Detecting Political Bias in News Articles Using BERT

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Motivations & Why It Matters

Existing Approaches

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Political Bias Detections

Human Evaluations

- Allsides Media Bia Chart
- AD Fonte Media

Machine Learnings

- Support Vector Machines (Pang 2004)
- RNN/LSTM (Iyyer et. al 2014)
- BERT (Baly et. al 2020)

Sources: allsides.com

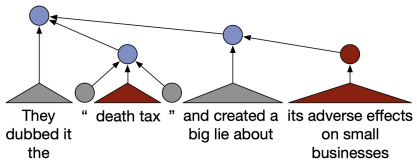

Figure 1: An example of compositionality in ideological bias detection (red → conservative, blue → liberal, gray → neutral) in which modifier phrases and punctuation cause polarity switches at higher levels of the parse tree.

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Our Approach

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BERT - A Refined Approach

Fine Tuning BERT Uncased Model by

- Comprehensive Data Cleaning and Preprocessing (Incomplete Data, Text Normalization, Source Anonymization)
- Experimenting with various Combination of Model Configurations and Hyperparameters (dropout rates, maximum token length, number of trainable layers, hidden layer dimensions, learning rates, and training epochs)
- Experiment with different model architectures (LSTM layer or CNN layer)
- Training and Test Set Variations (first paragraph of input text, one year data, 4 year data, removing top 5 sources data)
- Label Rebalancing

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Results

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Experiment Results I

Experiments	Train/Test Size	Accuracy	Weighted Average F1 Score
Naive Bayes Classification (Baseline Model)	20,114/5,029	69.00%	68.00%
BERT Uncased Fine-Tuning (CLS Token)	**20,114/5,029**	**91.00%**	**91.00%**
Baly et. al (2020)'s Fine-Tuned BERT (Random Split Dataset)	33,537/1,200	79.83%	80.19%

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Experiment Results II

Experiments	Accuracy	Weighted Average F1 Score
BERT CLS Token (12 NN Layers)		
Fine-Tuned BERT	91.00%	91.00%
Fine-Tuned BERT with a LSTM Layer	**91.00%**	**91.00%**
Fine-Tuned BERT with a CNN Layer	83.00%	83.00%
BERT with Fine-Tune with the First Six Sentences		
Fine-Tuned BERT with First Six Sentences	**87.00%**	**87.00%**

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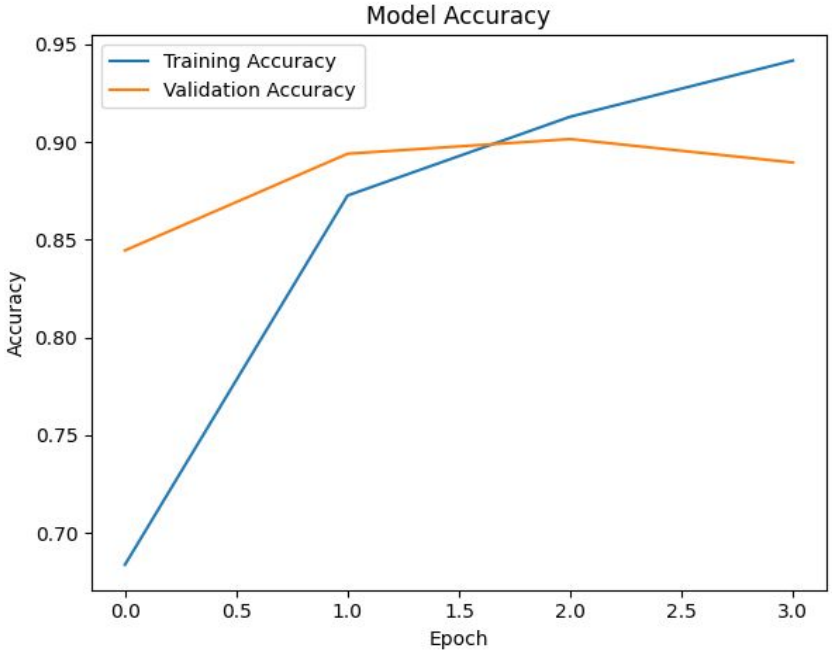
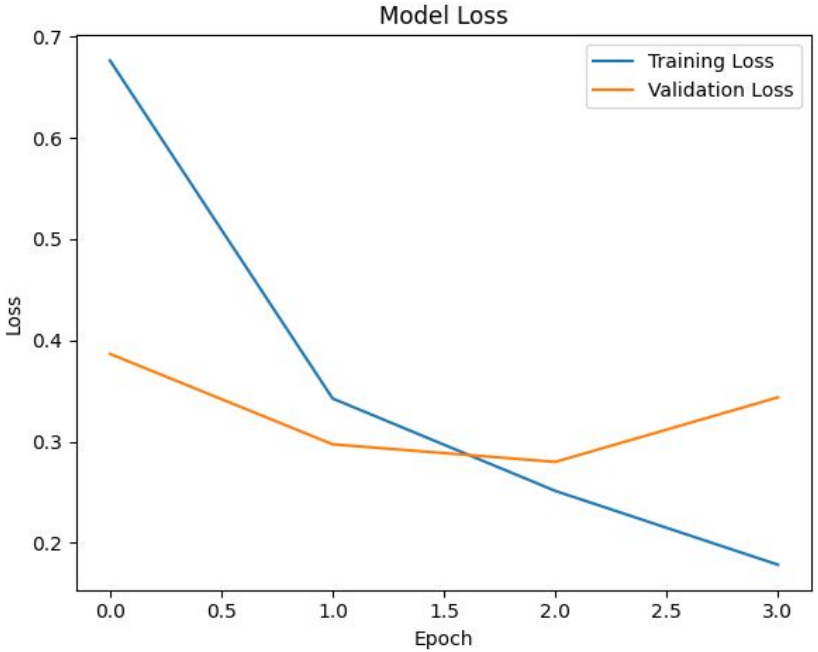
Learning Curve





