Edinburgh Airbnb Star Rating Outcomes Prediction Through Review Texts Analysis

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Problem Statement

How can Airbnb hosts improve their rentals?

What are the key factors that determine an outstanding Airbnb listing?

How can I answer this question through the analysis of guest reviews?

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Key Issue About Datasets

- No ratings scores for individual reviews

Listing Dataset

Listing ID	Listing Features	Rating Scores
1	Features_1	4.3
2	Features_2	4.6

Reviews Dataset

Listing ID	Reviews
1	A
1	B
1	C
2	D

Aggregate Listing and Review Data

- Same listing details on different reviews if they comment on the same Airbnb
- Half a million datapoints
- Assumed all reviews of same listing share same score

Listing ID	Listing Features	Rating Scores	Reviews
1	Features_1	4.3	A
1	Features_1	4.3	B
1	Features_1	4.3	C
2	Features_2	4.6	D

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Aggregate Listing and Review Data

- Reviews condensed to same listings
- Only about 6000 datapoints
- Better interpretability as overall rating score corresponds to overall reviews

Listing ID	Listing Features	Rating Scores	Reviews
1	Features_1	4.3	A + B + C
2	Features_2	4.6	D

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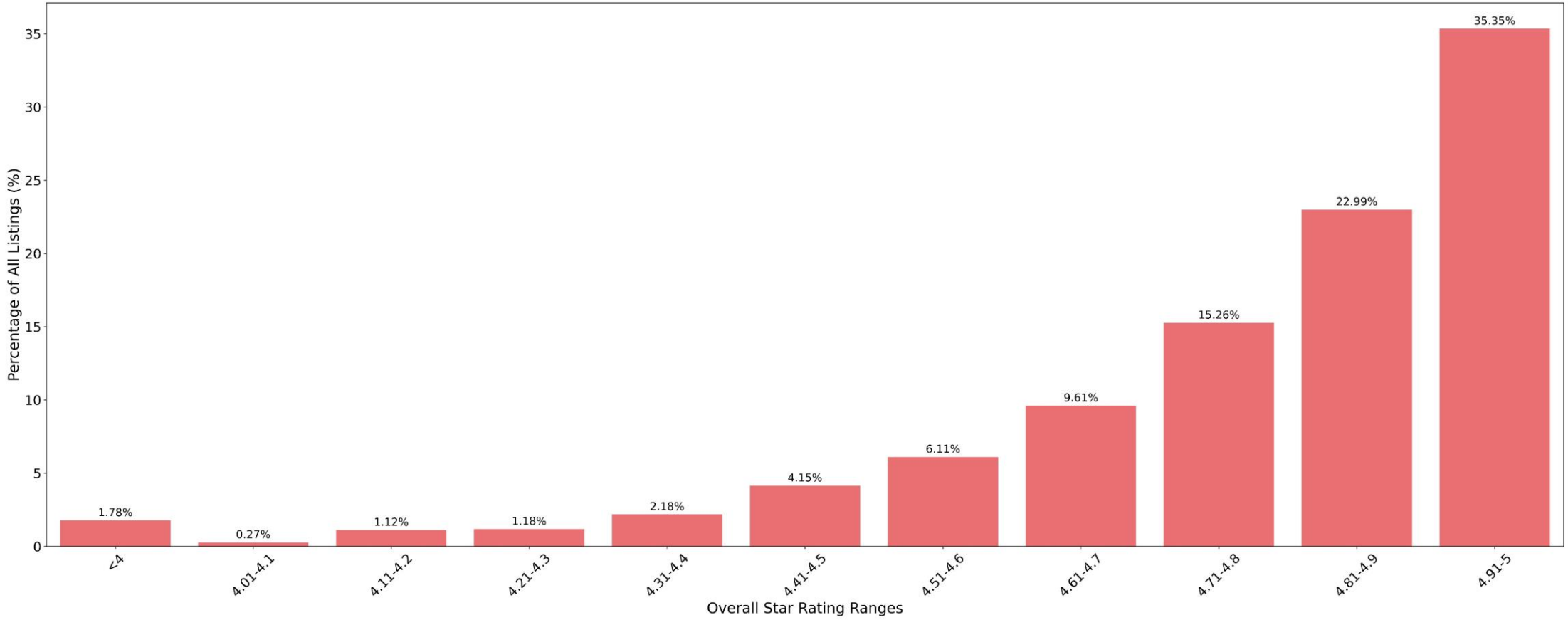
Listings Distributions by Overall Star Ratings

- 58% of the listings have above 4.8 overall rating.
- Only less than 2% of the listings have overall rating less than 4.
- Therefore, a threshold of 4.8 is selected to classify listings



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Modelling Workflow

Uncondensed Review Dataset

Listing ID	Listing Features	Rating Scores	Reviews
1	Features_1	4.3	A
1	Features_1	4.3	B
1	Features_1	4.3	C
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GridSearch (General Sweep)

GridSearch (N-grams)

Condensed Review Dataset

Listing ID	Listing Features	Rating Scores	Reviews
1	Features_1	4.3	A + B + C
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GridSearch (General Sweep)

GridSearch (N-grams)

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Modelling Approach

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GridSearch (General Sweep)

Purpose: Baseline Analysis

Limitation: Difficult to interpret

GridSearch (N-grams)

Listing ID	Listing Features	Rating Scores	Reviews
1	Features_1	4.3	A + B + C
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GridSearch (General Sweep)

GridSearch (N-grams)

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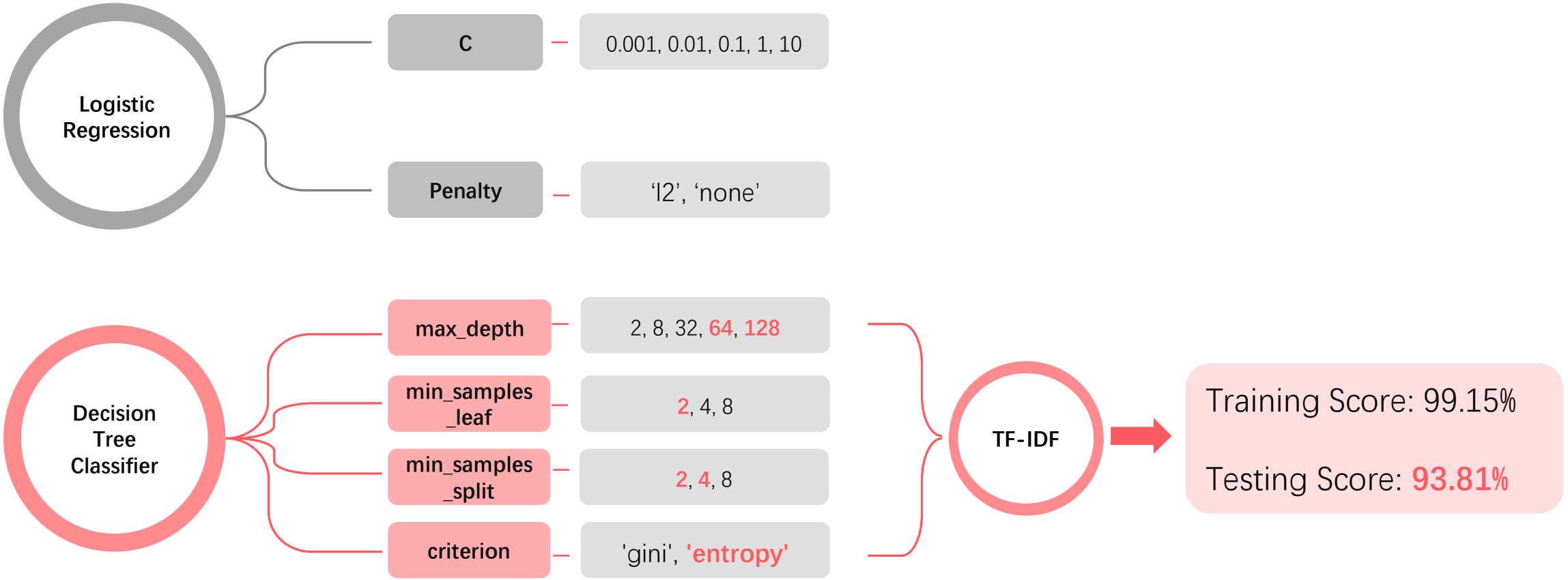
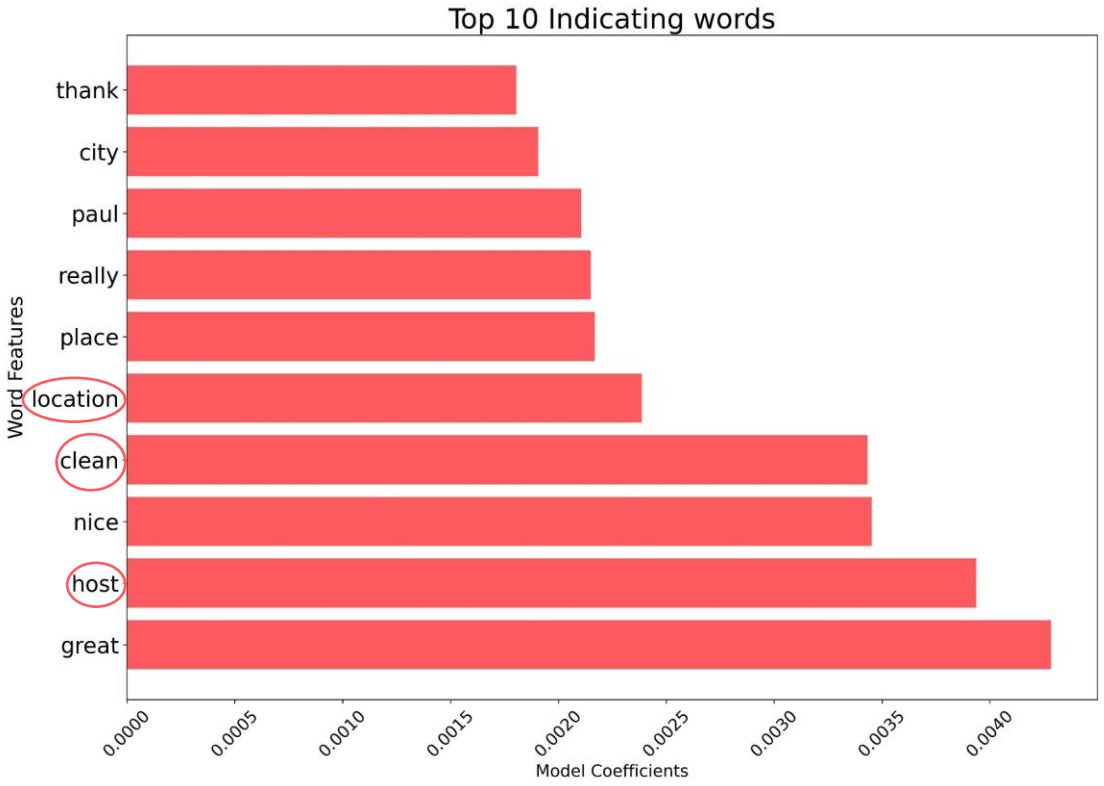
GridSearch 1: General Sweep

