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Natural Language Processing Challenge

IronHack Mini Project:
Fake News Detection Using NLP
Classifying Real vs Fake News Headlines

FAKE NEWS

- Develop an ML model to classify news headlines as real or fake
- Explore TF-IDF and multiple ML algorithms (Logistic Regression, Naive Bayes, SVM, Random Forest, XGBoost)
- We compare their performance, select the most accurate model, and use it to label the unseen test headlines.
- Tune best performers for maximum accuracy.
- Generate final predictions for the testing dataset.

IronHack Mini Project

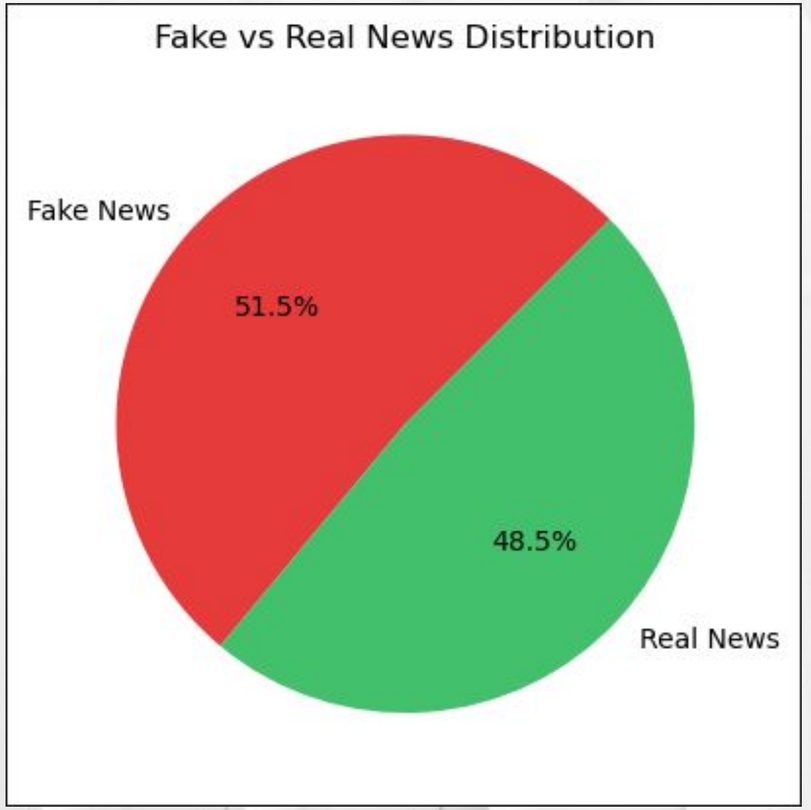
PROJECT GOAL

NLP
Mini Project

Dataset Sample

	fakeornot	headline
866	0	anderson cooper throws major shade at white ho...
4943	0	florida republican has an insane meltdown afte...
6532	0	trump promises to destroy the usa during inter...
16041	0	in his own words: stunning unofficial trump ad...
16903	0	the single chart to share that tells the truth...
32847	1	turkish nationalist opposition seeks to secure...
16578	0	so god made a patriot: ,i need a man who knows...
30193	1	mexican opposition leader anaya to seek presid...
3761	0	donald trump openly admits to america he has n...
27178	1	clinton loses to sanders in coal state of west...

- *Dataset Shape - 34.152 rows x 2 columns*
- *training_data.csv (headline + label)*
- *testing_data.csv (headline only)*
- *Train/validation split: 80/20*
- *Labels (“Fakeornot”): 0 = real, 1 = fake*



Dataset

LOGISTIC REGRESSION 93,1% ▲ RANDOM FOREST 91,1% ▼ LINEAR SVC 93,2% ▲ XGBOOST 90,5% ▼ NAIVE BAYES 92,8% ▲

Text Preprocessing

- Lowercasing
- Removing punctuation
- Stripping whitespace
- TF-IDF handles tokenization + term importance

TF-IDF Vectorization

Parameters used:

- n-grams: 1–2
- max_df: 0.9
- min_df: 5
- stop words: English

Converts text into numerical features representing word relevance.