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Additional Experiments I

Experiments*	**Train/Test Split***	**Weighted Average F1 Score**
Fine-Tuned BERT with 2016 Data (Pooler)	2,893/4,407	79.00%
Fine-Tuned BERT **with 4-Year Data (CLS)**	**5,977/622**	**80.00%**
Fine-Tuned BERT without Top-5 Sources and Test on those Unseen Top-5 Sources' Articles	11,332/2,000 (3 batches)	40.00%

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Error Analysis

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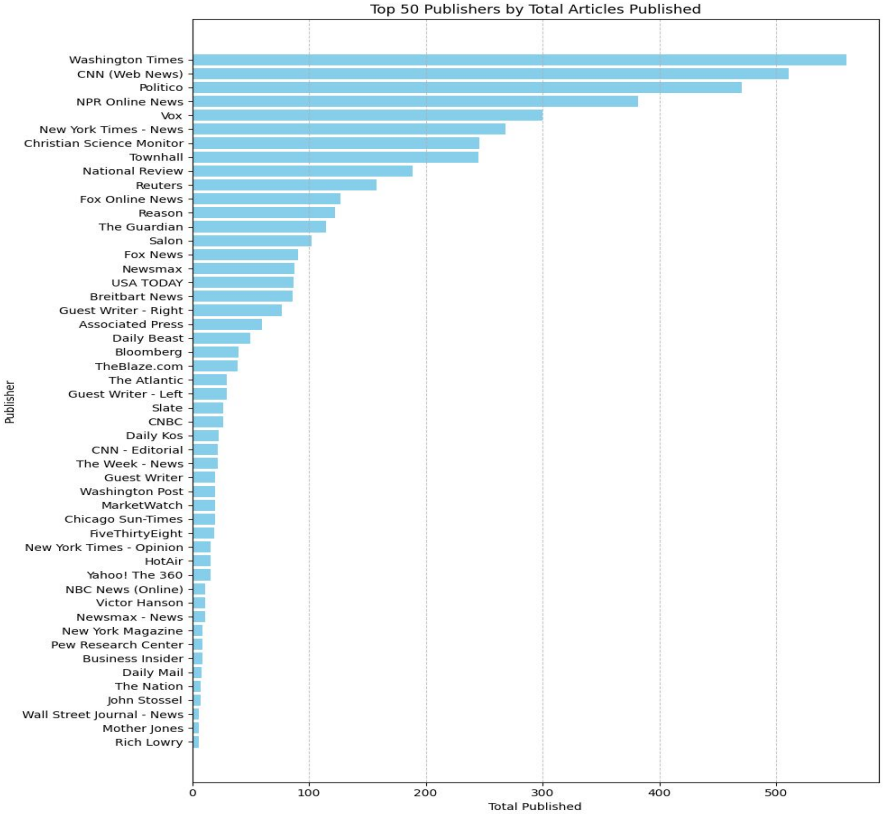
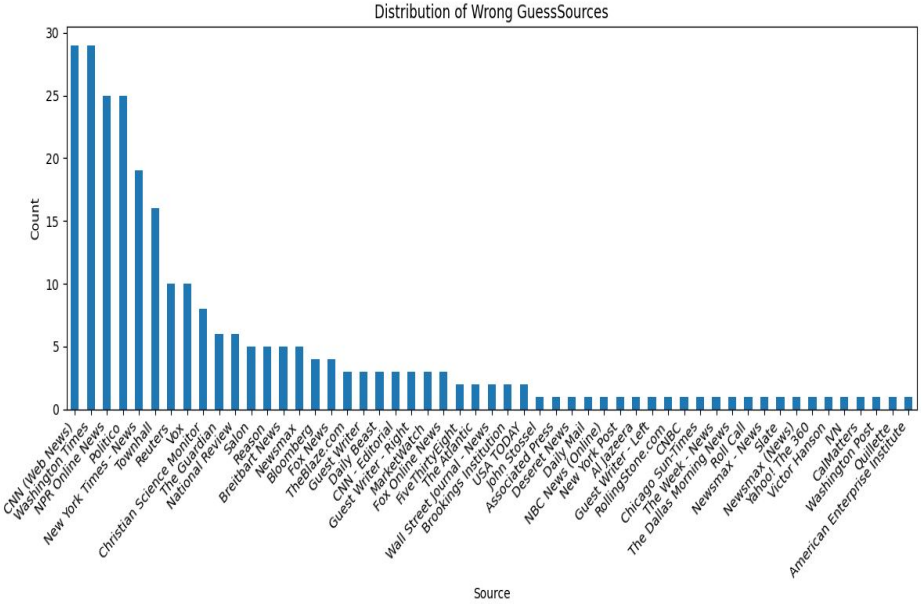
Publication Volumes Proportioned to Erros