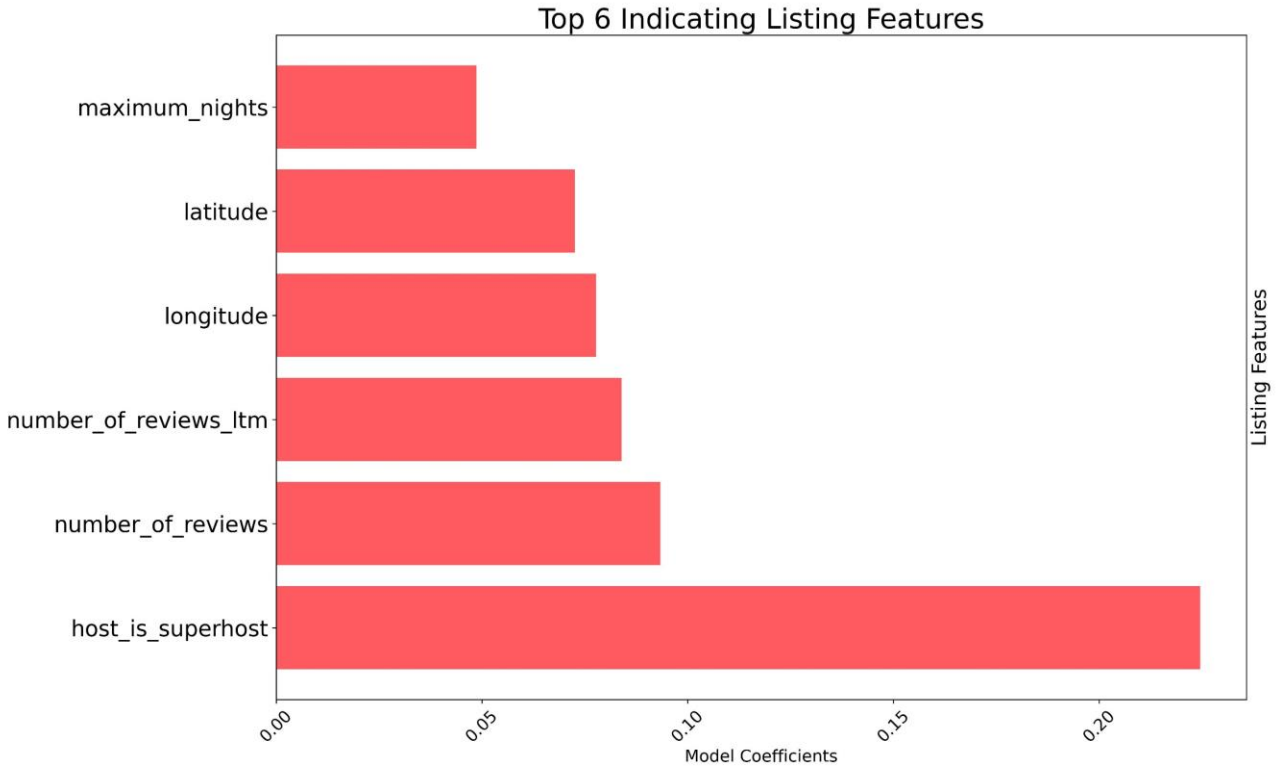
- Dataset: Same listing details on different reviews



GridSearch 1: General Sweep Extracted Features

- Dataset: Same listing details on different reviews





Next Approach

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GridSearch (General Sweep)

- Purpose: Baseline GridSearch
- Limitation: Difficult to interpret

GridSearch (N-grams)

- Purpose: Better Interpretability
- Limitation: Under aggregation assumptions

Listing ID	Listing Features	Rating Scores	Reviews
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GridSearch (General Sweep)

GridSearch (N-grams)