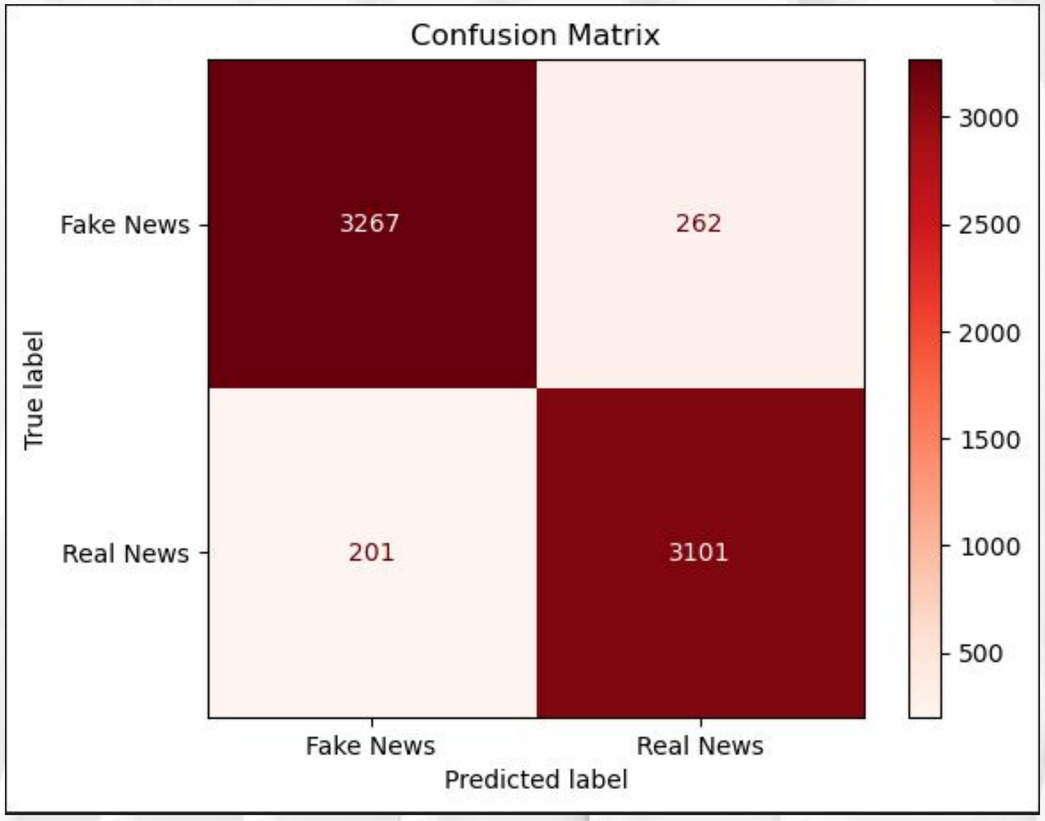
Baseline Model

Logistic Regression

Metrics Used: Accuracy, Precision, Recall, F1-Score

Baseline Model: Logistic Regression

Metric	Value
Accuracy	93,12%
Precision	91,92%
Recall	94,03%
F1-Score	92,96%



Text Preprocessing & Baseline Model Development

LOGISTIC REGRESSION 93,1% ▲ RANDOM FOREST 91,1% ▼ LINEAR SVC 93,2% ▲ XGBOOST 90,5% ▼ NAIVE BAYES 92,8% ▲

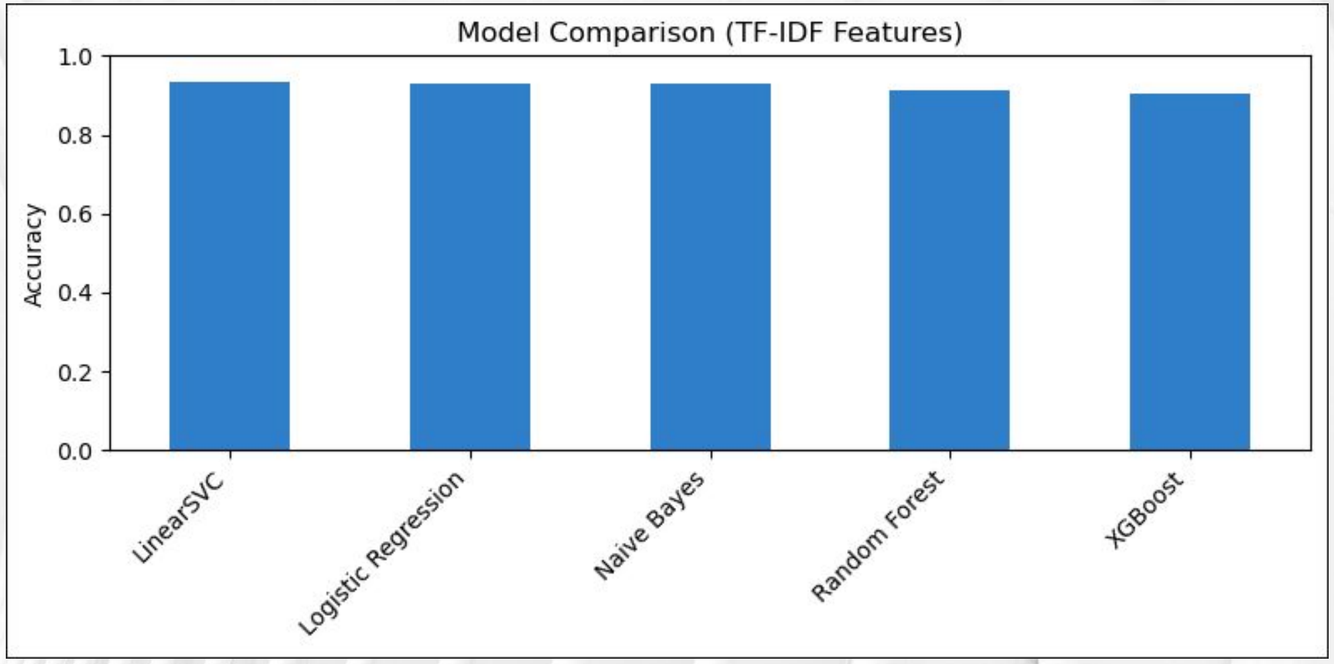
Trying Different Classifiers