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Additional Experiments II

Experiments	Train/Test Split*	Weighted Average F1 Score
Fine-Tuned BERT with Filtered Dataset (CLS)	**8,845/2,213**	**86.00%**
Fine-Tuned BERT with LSTM & Filtered Dataset (CLS)	8,845/2,213	85.00%
Fine-Tuned BERT without Top-5 Sources	**11,332/2,805**	**89.00%**

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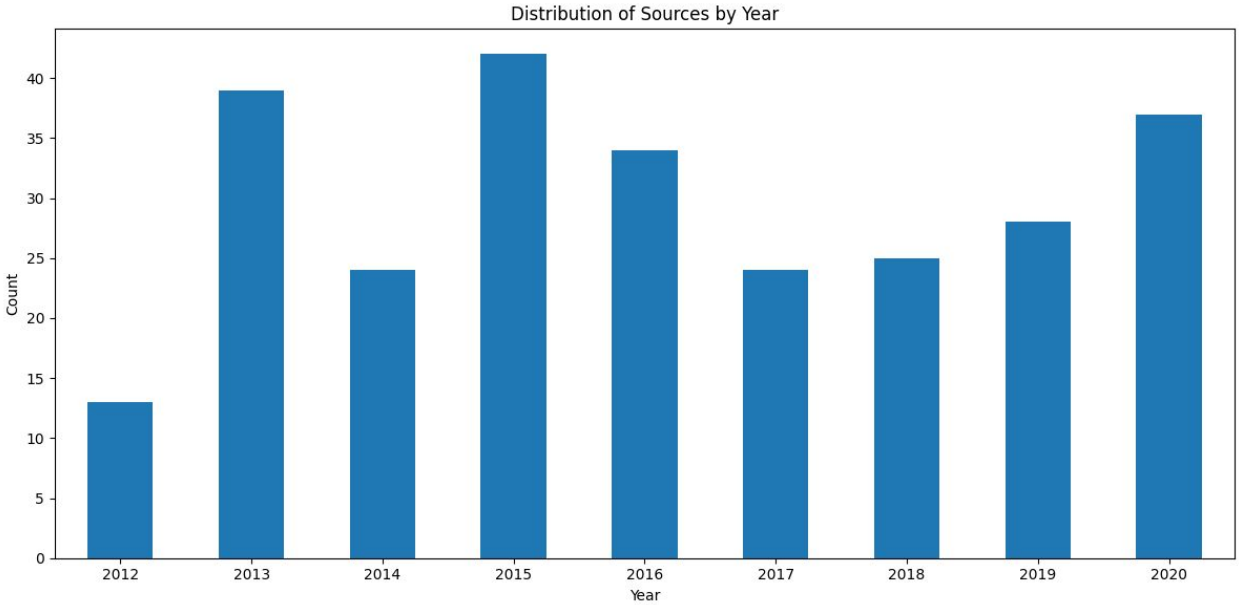
Publication Dates vs Erros