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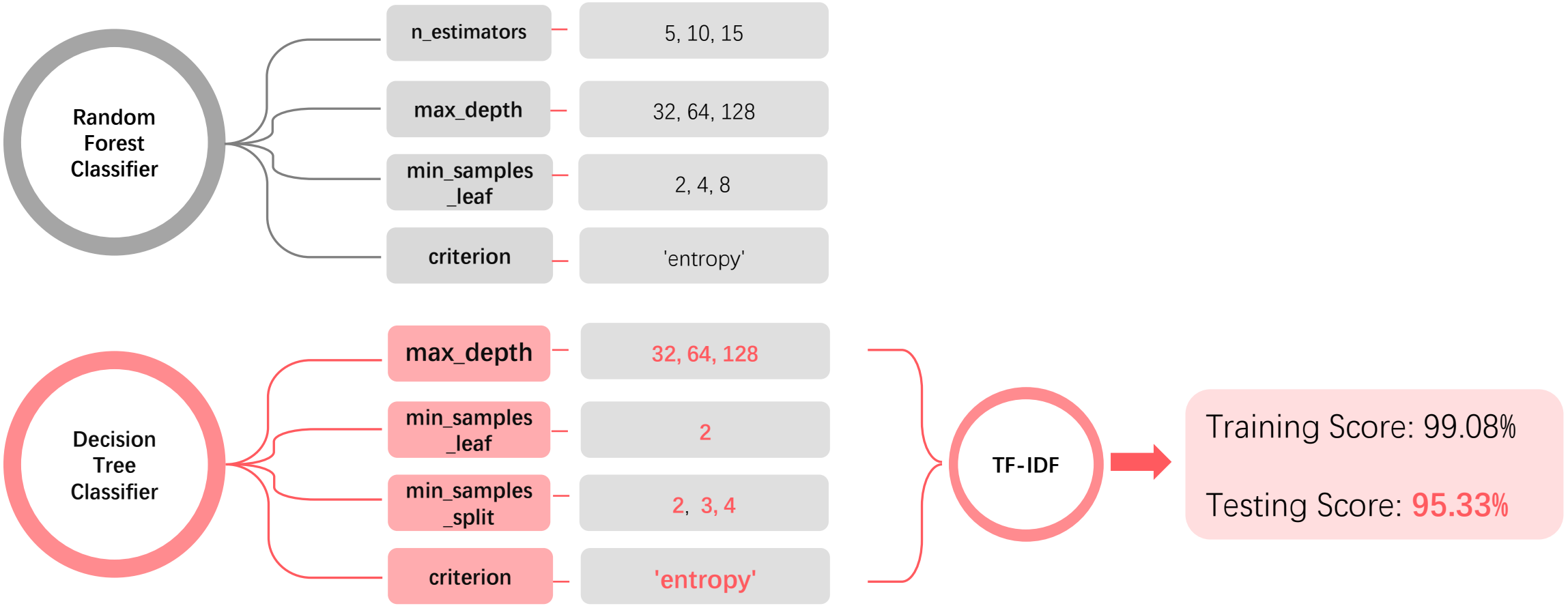
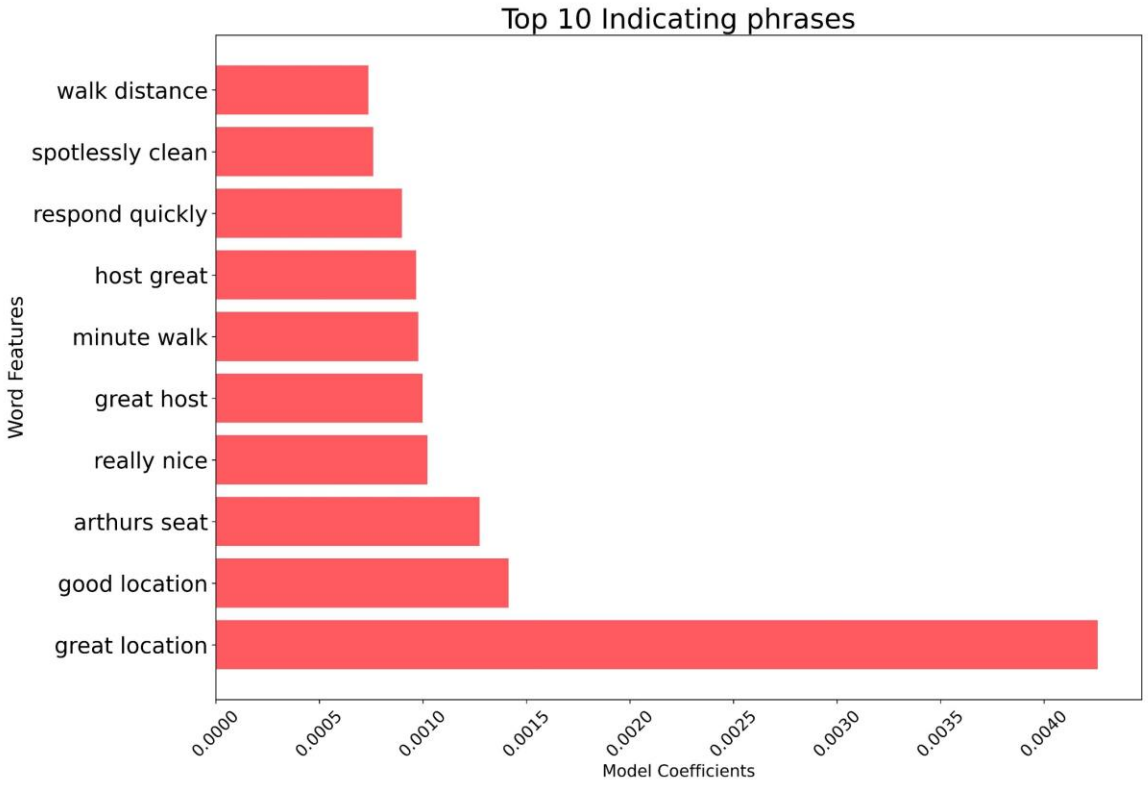
GridSearch 2: N-grams

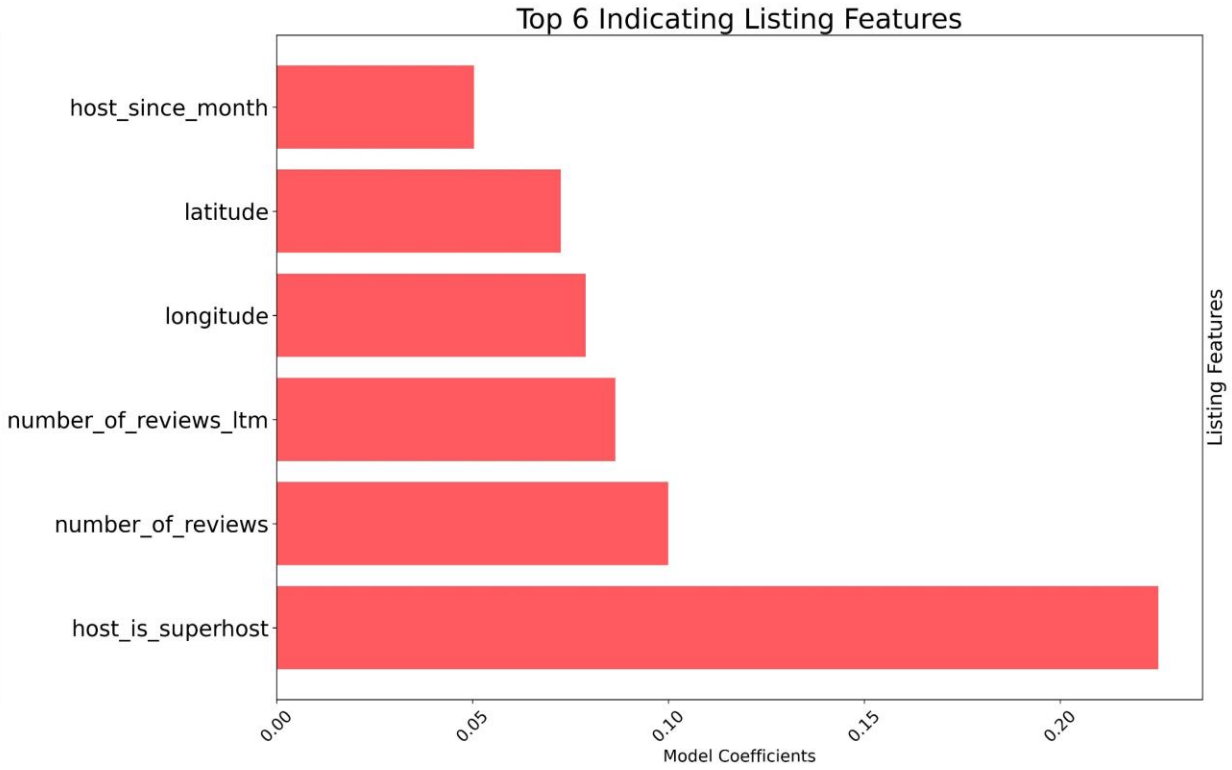
- Dataset: Same listing details on different reviews



GridSearch 2: N-grams Extracted Features

- Dataset: Same listing details on different reviews





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- GridSearch (General Sweep)
  - Purpose: Better generalization
  - Limitation: No actionable findings
- GridSearch (N-grams)