- Logistic Regression
- LinearSVC
- Naive Bayes (MultinomialNB)
- Random Forest
- XGBoost

Initial Results

Logistic Regression and LinearSVC showed strongest baseline performance.

Model	Accuracy Evaluation
LinearSVC	93.4%
Logistic Regression	93.2%
Naive Bayes	92.3%
Random Forest	91.6%
XGBoost	90.3%



Models Evaluation & Initial Results

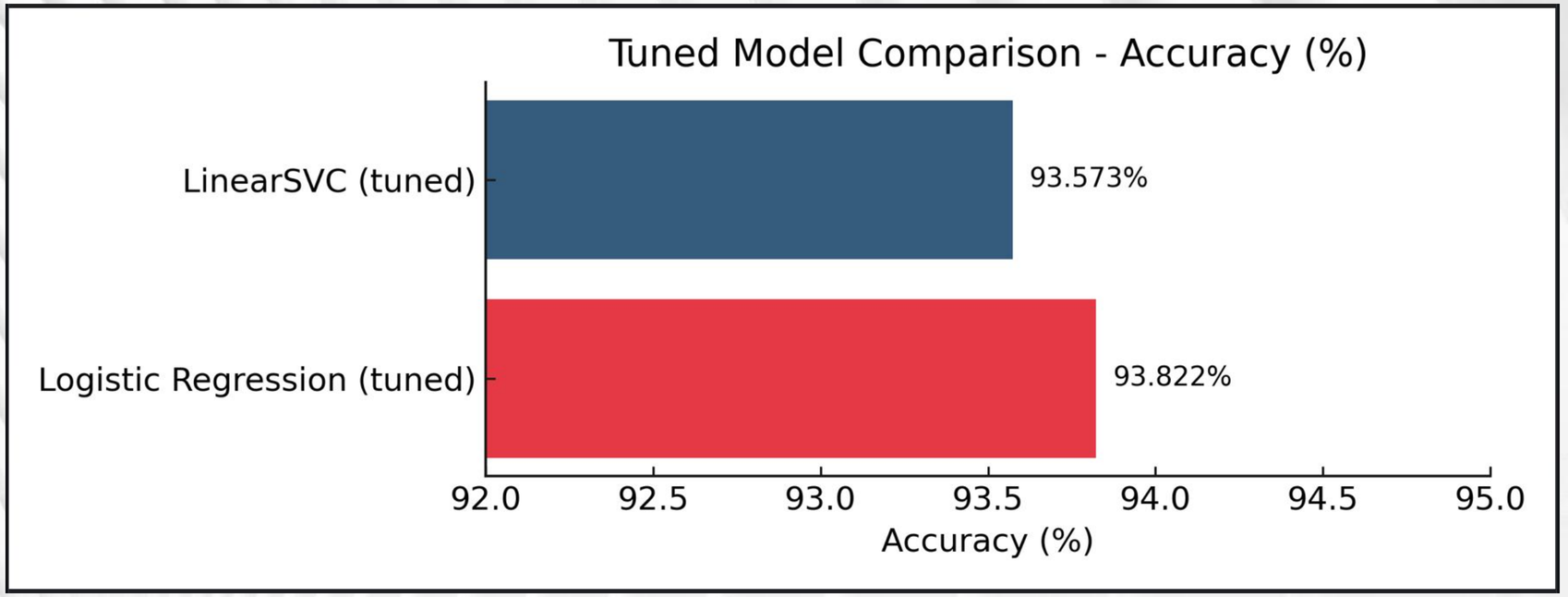
LOGISTIC REGRESSION 93,1% ▲ RANDOM FOREST 91,1% ▼ LINEAR SVC 93,2% ▲ XGBOOST 90,5% ▼ NAIVE BAYES 92,8% ▲