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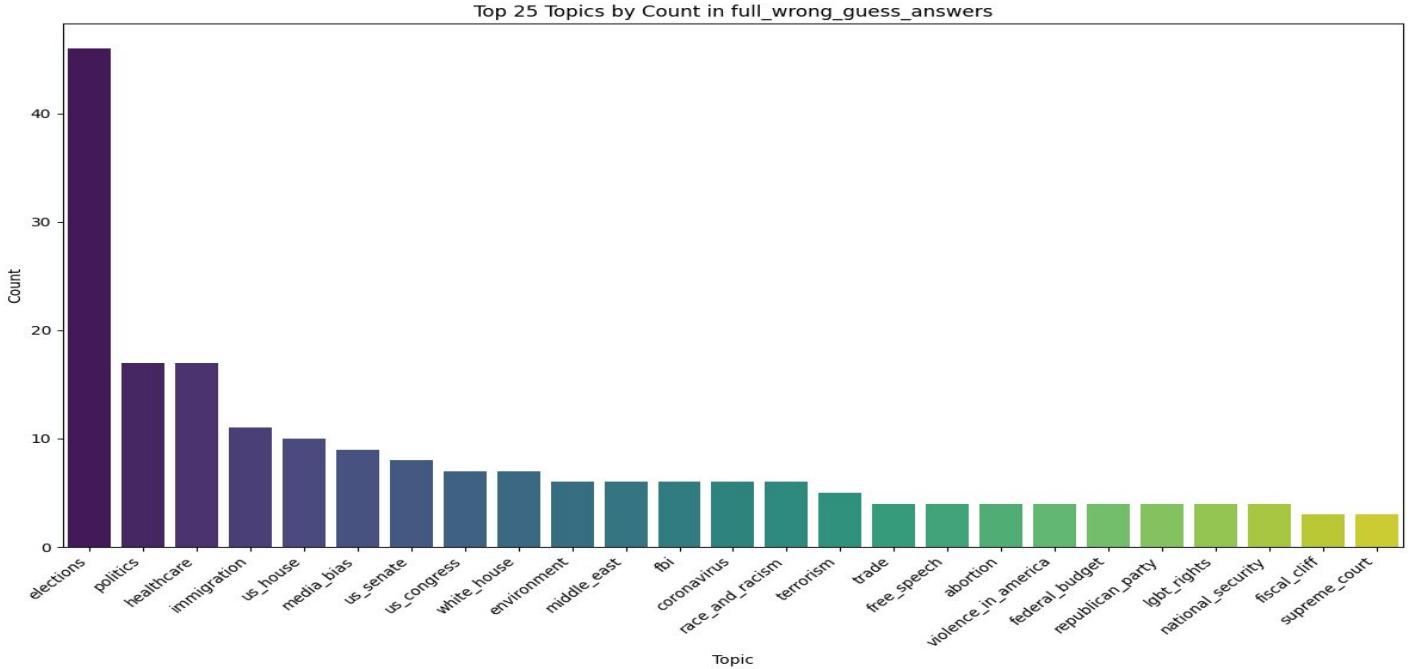
News Articles Topics vs Erros