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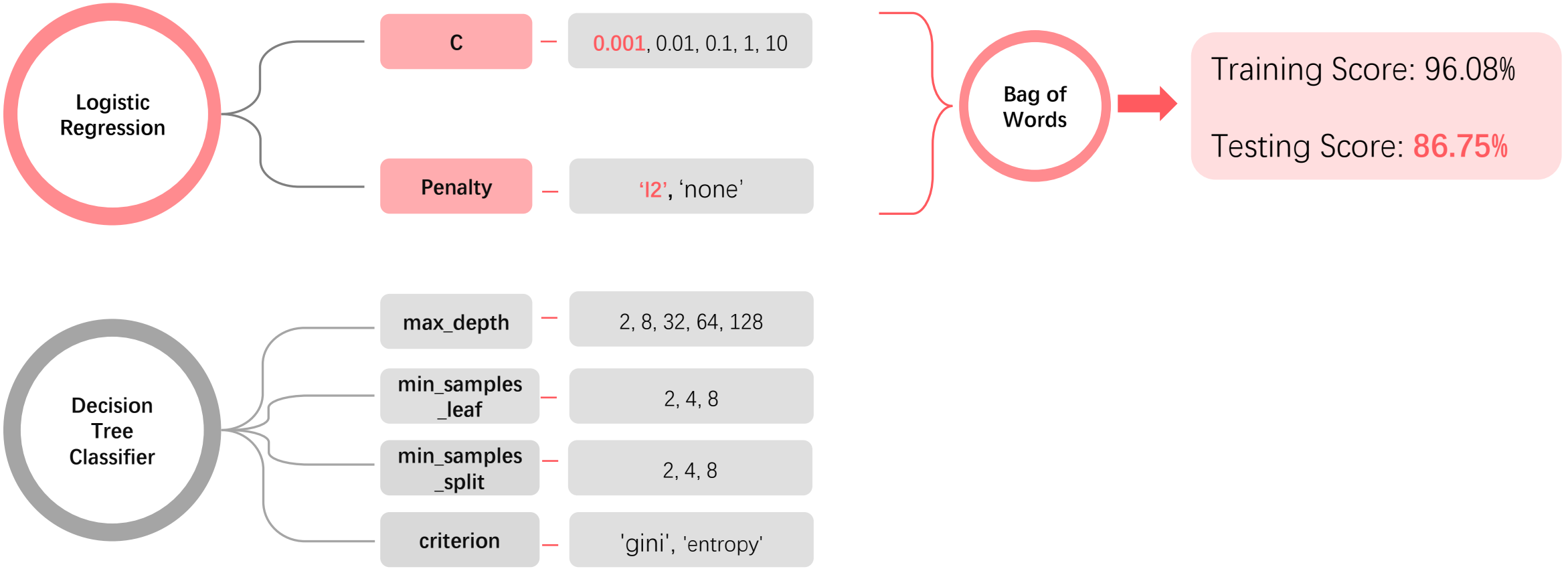
GridSearch 3: General Sweep

- Dataset: Reviews condensed to same listings



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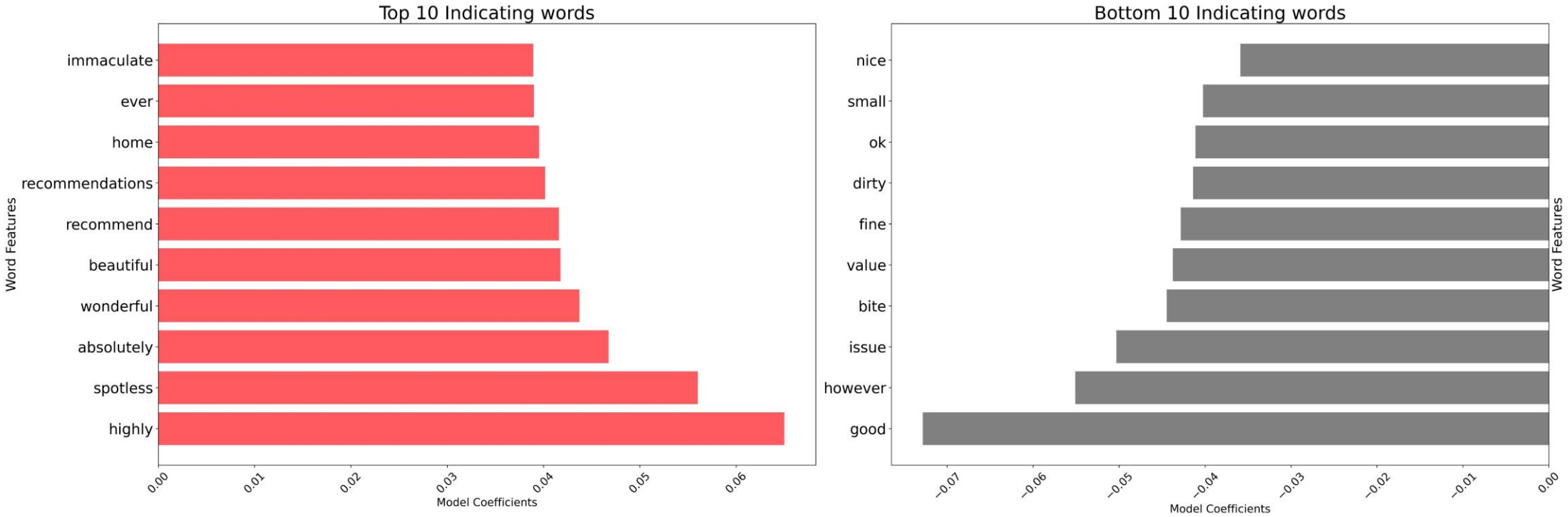
GridSearch 3: General Sweep Extracted Features

- Dataset: Reviews condensed to same listings



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GridSearch (General Sweep)

- Purpose: Baseline GridSearch
- Limitation: Difficult to interpret

GridSearch (N-grams)

- Purpose: Better Interpretability
- Limitation: Under aggregation assumptions

Listing ID	Listing Features	Rating Scores	Reviews
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GridSearch (General Sweep)

- Purpose: Better generalization
- Limitation: No actionable findings

GridSearch (N-grams)

- Purpose: Better generalization & Interpretability
- Limitation: Negative indicators

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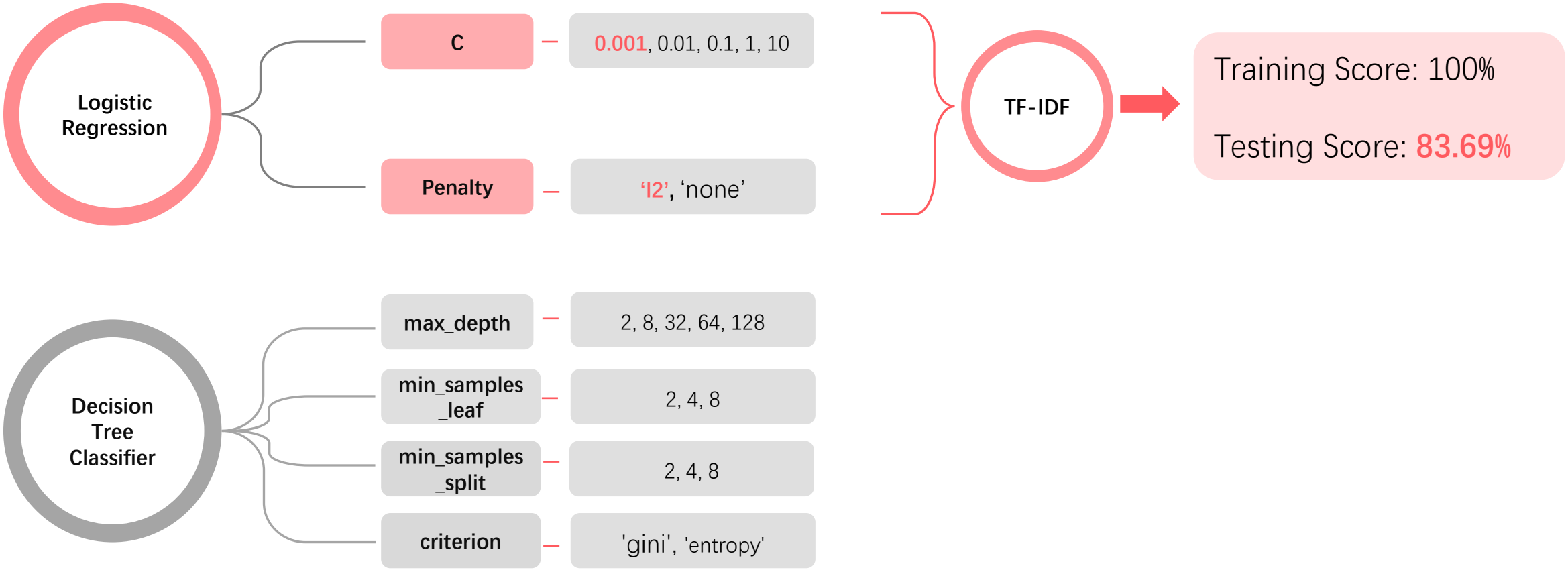
GridSearch 4: N-grams

