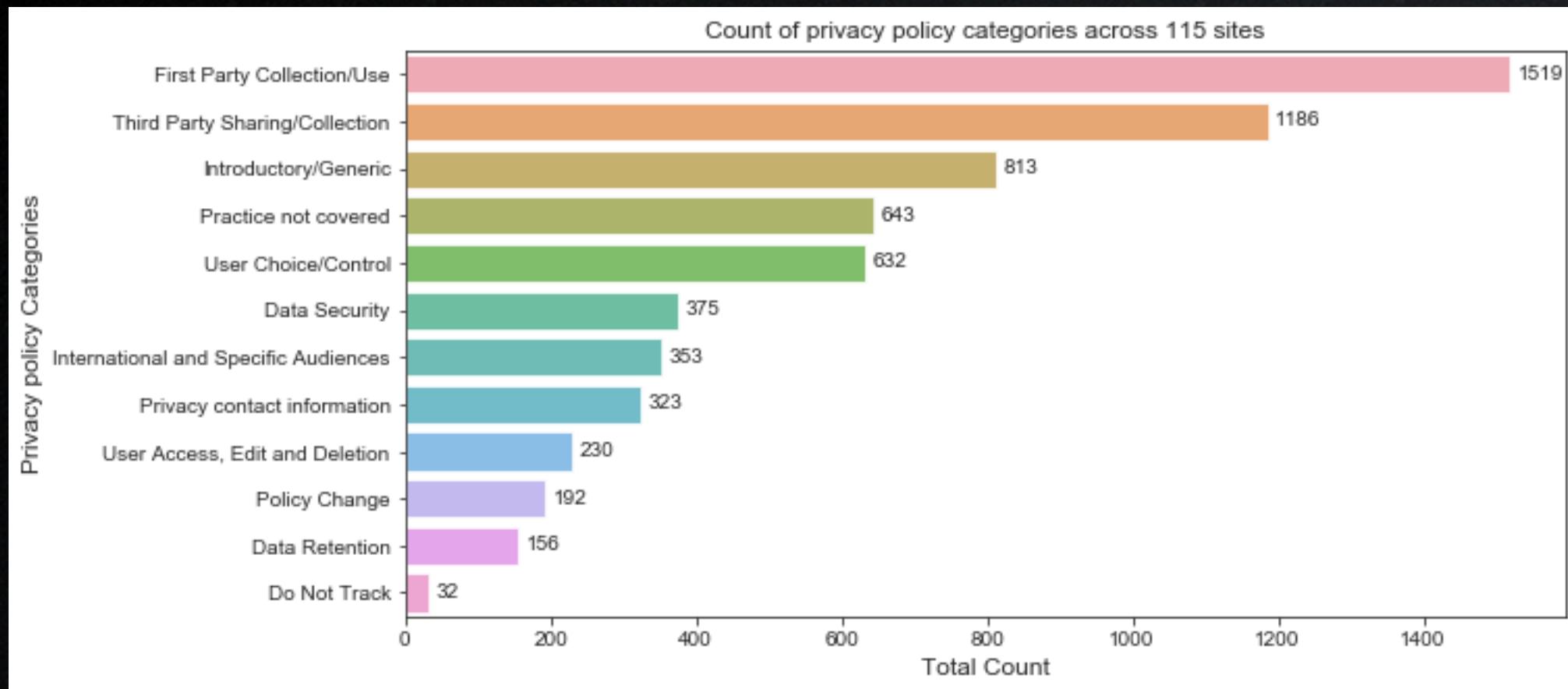
- Pieces of policy information spread across several files (for eg., annotations, segments, metadata etc)
- Main tasks involved are:
  - Processing policy-specific files
  - Matching annotation information with their respective segment information
  - Parsing attribute level information from JSON typed strings
  - Processing site metadata (for eg., irregular sector information)