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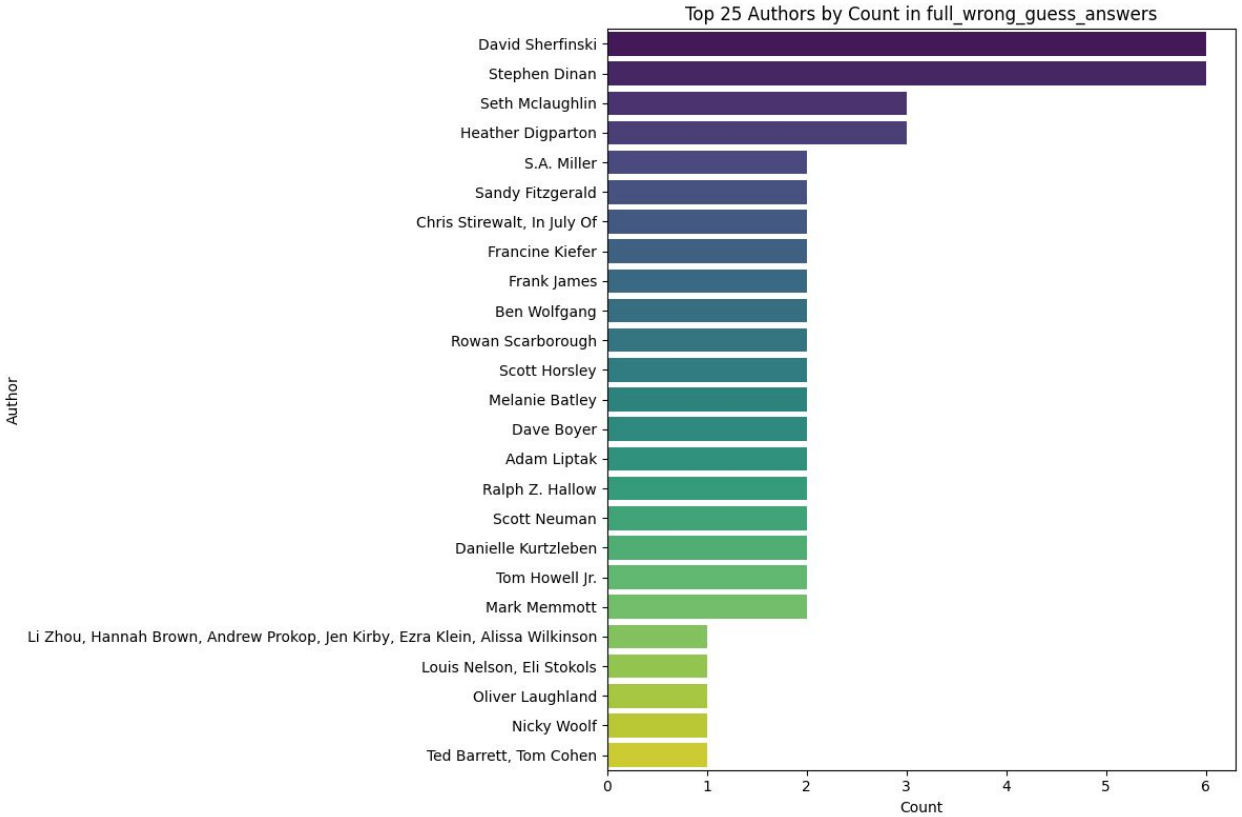
News Articles Authors vs Erros



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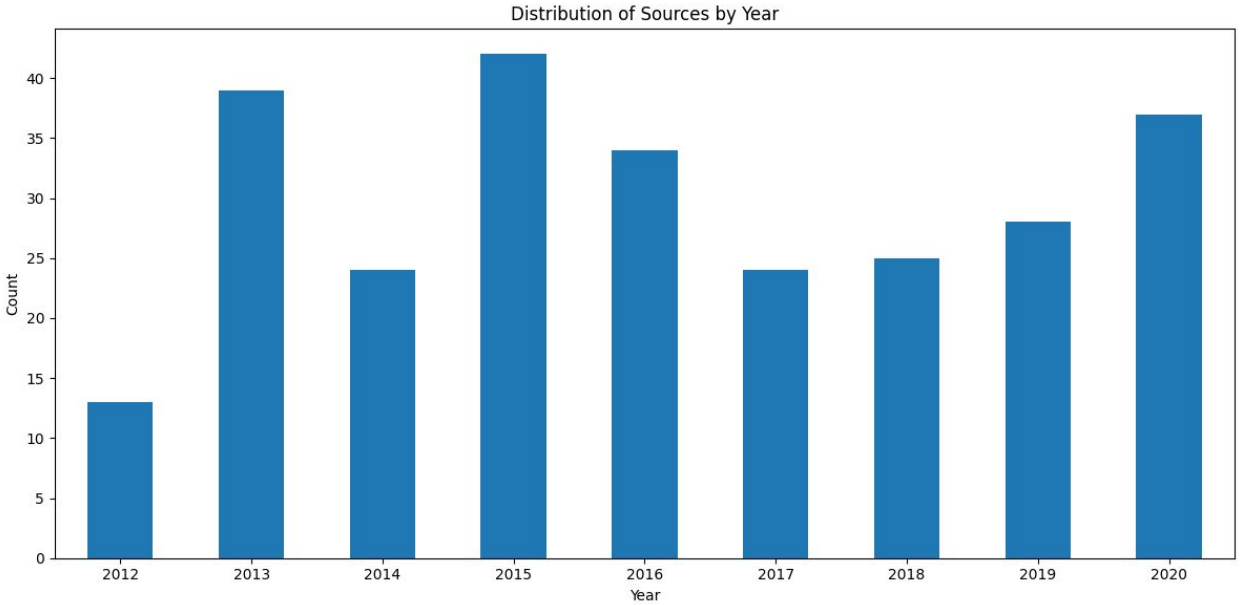
Publication Dates to Erros



