DATA & AI 6

Aspect-Based Sentiment Analysis Project

Comparing Lexicon-Based, Transformer-Based, and LLM-Driven Approaches

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Project Scope & Models Compared

1

LexiconABSA

Rule-based (spacy + VADER). Strengths: Fastest, Interpretable, Low Cost. Weaknesses: No context/sarcasm, High Noise/Irrelevant Aspects.

2

Transformer_ABSA

Supervised ML. Strengths: Best Balance of Accuracy & Speed. Weaknesses: Requires training, Moderate Resource Use.

3

LLMABSA

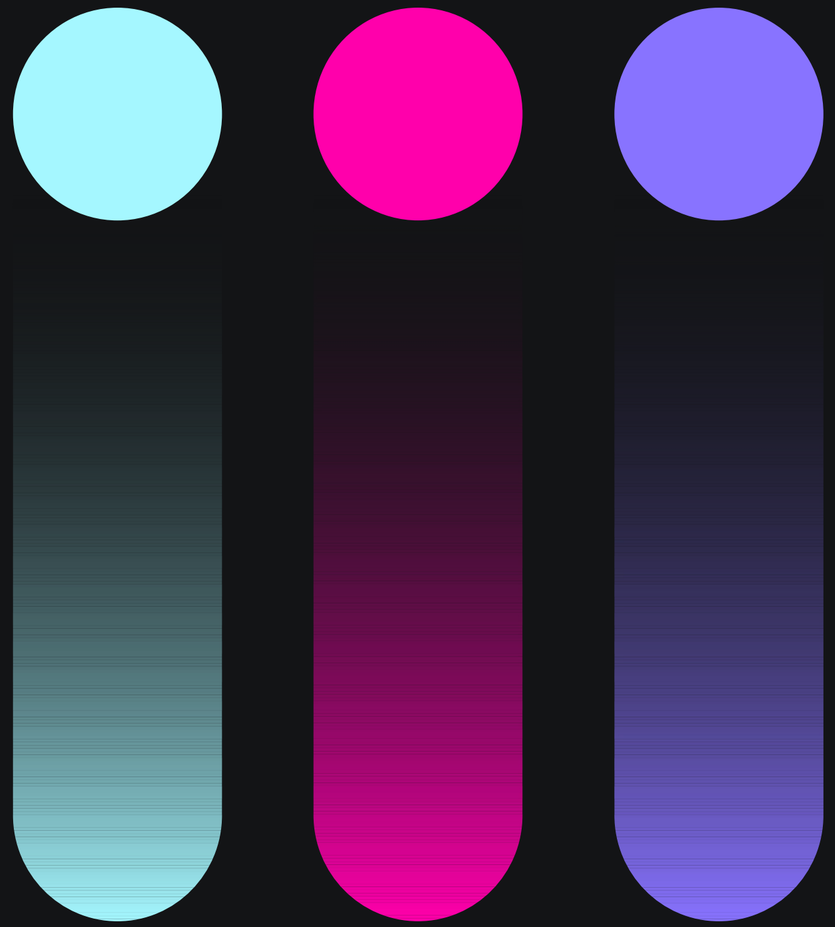
Few-shot Prompting (Ollama). Strengths: Highest Quality (best aspect filtering, handles sarcasm/ambiguity). Weaknesses: Slowest, Highest Cost/Resource Use.

Performance Results & Key Trade-Offs

- Quantitative Speed Benchmark (Table):
  - Lexicon: ≈ 7ms (1x baseline)
  - Transformer: ≈ 40ms (3-5x slower)
  - LLM: ≈ 500ms (40-60x slower)
- Aspect Extraction Quality:
  - Finding: LLMABSA showed superior aspect quality by filtering irrelevant terms (pronouns, generics) and consolidating related concepts. Lexicon/Transformer extracted a lot of noise.
- Qualitative Edge Case Handling:
  - Finding: LLMABSA was the only model to consistently handle sarcasm ("Haven't heard complaints from my dog") and ambiguity ("Great" → "Overall" POSITIVE).