# Entity-Relationship Diagram

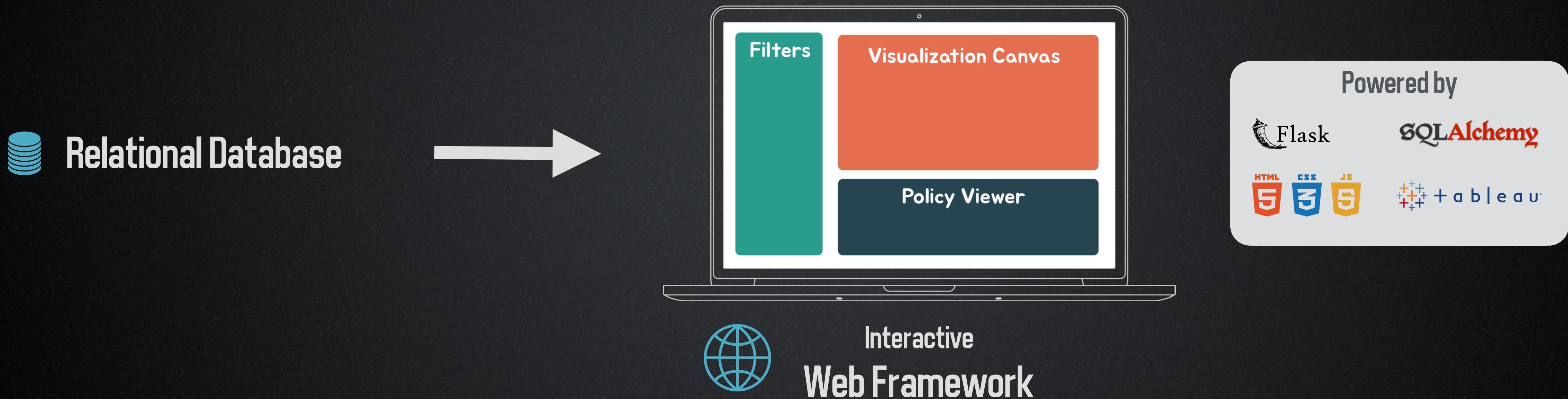


# Few Preliminary findings



# Visualization framework

- ★ Convey high-level insights from the corpus to general consumers and/or regulators
- ★ Filter on metadata and attribute values to generate plots for each privacy category
- ★ Switched from Plotly Dask framework to Tableau
- ★ Use Tableau Javascript API to integrate with front-end



# Modeling Methodology

Datasets	Majority Dataset	Union Dataset		
Text Vectorization	BOW TF-IDF	Word2vec GloVe fastText	Doc2vec ELMo USE	
	Generic	Word embeddings	Doc embeddings	
Models	Problem Transformation	Algorithm Adaptation	Ensemble Methods	Language Neural Models
Evaluation Metrics	Hamming loss PRF Accuracy	Micro PRF Macro PRF	Train Time Test Time	
	Example based	Label based	Efficiency	

# Problem Transformation Methods

## Binary Relevance

X	$Y_1$	$Y_2$	$Y_3$	$Y_4$
$x^{(1)}$	0	1	1	0
$x^{(2)}$	1	0	0	0
$x^{(3)}$	0	1	0	0
$x^{(4)}$	1	0	0	1
$x^{(5)}$	0	0	0	1

X	$Y_1$	X	$Y_2$	X	$Y_3$	X	$Y_4$
$x^{(1)}$	0	$x^{(1)}$	1	$x^{(1)}$	1	$x^{(1)}$	0
$x^{(2)}$	1	$x^{(2)}$	0	$x^{(2)}$	0	$x^{(2)}$	0
$x^{(3)}$	0	$x^{(3)}$	1	$x^{(3)}$	0	$x^{(3)}$	0
$x^{(4)}$	1	$x^{(4)}$	0	$x^{(4)}$	0	$x^{(4)}$	1
$x^{(5)}$	0	$x^{(5)}$	0	$x^{(5)}$	0	$x^{(5)}$	1

## Classifier Chains

X	y1	y2	y3	y4
$x1$	0	1	1	0
$x2$	1	0	0	0
$x3$	1	0	0	0
$x3$	0	1	0	0

X	$Y_1$	X	$Y_2$	X	$Y_3$	X	$Y_4$
$x^{(1)}$	0	$x^{(1)}$	1	$x^{(1)}$	1	$x^{(1)}$	0
$x^{(2)}$	1	$x^{(2)}$	0	$x^{(2)}$	0	$x^{(2)}$	0
$x^{(3)}$	0	$x^{(3)}$	1	$x^{(3)}$	0	$x^{(3)}$	0
$x^{(4)}$	1	$x^{(4)}$	0	$x^{(4)}$	0	$x^{(4)}$	1
$x^{(5)}$	0	$x^{(5)}$	0	$x^{(5)}$	0	$x^{(5)}$	1