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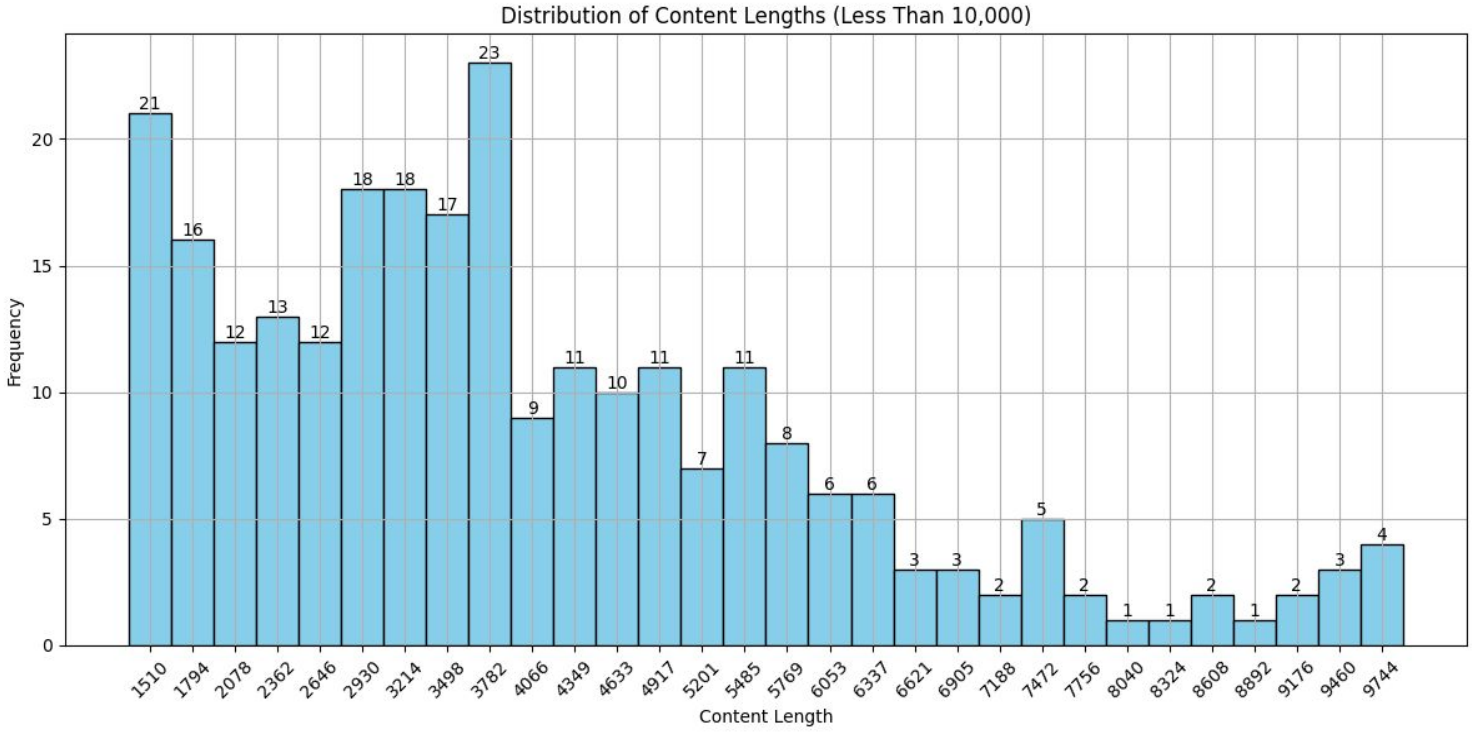
Incorrectly Classified News Articles Length