- Dataset: Reviews condensed to same listings



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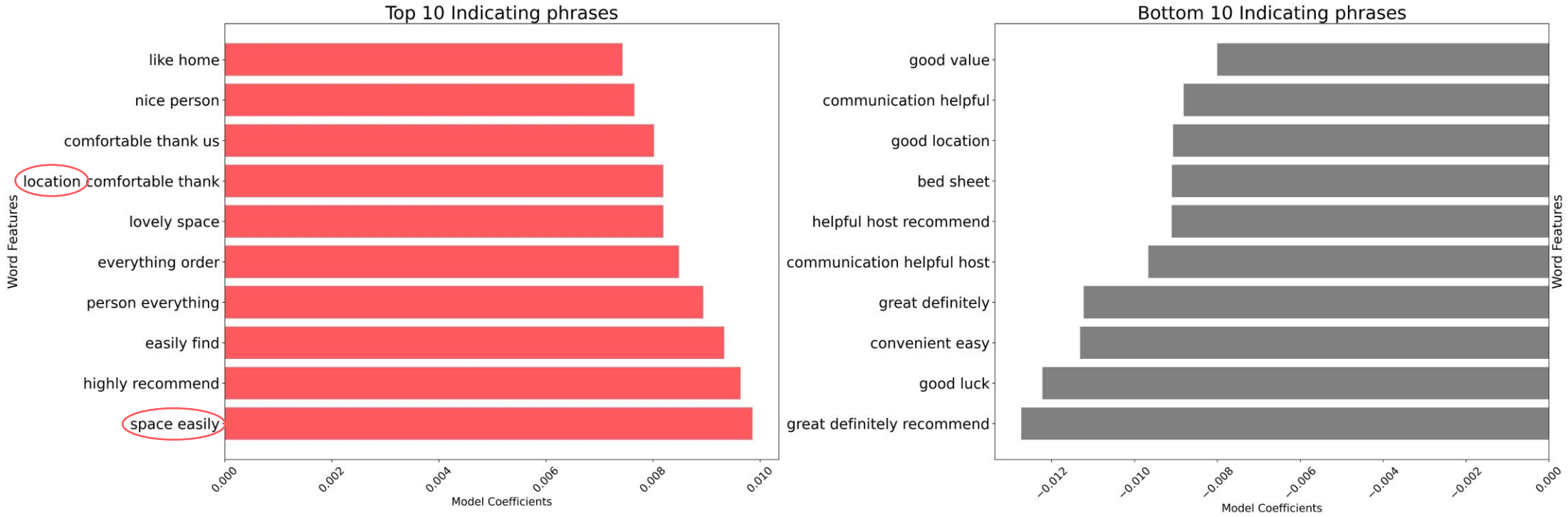
GridSearch 4: N-grams Extracted Features

- Dataset: Reviews condensed to same listings



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Is it possible to extract sub-rating specific key features from guests reviews?

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Modelling on predicting sub-rating outcomes

Targets

- Location
- Cleanliness
- Communication
- Check-in

Data

- Uncondensed Review Dataset

Threshold

- Rating score of 4.8

Vectorizer

- Bag of Words with N-grams
- TF-IDF with N-grams

Model

- GridSearch on Decision Tree Classifier
- Small ranges of hyperparameters

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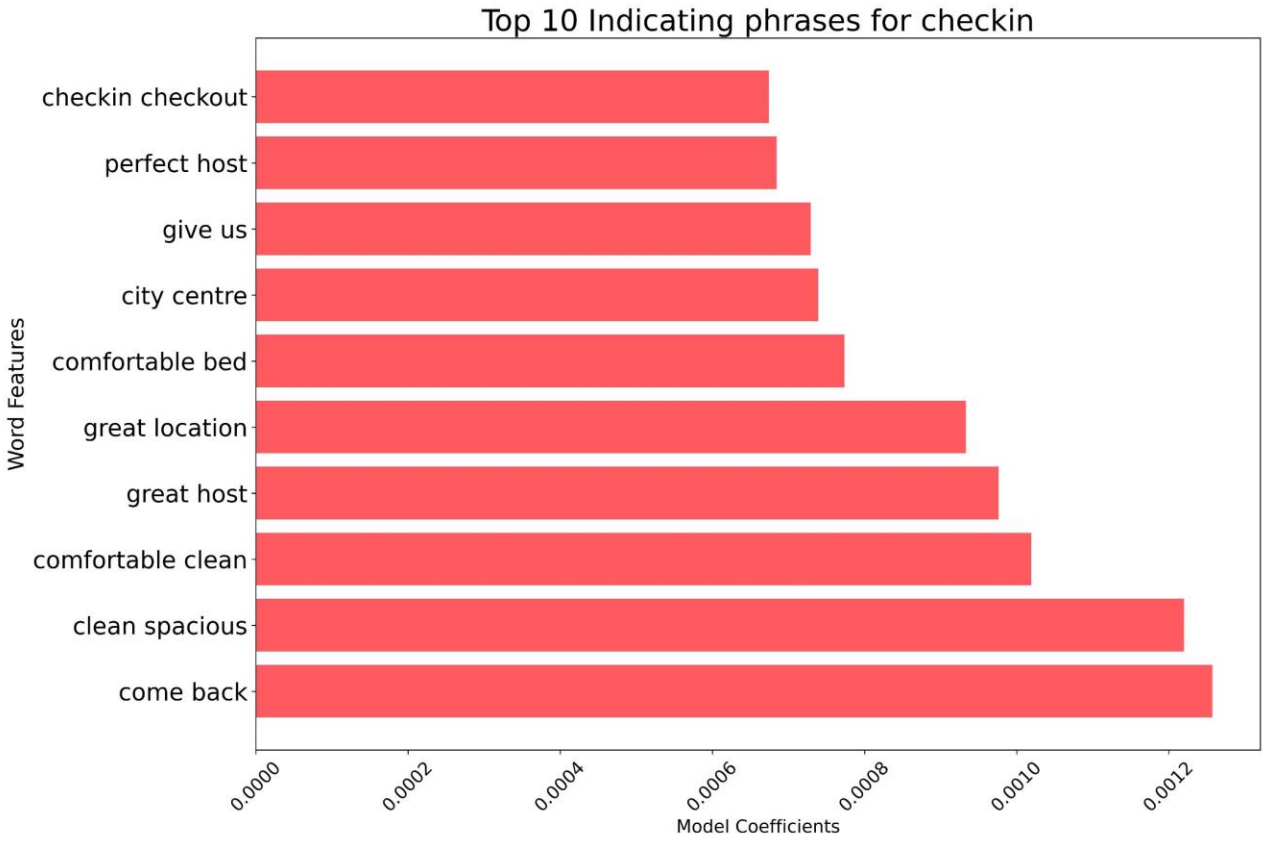
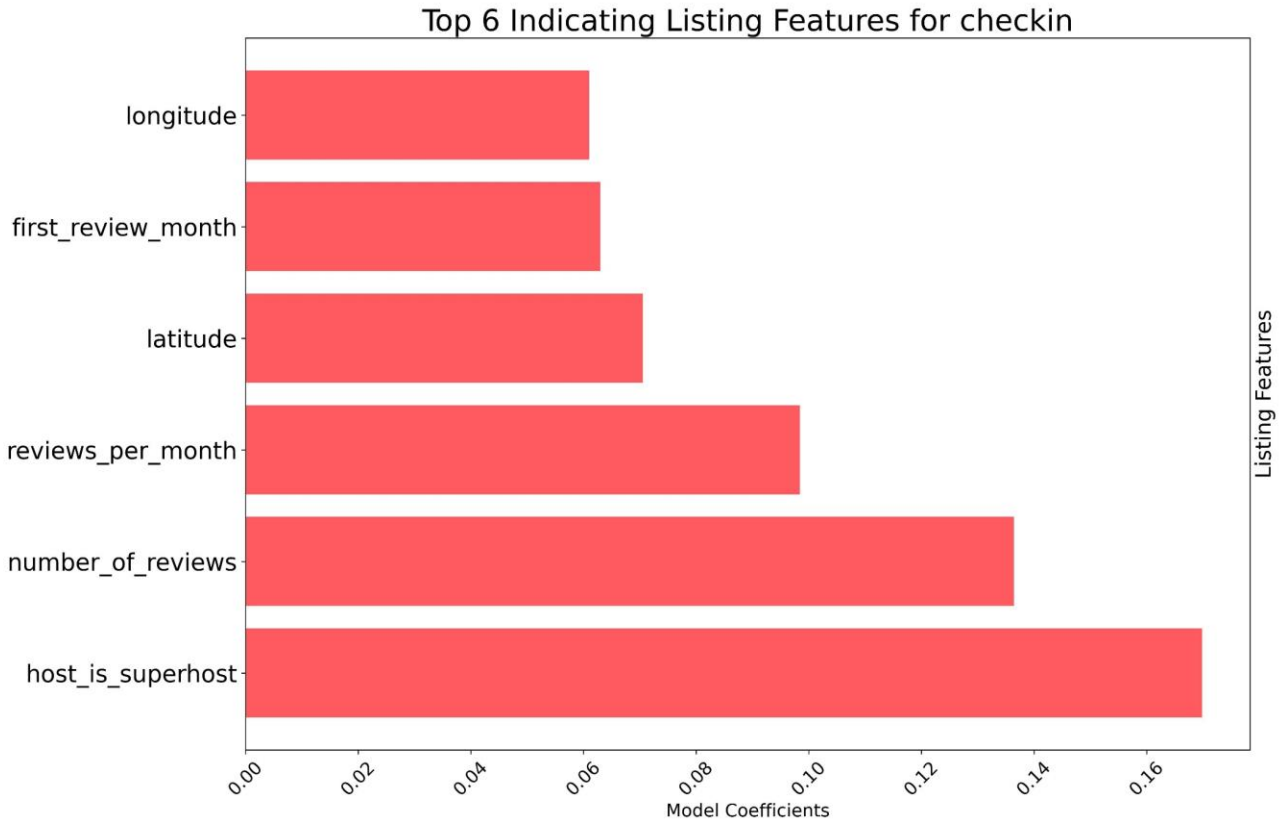
Sub-rating Check-in Predictions Results