Detailed Accuracy & Contextual Analysis

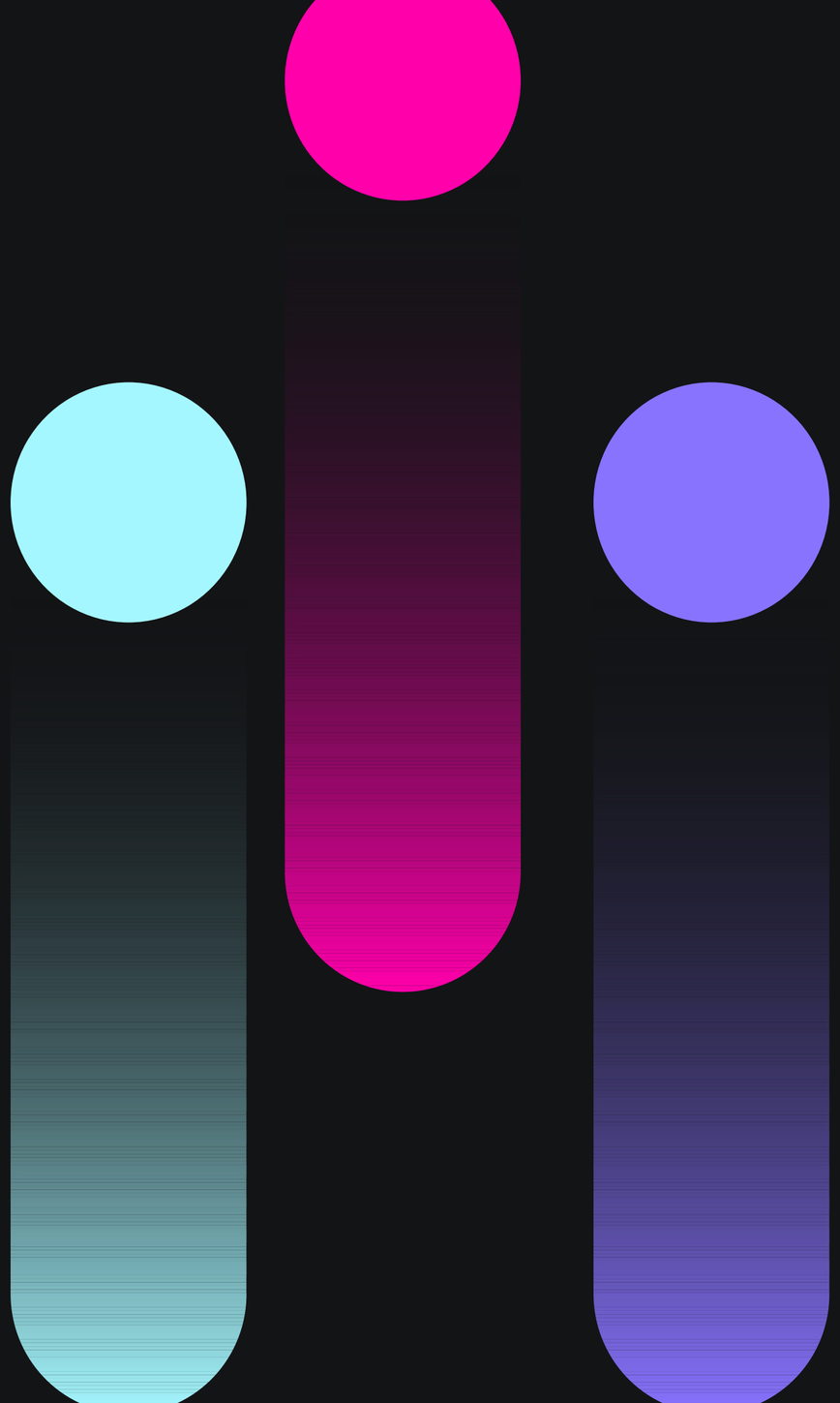
- Accuracy by Case Type (Summary):
  - Simple Cases: All models were Good/Excellent.
  - Complex Cases (Multi-Aspect): Lexicon: Poor; Transformer/LLM: Good/Very Good.
  - Edge Cases (Sarcasm/Ambiguity): Lexicon/Transformer: Poor/Fair; LLM: Excellent.
- Key Behavioral Difference (Context):
  - Implicit Sentiment: LLM and Transformer handled implied negativity (e.g., "makes me question freshness") well, while Lexicon failed.
  - Aggregation: LLM excelled at cleanly separating and scoring multiple conflicting sentiments in one review.



Conclusion & Recommendations

- Core Conclusion: Model sophistication (Lexicon → Transformer → LLM) directly correlates with ABSA performance, but at the cost of latency and resources.
  - Deployment Recommendations (3 Scenarios):
    i. Real-Time/High-Volume/Low-Resource: Choose LexiconABSA (fastest, cheapest).
    ii. General Production/E-Commerce: Choose Transformer_ABSA (best balance of accuracy and speed).
    iii. High-Value/Nuanced Research/B2B Feedback: Choose LLMABSA (highest quality, best aspect filtering).

Thank You



Thank You