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Sample Error: 512 Limits the Full Understanding

Figure 10: Sample News Articles that the first portion is background information (True Label is Center; BERT model prediction is 2)

"Pesident barack obama ' s administration reportedly misled congress — american people — crucial element iran nuclear deal. a gopled investigation senate permanent subcommittee investigation revealed wednesday obama ' s treasury department secretly worked license allow iran access american financial system. a license, according treasury department, authorization [treasury] engage transaction otherwise would prohibited. " it ' s big claim. recall iran deal u lift certain sanction tehran exchange iranian curbing nuclear program. u didn ' t remove every penalty signing agreement 2015 — meaning iran ' s access u financial system still limited. but according new report, u treasury department issued license oman ' s bank muscat february 24, 2016. license would let iran change $ 5. 7 billion worth omani rial held bank euro — first changing u dollars. iran could change money dollar without license, since would violated sanction still place. however, two u bank refused help conversion iranianowned omani rial dollar — even obama official approached — reportedly citing severe hit reputations. all, knew would perceived circumventing iran nuclear deal aiding tehran. the associated press first report senate subcommittee ' s findings. sean kane, former sanction official obama ' s treasury department lawyer dechert llp, told treasury not practice allowing iran even indirect access u financial system. " he continued, reported appears limited authorization would allowed onetime conversion specific iranian reserve held abroad, something allowed continue accessing u financial system goingforward basis. " kane also noted treasury issue license based america ' s changing foreign policy needs. that ' s critic see it. obama effort boost iran ' s economy ran counter american interests, skirted law, " jonathan schanzer, iran expert conservative foundation defense democracy think tank, tweeted wednesday. did obama administration lie helping iran? what make revelation worse, republican lawmaker say, obama administration may best misled — worst, deliberately lied — granting iran limited access u financial system. the obama administration misled american people congress desperate get deal iran, " sen. rob portman (roh), subcommittee ' s chair, said statement. here ' s portman others make claim : wednesday ' s report, note statement top obama official saying type action wasn ' t possibility. iran continue denied access [us ' s] financial commercial market, " thentreasury secretary jack lew told senate foreign relation committee july 2015. and adam szubin, top treasury official obama, said senate banking committee later month : iranian bank able clear u dollar new york, hold correspondent account relationship u financial institutions, enter financing arrangement"

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Proprietary Model’s Prediction

```
# ------------------------------------------------
# Input text:
# democrat congress seeking capitalize unrest teacher pay led classroom walkout handful states, offering electionyear plan roll back part last year ’ s gop tax cut boost fund schools,
#including higher wage educators. state local school district would get $ 50 billion decade raise teacher pay recruit educators. plan would provide another $ 50 billion school building resources,
#expand public school teachers ’ collective bargaining rights. the measure among series initiative democrat offering rally core voter ahead election november, every house seat ballot, along third
#senate seats. minority party chambers, democrat lack power bring plan vote. on monday, democrat focused controversy surrounding president donald trump allegation corruption administration, promising
#new ethic rule restriction campaign donation undisclosed contributors. to pay education plan, house minority leader nancy pelosi democratic leader want cancel new tax cut benefit wealthiest 1 percent a
#instead giving tax cut richest americans, give pay raise teacher country student depend succeed, ” senate majority leader chuck schumer said news conference. joining democrat leader american federation
#key donor party candidates. the recent teacher walkout occurred important election battleground state including arizona, gop senator jeff flake retiring, west virginia, incumbent democratic senator joe
#virginia ended nineday strike march 5 percent pay raise. state teacher demonstrated higher pay include oklahoma, kentucky colorado.


# True label:
# 1

# Predicted label:
# 2

# Chatgpt's Predicted Label (8k Tokens):
#TThe text reflects a left-leaning or progressive political ideology due to the focus on increasing funding for education, raising teacher pay, and opposing tax cuts for the wealthiest Americans.


# Claude 3.5 Sonet (200k Tokens))
#While the text does include some factual reporting of events, the overall framing and focus on Democratic proposals and critiques of Republican policies suggest a left-leaning bias. The language used,
#such as "Instead of giving tax cuts to the richest Americans," echoes typical left-wing rhetoric.
```

End
Any Questions?