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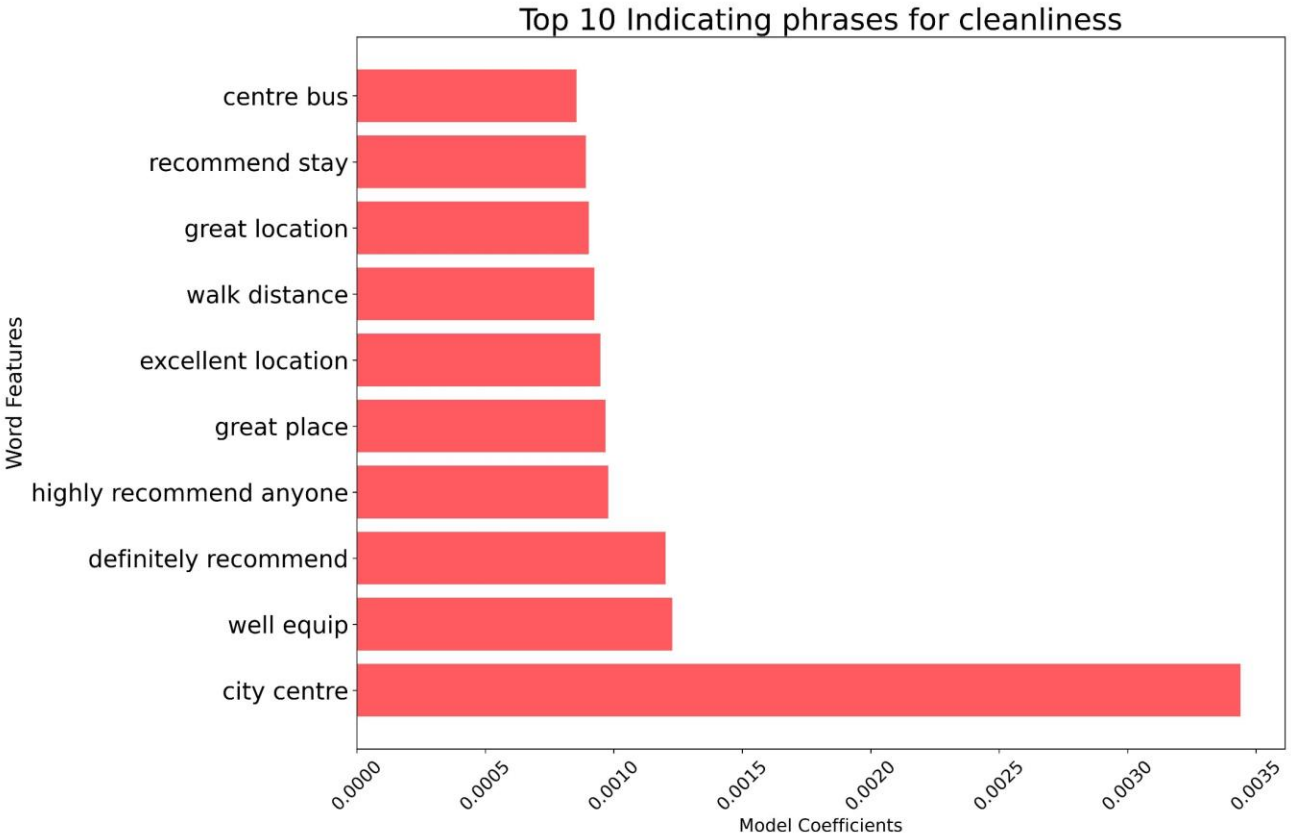
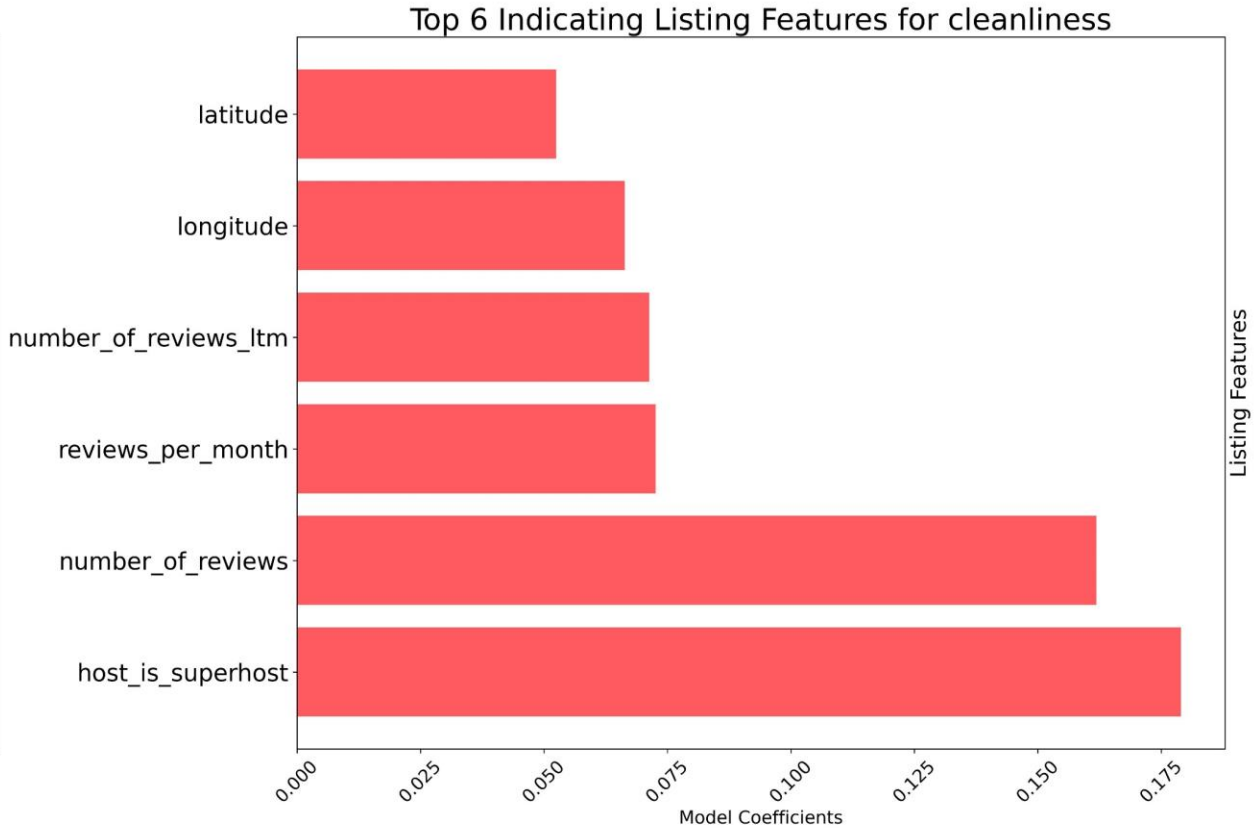
Sub-rating Cleanliness Predictions Results