Breaking News
LIVE
WAIT, LET'S TUNE OUR MODELS
LOGISTIC REGRESSION 93,1%
RANDOM FOREST 91,1%
LINEAR SVC 93,2%
XGBOOST 90,5%
NAIVE BAYES 92,8%

LIVE

Tuning the Best Performance Models

- Used GridSearchCV
- 3-fold cross-validation
- Tuned: Logistic Regression and LinearSVC
- Improved accuracy beyond baselines



2 Best Performing Models

Hyperparameter Tuning

LOGISTIC REGRESSION 93,1% ▲ RANDOM FOREST 91,1% ▼ LINEAR SVC 93,2% ▲ XGBOOST 90,5% ▼ NAIVE BAYES 92,8% ▲

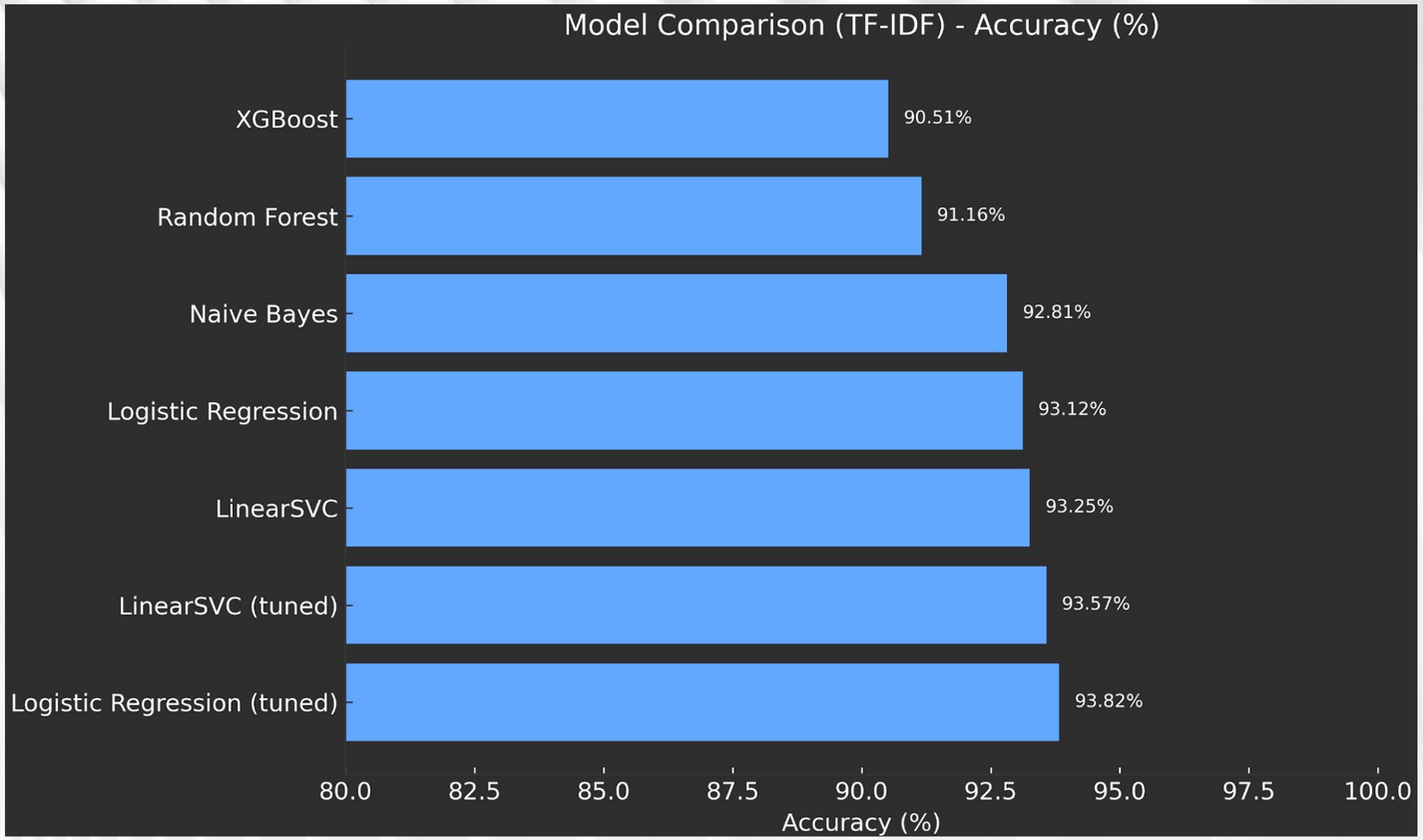
Overall Evaluation

Comparison of accuracy across all evaluated TF-IDF models.