X	y1
$x1$	0

X	y1	y2
$x1$	0	1
$x2$	1	0
$x3$	0	1

X	y1	y2	y3
$x1$	0	1	1
$x2$	1	0	0
$x3$	0	1	0

Classifier 1

Classifier 2

Classifier 3

X	y1	y2	y3	y4
$x1$	0	1	1	0
$x2$	1	0	0	0
$x3$	0	1	0	0
$x3$	0	1	0	0

Classifier 4

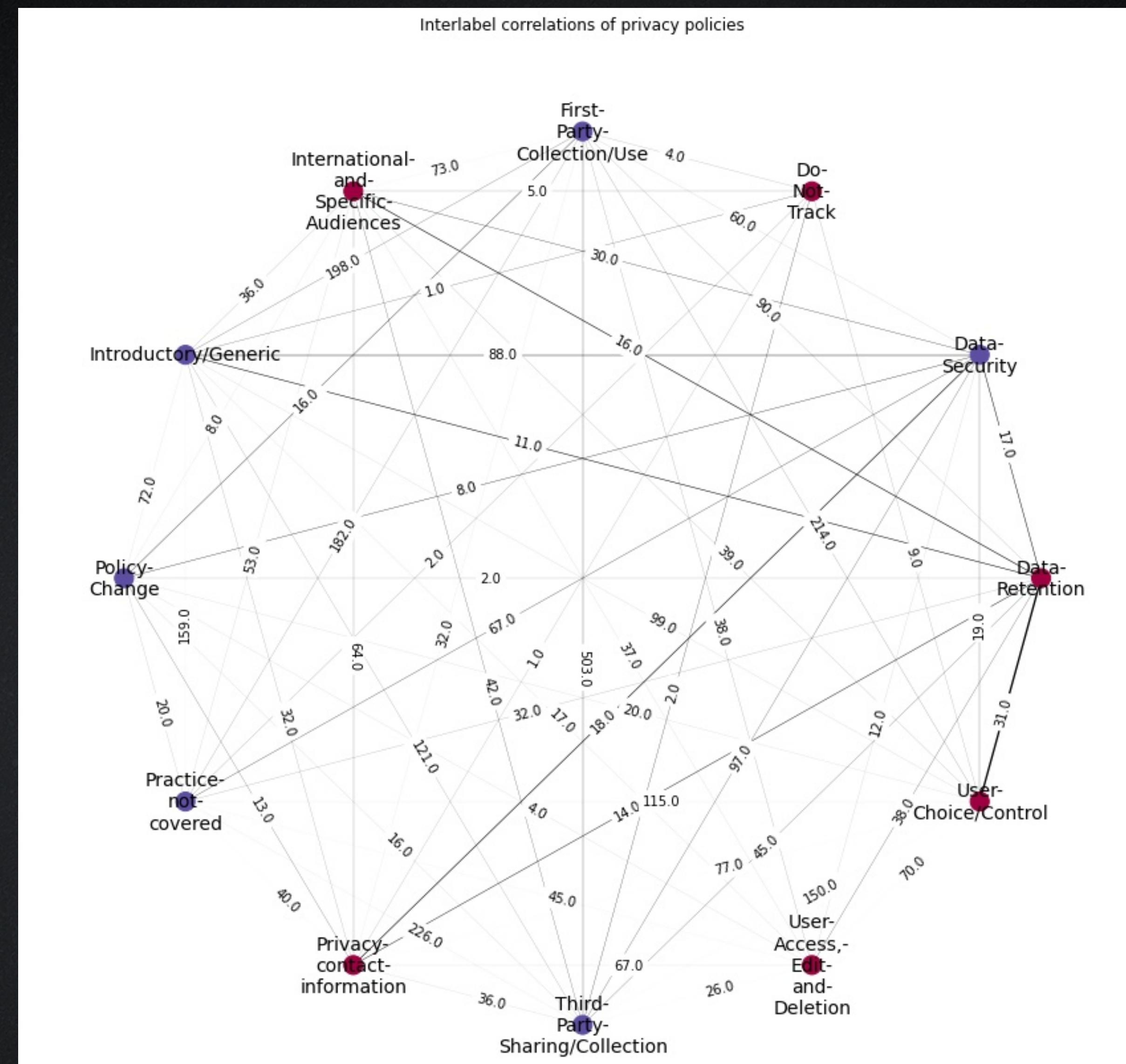
Base classifiers: Logistic Regression, SVM, Decision Trees

## Label Power-set

X	y1	y2	y3	y4
$x1$	0	1	1	0
$x2$	1	0	0	0
$x3$	0	1	0	0
$x4$	0	1	1	0
$x5$	1	1	1	1
$x6$	0	1	0	0

X	y1
$x1$	1
$x2$	2
$x3$	3
$x4$	1
$x5$	4
$x6$	3

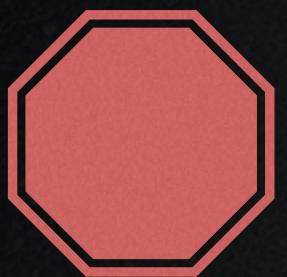
# Inter-label Correlations of Privacy Policies