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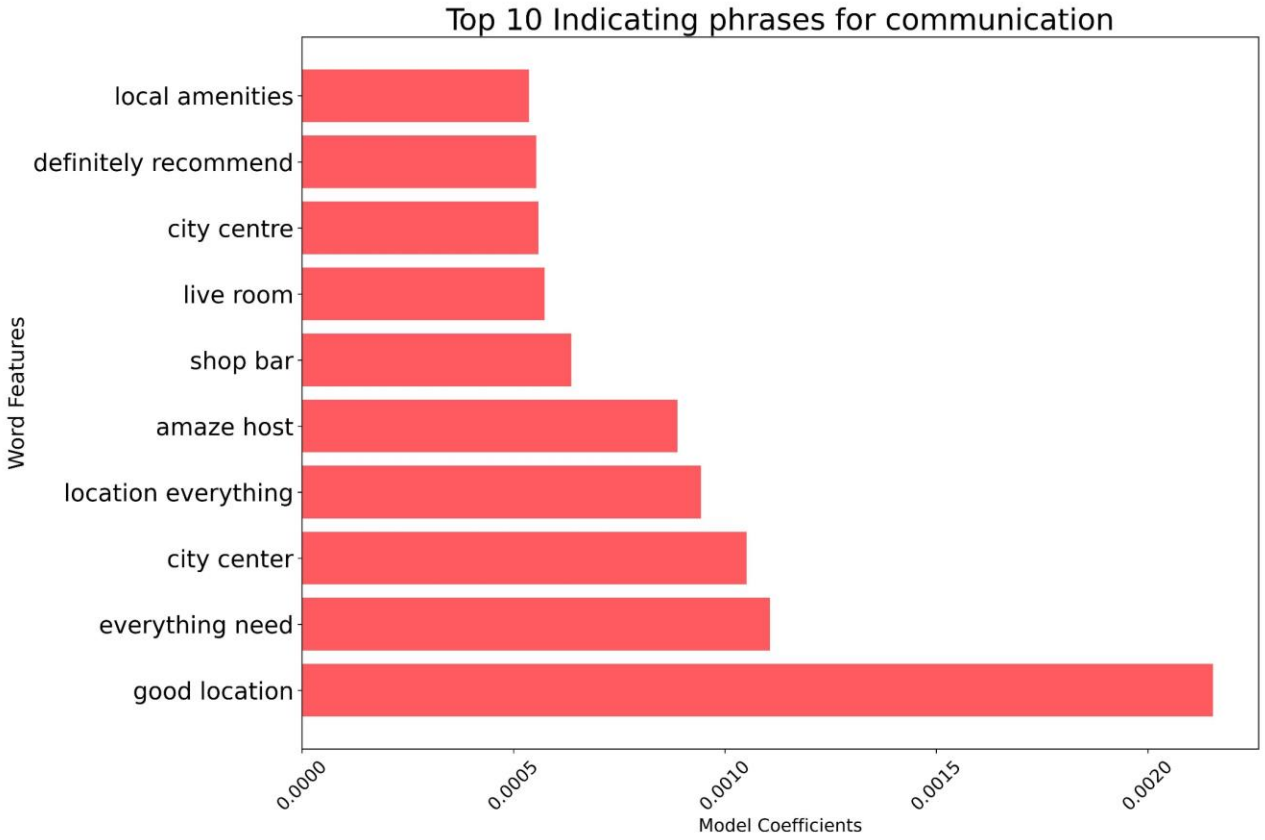
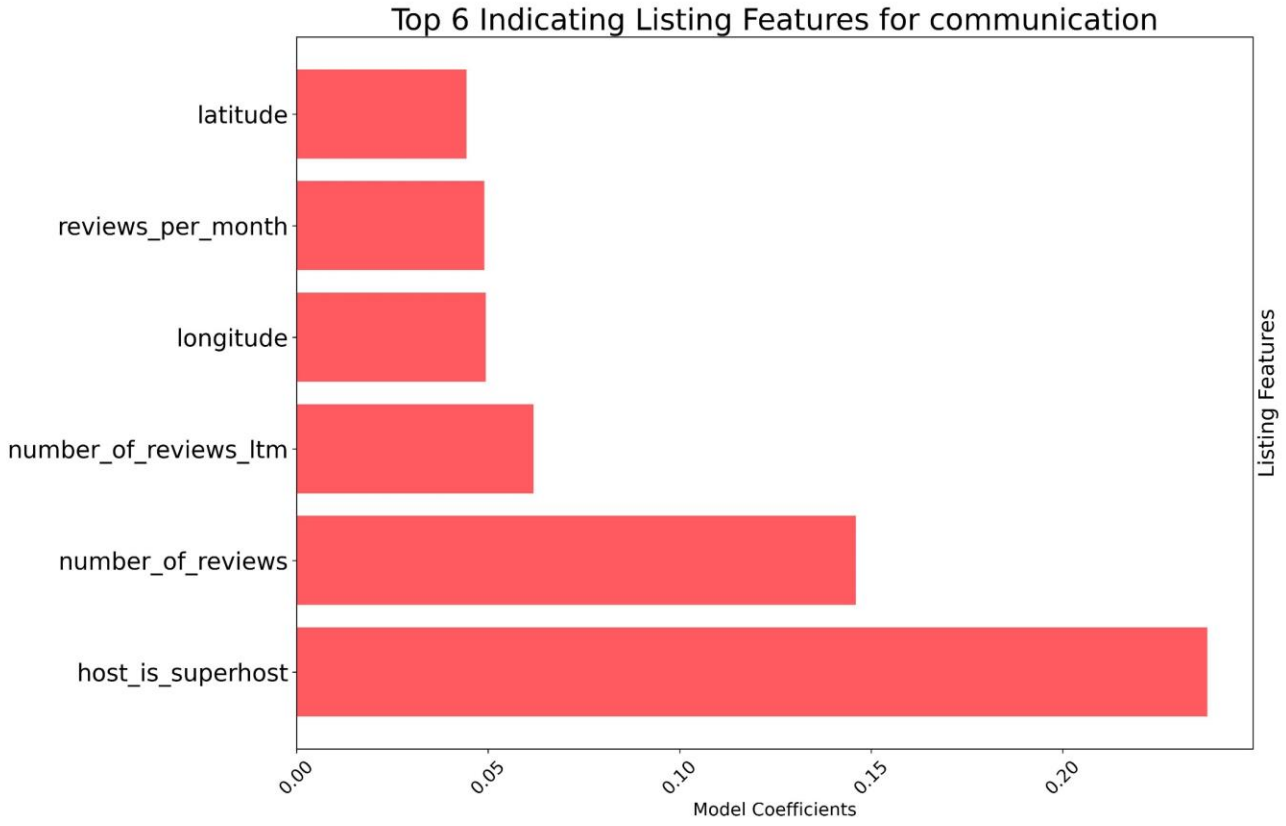
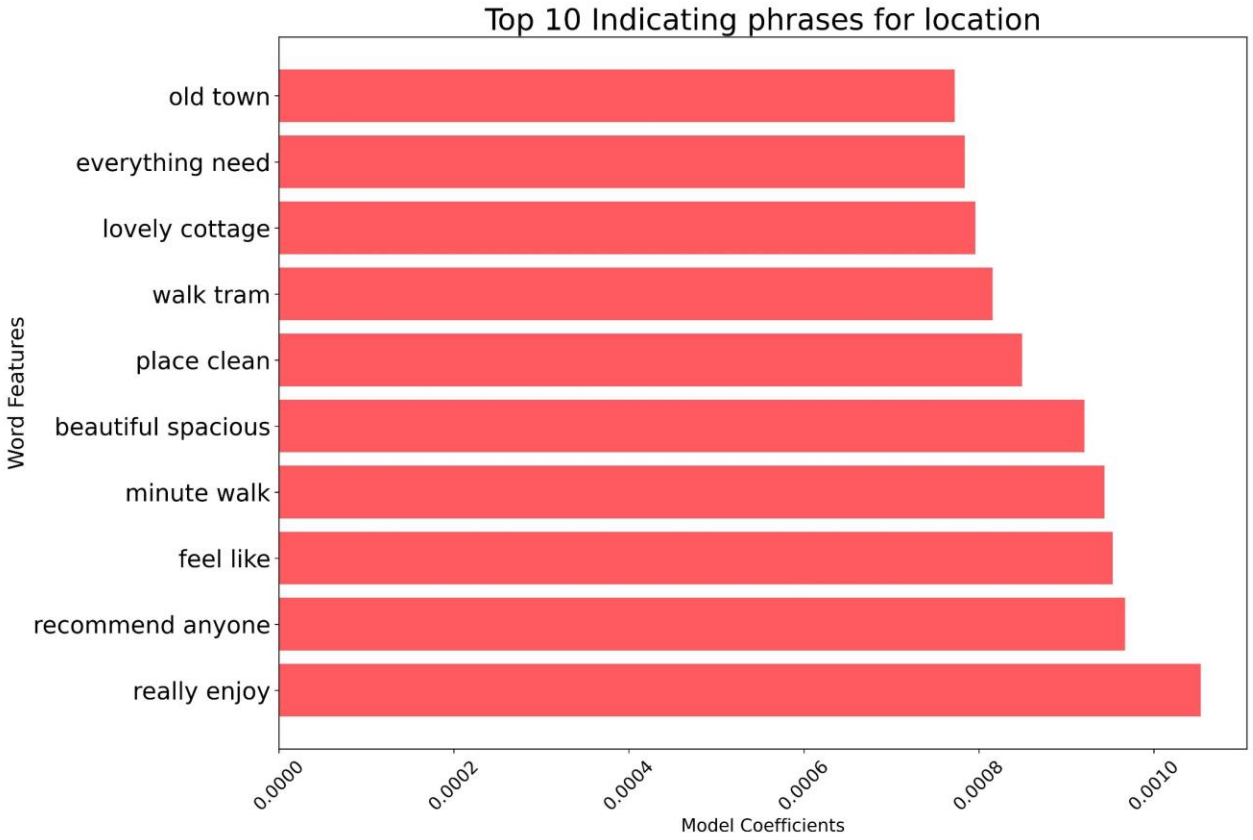
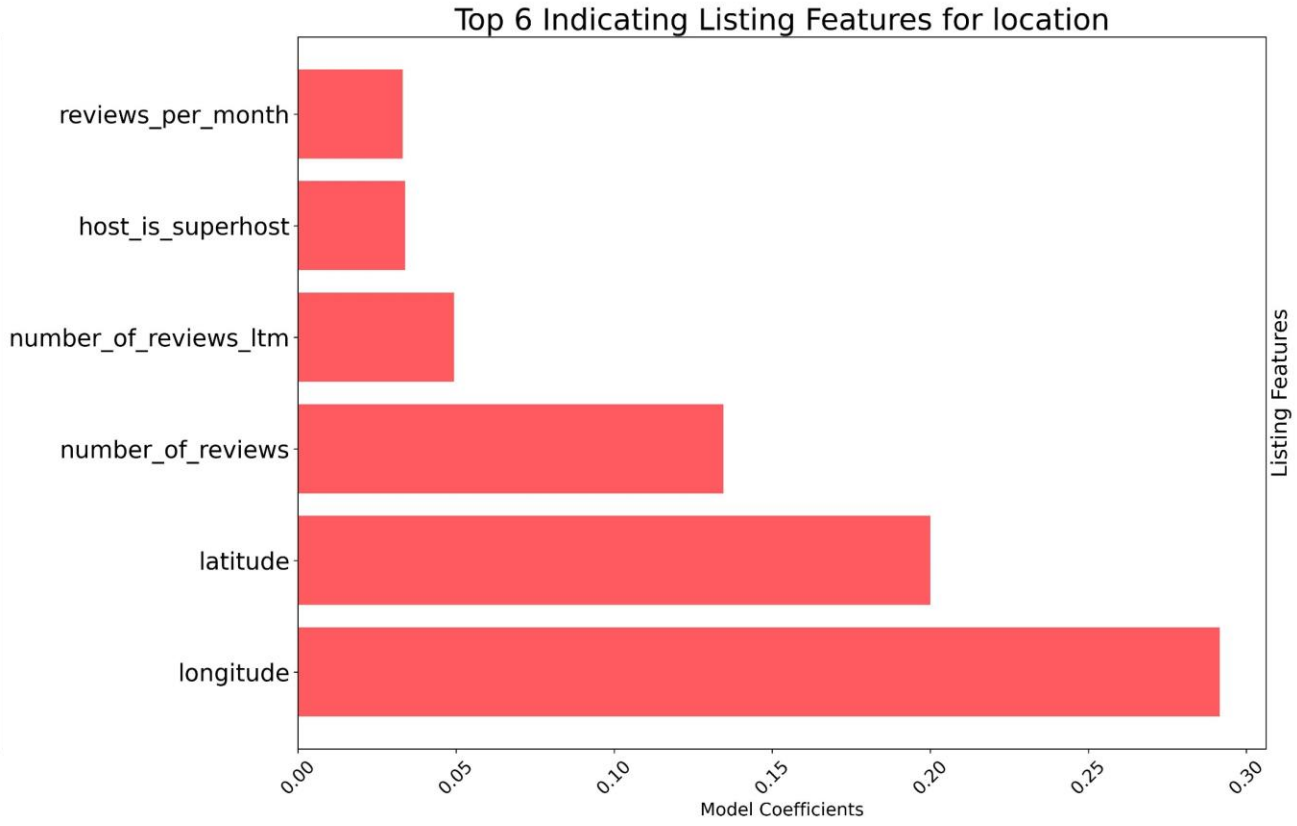
Sub-rating Communication Predictions Results



