"QuoteSense: A Multi-Model Pipeline for Emotion Detection in Motivational Quotes"
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QuoteSense is a comprehensive NLP pipeline designed to detect and analyze the emotional undertone of motivational quotes using multiple machine learning approaches. It explores the stylistic and semantic dimensions of quotes by comparing traditional ML, deep learning, and transformer-based models. The project not only classifies quotes by emotion but also provides rich analysis of model behavior, misclassifications, and linguistic patterns.

Project Overview

The goal of this project is to develop an end-to-end emotion classification system for motivational quotes. Using a labeled dataset of quotes with associated emotional categories, the system predicts the dominant emotion expressed in each quote and analyzes linguistic characteristics.

We explore three modeling approaches:

1. **Traditional ML** using TF-IDF + Logistic Regression
2. **Deep Learning** with LSTM on tokenized/padded sequences
3. **Transformer-Based Models** using DistilBERT fine-tuning

Additionally, the project visualizes insights through:

- Word frequency analysis
- t-SNE and UMAP dimensionality reductions
- Word clouds
- Misclassification clusters

Methodology
1. Data Preparation
The dataset used in this project includes a total of 44,000 motivational quotes, evenly split between:

- 22,000 Human-authored quotes — curated from various online sources via web scraping
- 22,000 AI-generated quotes — created using generative language models (e.g., GPT-based)

Each quote is annotated with one of several emotion labels, and is further enriched with four novel stylistic and semantic features to provide deeper insights:These engineered features help analyze and compare stylistic differences between human and AI-generated content, and offer

additional signal for emotion classification and cluster interpretation.

Feature	Description
CreativityScore	Measures originality and novelty in the quote's language
PoeticToneScore	Quantifies the lyrical or poetic tone in the structure of the quote
EmotionalBalanceIndex	Reflects the balance between positive, neutral, and negative emotional cues
SemanticClicheScore	Captures the presence of common or overused expressions (clichés)

Preprocessing Steps:

- Duplicates removed, quotes cleaned
- Emotion labels encoded
- Data split into train/test sets

2. Model Pipelines
1) Logistic Regression
Input: TF-IDF features (top 5000)
Output: Emotion class
Pros: Fast baseline, interpretable weights

2) LSTM Neural Network
Input: Tokenized & padded sequences (max length = 30)
Embedding + LSTM + Dense layers
Captures sequential dependencies in quotes

3) DistilBERT Fine-Tuning
Pre Trained transformer model from HuggingFace
Fine-tuned on labeled quotes
Token classification with attention to semantic nuance

Evaluation & Findings

Model	Accuracy (Test Set)	Notes
Logistic Regression	0.83	Performs well on structured/explicit emotional language
LSTM	0.8492	Improves on temporal/creative phrasing
DistilBERT	0.92	Best performance across subtle, poetic, or abstract quotes

Transformer models outperform traditional models due to their contextual understanding of language.

- LSTM handles syntactic flow better than TF-IDF.
- Misclassified quotes tend to express overlapping emotions or poetic ambiguity.

Predicting New Quotes and Emotions:

```
] test_quotes = [
    "Let your light shine through every shadow you meet.",
    "Fear is a reaction. Courage is a decision.",
    "Gratitude makes sense of our past, brings peace for today, and creates a vision for tomorrow."
]

predict_emotions_batch(test_quotes)

['Wisdom', 'Fear', 'Gratitude']
```