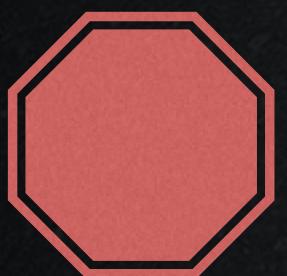
# Roadblocks



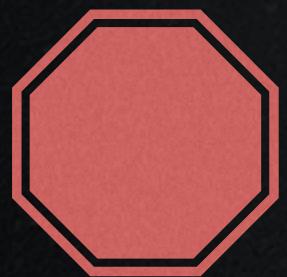
Stratified splitting



Threshold calibration



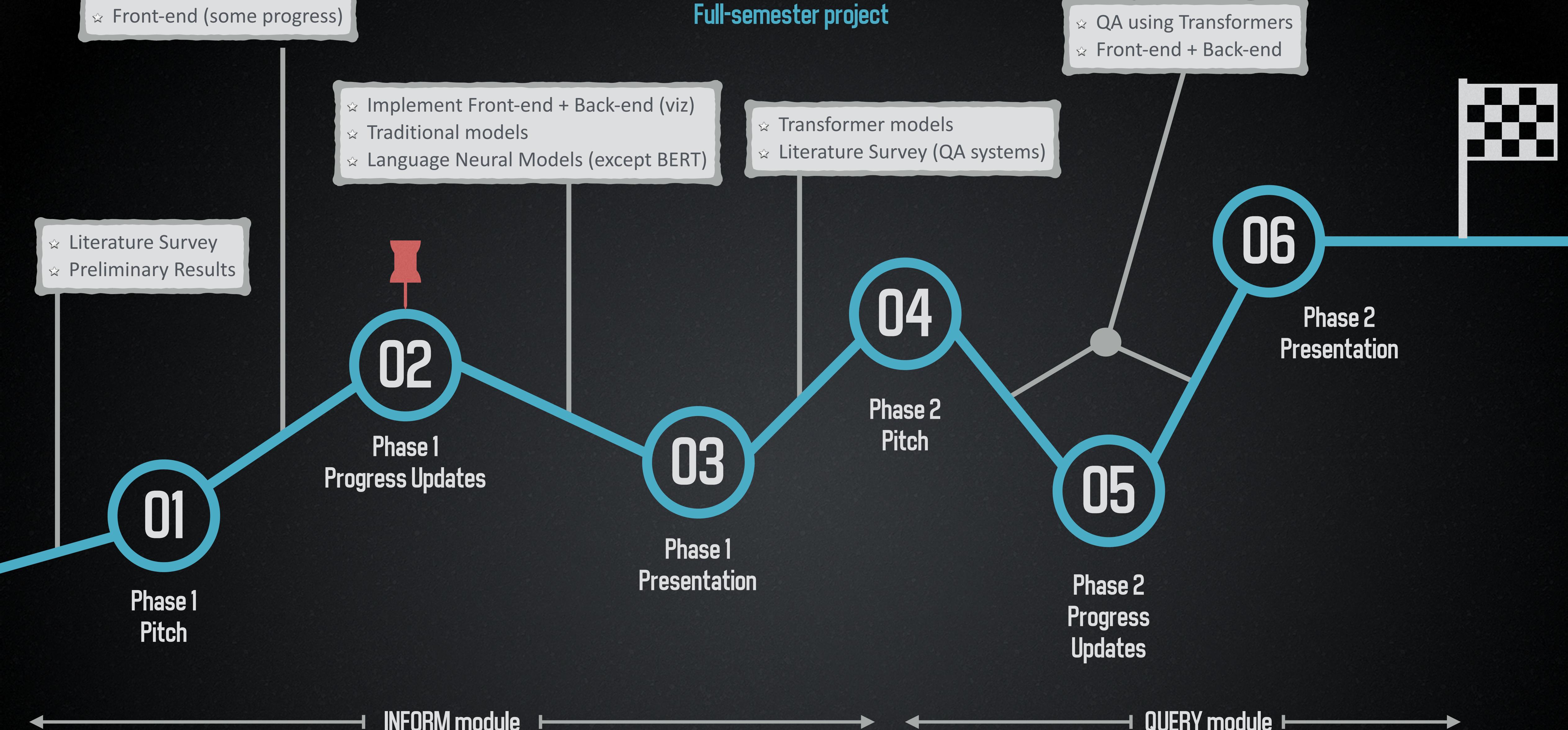
Handling inter-label correlation



Extensive pre-processing and literature review

# Project Timeline

Full-semester project



# End of Phase Deliverables

(INFORM module)



Tableau Visualization Dashboards



Front-end + Back-end for visualization framework



Traditional models



Language Neural Models ( except transformer models)

THANK  
YOU