Linear models (Logistic Regression and LinearSVC) outperform tree-based models.

The **tuned Logistic Regression achieves the highest accuracy (93.82%)**, emerging as the top performer.

Hyperparameter tuning provided consistent improvements, especially for linear models.



Final Model Comparison

NLP MINI PROJECT

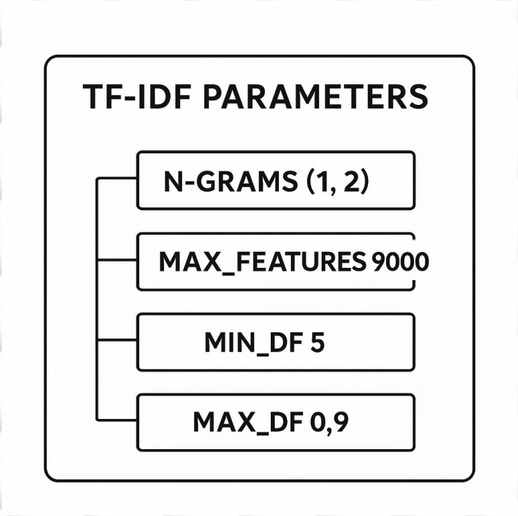
LOGISTIC REGRESSION 93,8% ▲ RANDOM FOREST 91,6% ▲ LINEAR SVC 93,4% ▲ XGBOOST 90,3% ▼ NAIVE BAYES 92,9% ▲

Logistic Regression (Tuned)	*LinearSVC (Tuned)*	*LinearSVC*
93,8%	**93,6%**	**93,4%**
Accuracy	Accuracy	Accuracy

Best Overwall

Training Final Model

- TF-IDF retrained on full dataset



- Final Logistic Regression (tuned) trained on all labeled data
- Saved vectorizer + model for prediction

Predictions for Test File

- Applied full TF-IDF: transform it with the tfidf_full vectorizer, predict,
- Predicted labels 0/1: overwrite the first column (which originally contains 2s) with 0/1.
- Updated first column accordingly
- Saved as testing_predicted.csv

FINAL MODEL TRAINED

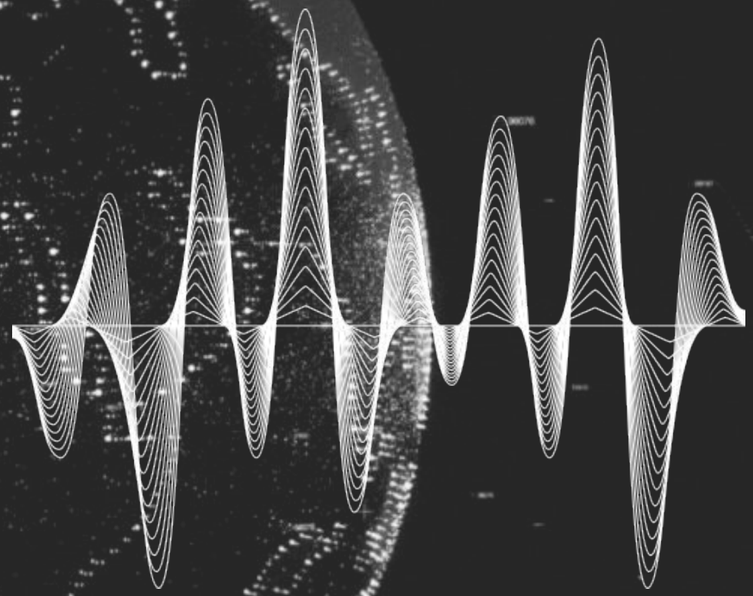
Conclusion

- Classical models can outperform deep learning on short text
- TF-IDF was highly effective
- Logistic Regression achieved 93.8 percent accuracy
- Reliable approach for fake news classification

— **Next Steps for future improvement:**

- ➢ Fine-tune transformer models
- ➢ Add character-level features
- ➢ Combine TF-IDF with embeddings
- ➢ Deploy as API or dashboard

LIVE



Thank You!