Misclassified Quotes:

```
Total misclassified: 125

Quote: Young players need freedom of expression to develop as creative players... they should be encouraged to try skills without fear of failure.
Actual: Wisdom
Predicted: Fear
___
Quote: You can't be afraid to put out a fire if you're a fireman. You can't be afraid to be a police officer and carry a gun if you're afraid to get up and go out there
Actual: Wisdom
Predicted: Fear
___
Quote: Whoever said money can't buy happiness simply didn't know where to go shopping.
Actual: Wisdom
Predicted: Joy
___
Quote: We are increasingly likely to find ourselves in places with background music. No composers have thought to write for these modern spaces, which represent 30% of
Actual: Wisdom
Predicted: Joy
___
Quote: My fellow Americans, ask not what your country can do for you, ask what you can do for your country.
Actual: Sadness
Predicted: Wisdom
___
```
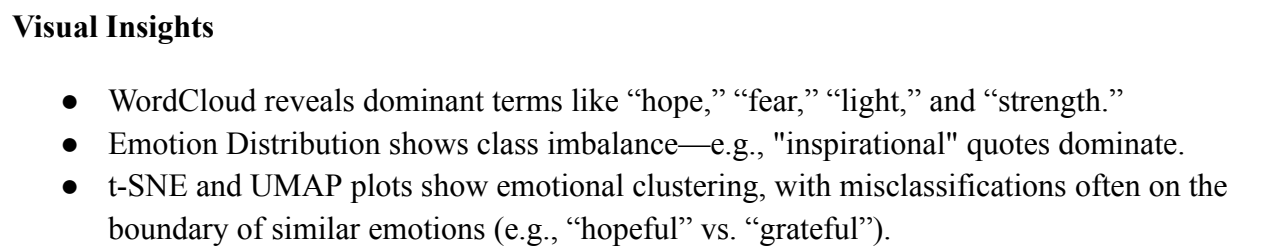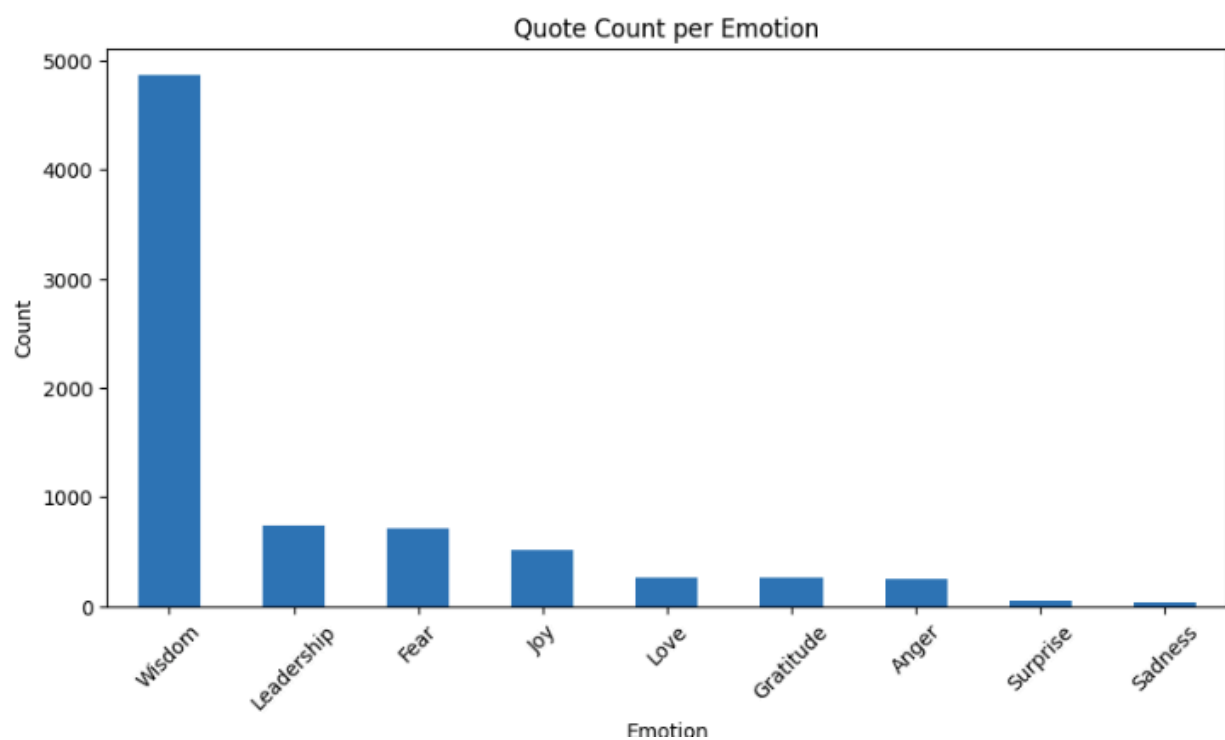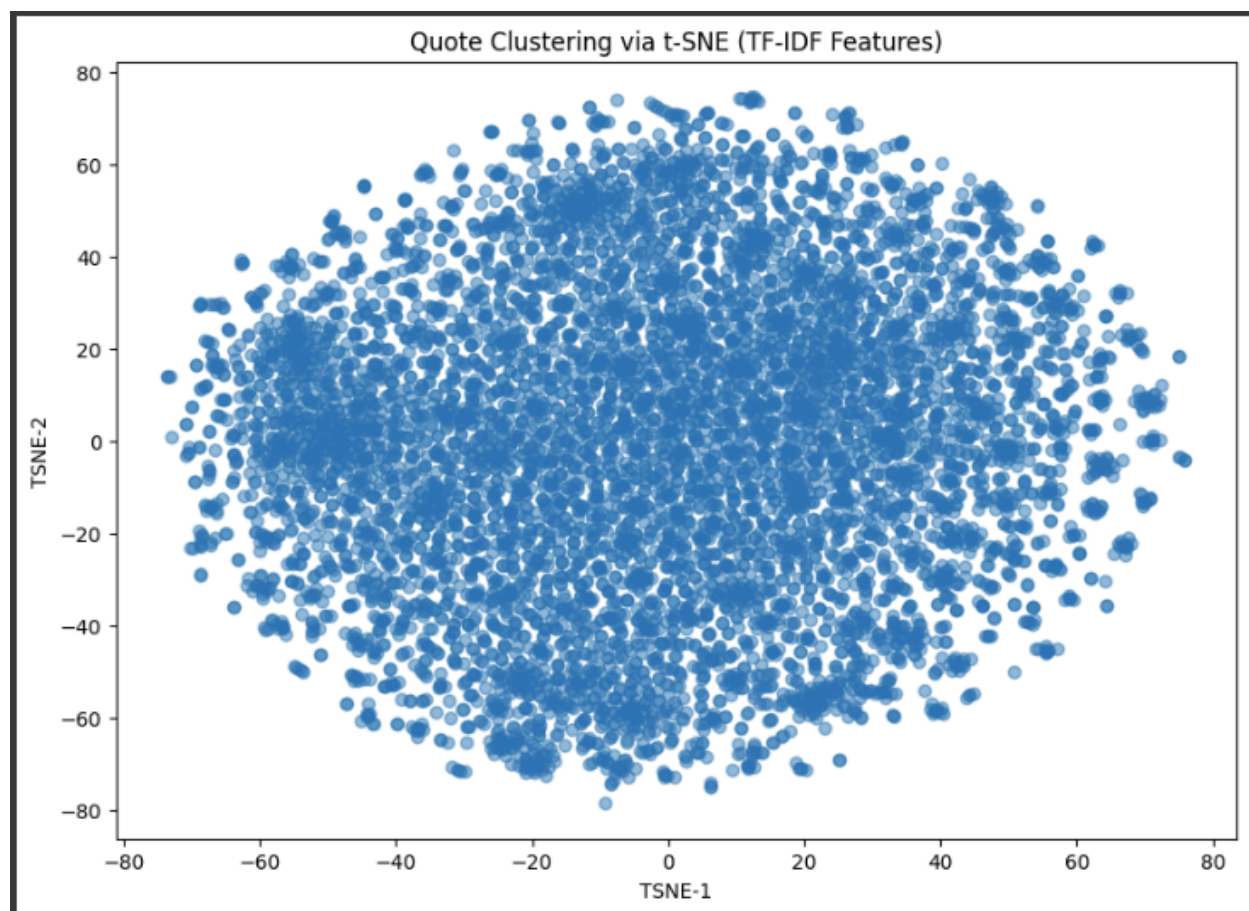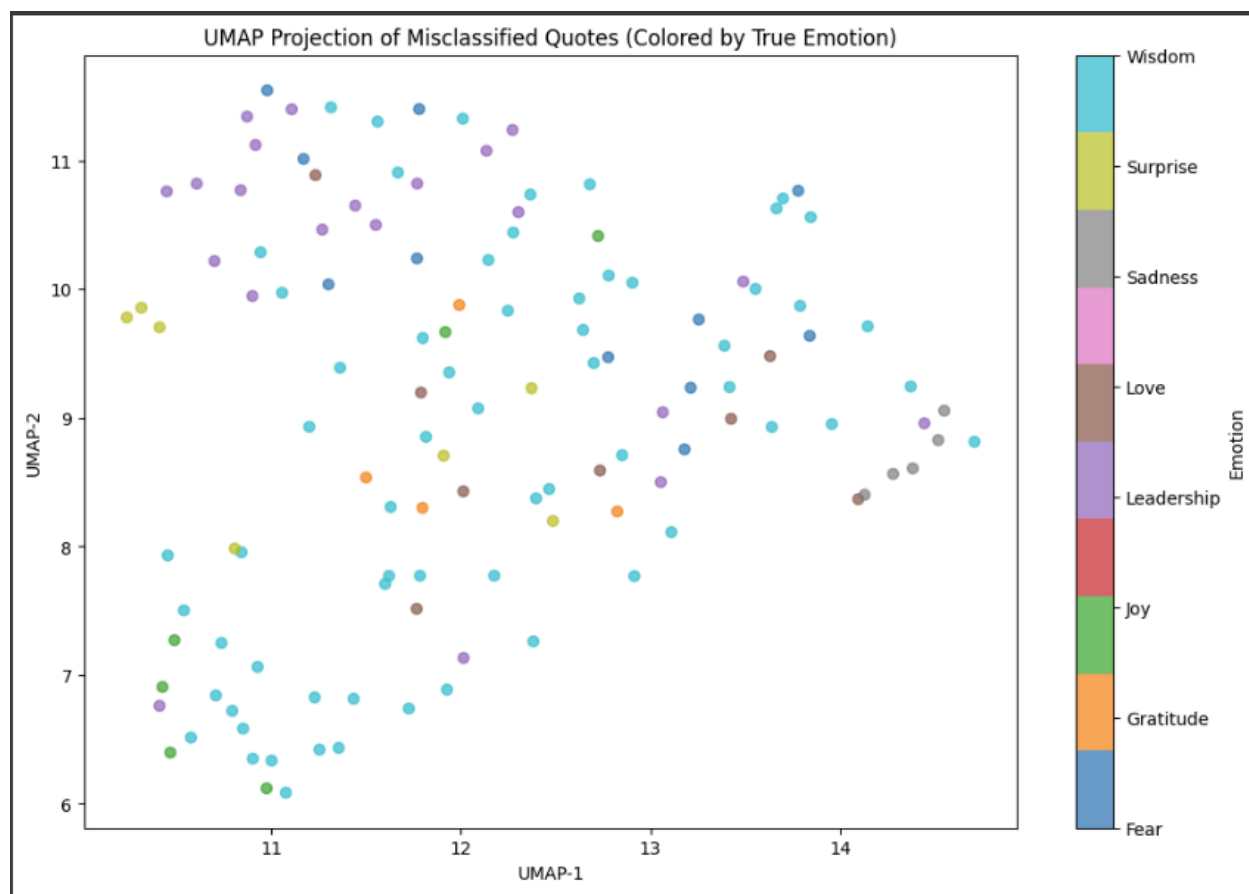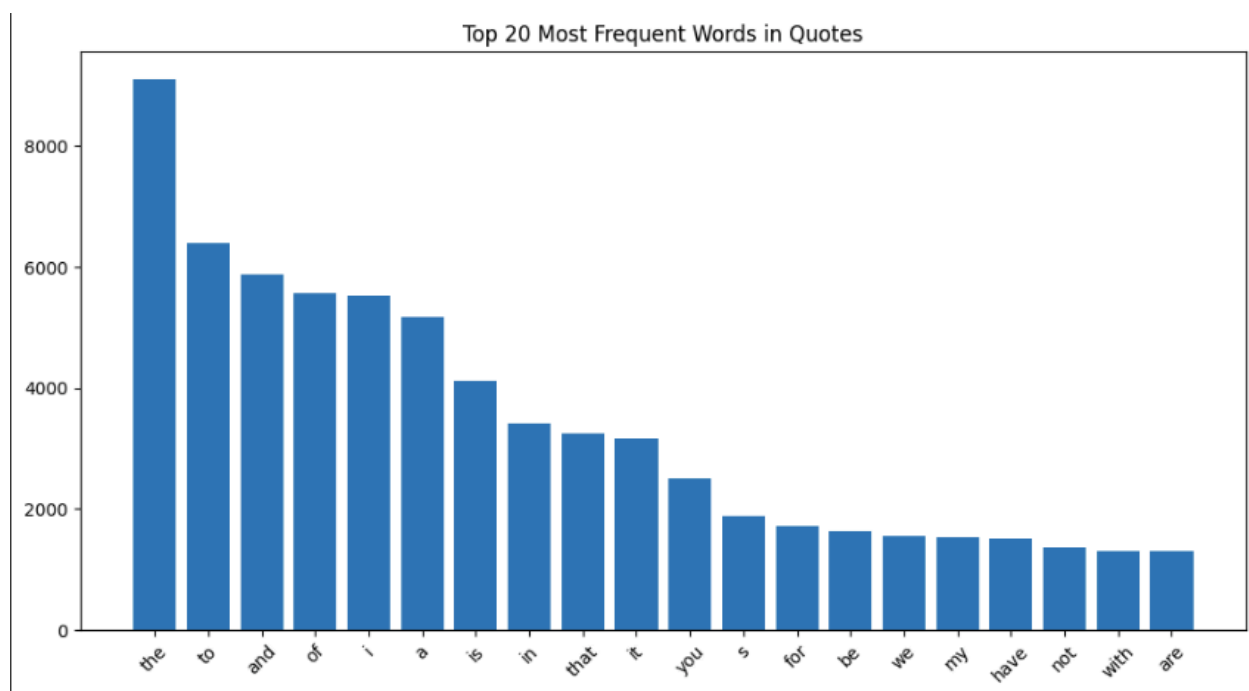
Visual Insights

- WordCloud reveals dominant terms like "hope," "fear," "light," and "strength."
- Emotion Distribution shows class imbalance—e.g., "inspirational" quotes dominate.
- t-SNE and UMAP plots show emotional clustering, with misclassifications often on the boundary of similar emotions (e.g., "hopeful" vs. "grateful").

Word Cloud of All Quotes

Quote Clustering via t-SNE (TF-IDF Features)

Quote Count per Emotion

Top 20 Most Frequent Words in Quotes

UMAP Projection of Misclassified Quotes (Colored by True Emotion)

Conclusion:

QuoteSense successfully classifies emotions in 44,000 motivational quotes using traditional ML, LSTM, and transformer models. DistilBERT achieved the best performance, especially on nuanced or abstract quotes. By introducing four stylistic metrics—CreativityScore, PoeticToneScore, EmotionalBalanceIndex, and SemanticClicheScore—we gained deeper insights into how AI vs. human-authored quotes differ in tone and expression. This project highlights the value of combining emotion detection with stylistic analysis to better understand and compare textual content.