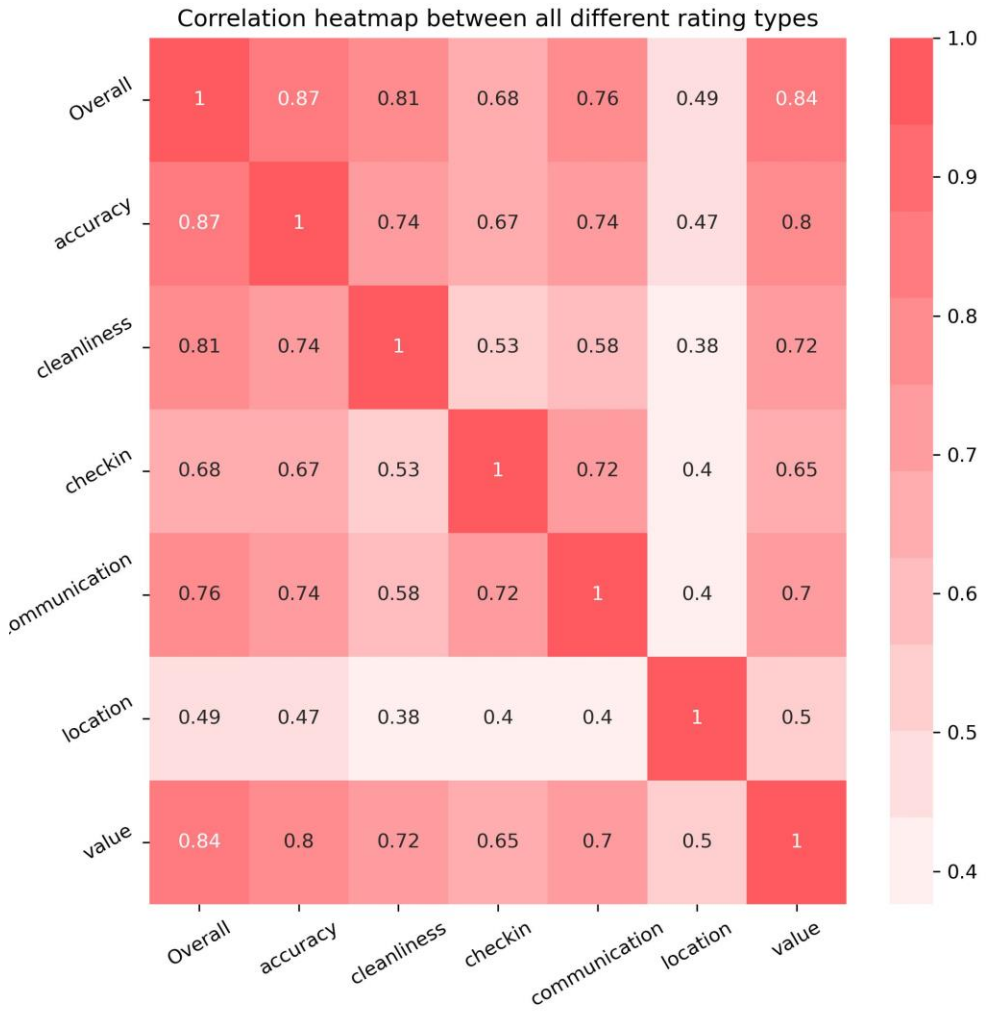


Sub-rating Location Predictions Results





Rating Scores Correlations



Next Steps

- Obtain corresponding rating scores for individual reviews
- Feature Engineering for sub-ratings
- Include more in-depth models to better interpret results

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