sentiment-analysis-golden-apple-1

March 4, 2025

0.1 Data Source & Translation Information

The data presented here was **scraped from 2GIS**. The scraper used for this process is **under NDA**, and details about its implementation cannot be disclosed.

The original reviews were written in **Russian**. The translation into **English** was performed **manually** by ChatGPT without using any third-party **API services**. This approach was chosen to **avoid additional costs** for the project.

```python
[13]: reviews_with_ratings = {
          "I always buy perfumes here, great selection and reasonable prices.": 5,
          "The consultants really know their cosmetics, thanks for the advice!": 4,
          "I liked the discount system, I can buy my favorite cosmetics cheaper.": 4,
          "Very convenient website, easy to find and order the products I need.": 4,
          "I love this store for exclusive fragrances that I can't find anywhere else.
       ↪": 5,
          "The packaging is always flawless, a pleasure to open!": 5,
          "Fast delivery, my order arrived even earlier than expected.": 5,
          "The consultant helped me find the perfect cream for my skin.": 4,
          "The bonus system is great, I accumulated points and bought perfume at a␣
       ↪good discount!": 5,
          "The decorative cosmetics here are top-notch, especially the eyeshadows and␣
       ↪lipsticks.": 5,
          "The store impresses with the quality of its products and service.": 5,
          "I love that they often have exclusive collections and limited editions.":␣
       ↪5,
          "Great service, the staff is attentive and friendly.": 5,
          "The perfume is long-lasting and original, stays on my skin all day.": 5,
          "Very beautifully designed stores, it's a pleasure to visit.": 5,
          "I often buy gifts here, always great quality.": 5,
          "The mascara I bought turned out to be amazing, I'll only buy it here from␣
       ↪now on!": 5,
          "Fast delivery, the product arrived in perfect condition.": 5,
          "Very convenient pick-up system, no waiting required.": 4,
          "The bonus program is beneficial, it's easy to accumulate points.": 5,
          "I love this store and always keep an eye on new arrivals.": 5,
          "You can always test products before purchasing.": 4,
          "Authentic perfumes, verified with certificates.": 5,
```

```
    "The staff is polite and doesn't push unnecessary products but genuinely␣
↪helps.": 5,
    "Lots of niche cosmetics that you won't find in other stores.": 4,
    "The store is good, but the selection could be bigger.": 3,
    "The consultants are friendly, but sometimes they can't help with rare␣
↪brands.": 3,
    "Delivery arrived on time, but the packaging was slightly crumpled.": 3,
    "Prices are average, you can find cheaper options in other stores.": 3,
    "I've shopped here several times, but products sell out quickly.": 3,
    "Nice store, but avoid it during holidays - the lines are huge.": 3,
    "Cosmetics are high-quality, but it's not always easy to find the right␣
↪shade.": 3,
    "Samples are included in orders, but I wish there were more.": 3,
    "There are great discounts, but they rarely apply to popular products.": 3,
    "Sometimes consultants are busy, and you have to wait for help.": 3,
    "The perfume is nice, but the longevity is weaker than expected.": 3,
    "It's easy to order online, but the in-store selection is better.": 3,
    "The cream is okay, but the price could be lower.": 3,
    "The store is beautiful, but sometimes it's hard to find what you need.": 3,
    "Delivery works fine, but delays do happen.": 3,
    "The bonus system is interesting, but the rules could be simpler.": 3,
    "Bought a foundation, but the shade was slightly darker than expected.": 3,
    "Discounts aren't always available on the products I want.": 3,
    "A lot of interesting brands, but some popular ones are missing.": 3,
    "The store is good, but they need more staff during peak hours.": 3,
    "Testers are available, but not for all shades.": 3,
    "The website sometimes lags when placing an order, but overall, it's␣
↪convenient.": 3,
    "Courier delivery is convenient, but it's not always on time.": 3,
    "Prices are reasonable, but some products are a bit overpriced.": 3,
    "Nice selection, but I wish they had more budget-friendly brands.": 3,
    "Consultants are knowledgeable, but sometimes you have to wait for␣
↪assistance.": 3,
    "Bought a shampoo here, it's okay but not worth the price.": 3,
    "The perfume is pleasant, but the longevity could be better.": 3,
    "Good selection, but I wish there were more promotions.": 3,
    "Prices are too high; you can find cheaper options elsewhere.": 1,
    "Consultants aren't always helpful and sometimes give contradictory advice.
↪": 1,
    "Delivery was delayed, I had to call customer service.": 1,
    "Some products are listed as available online but are out of stock in-store.
↪": 1,
    "No samples were included in my order, even though they were promised.": 1,
    "Ordered a perfume, but the box was severely damaged.": 1,
    "Not many budget-friendly brands, mostly just luxury.": 1,
    "Bought a cream, but it had an expired shelf life.": 1,
```

```python
    "The store is good, but the checkout lines are enormous.": 1,
    "Cosmetics are high-quality, but the service isn't always satisfying.": 1,
    "The perfume fades quickly, I expected better longevity.": 1,
    "The website shows discounts, but they don't apply in the store.": 1,
    "Consultants push expensive products even when I ask for something␣
↪affordable.": 1,
    "Too few testers, making it hard to choose the right foundation shade.": 1,
    "The website froze when placing an order, so I had to redo it.": 1,
    "Delivery was delayed by two days, and customer support was slow to respond.
↪": 1,
    "During holidays, the store is overcrowded, making it impossible to shop.":␣
↪1,
    "No samples in my order, even though I spent a large amount.": 1,
    "Prices are higher than in other places, even though the quality is good.":␣
↪1,
    "Not all consultants are knowledgeable, and getting useful advice can be␣
↪difficult.": 1,
    "The perfume was nice, but the longevity was average.": 3,
    "Consultants helped, but I had to wait a long time.": 3,
    "A good store, but sometimes it's hard to find the right product.": 3,
    "The packaging was good, but I wish they included more samples.": 3,
    "Prices aren't always appealing, but the quality is good.": 3,
    "Delivery was slightly delayed, but the product was fine.": 3,
    "The bonus system is interesting, but it's hard to accumulate points.": 3,
    "The selection is good, but I wish they had more budget-friendly brands.":␣
↪3,
    "Consultants are friendly, but they're often busy and can't help␣
↪immediately.": 3,
    "The store looks nice, but it's too crowded during holidays.": 3,
    "The website is user-friendly, but there are occasional glitches.": 3,
    "The perfume is good, but it's more expensive than I expected.": 3,
    "Cosmetics are high-quality, but I wish they had more variety.": 3,
    "The store is nice, but checkout was slow.": 3,
    "Ordered a cream, it worked well, but it was overpriced.": 3,
    "Good selection, but not all products are in stock all the time.": 3,
    "The perfume is original, but the packaging was slightly damaged.": 3,
    "Consultants are professional, but not always available.": 3,
    "The website lags sometimes, but overall, it's easy to order.": 3,
    "The mascara was good, but the price could be lower.": 3,
}
```

```python
[14]: new_reviews_with_ratings = {
    "I love shopping here! They always have the latest beauty products.": 5,
    "The perfume selection is amazing, I found my signature scent here!": 5,
    "Customer service is top-notch. The consultants are always friendly and␣
↪helpful.": 5,
```

```
  "Fast and efficient delivery, my order arrived well-packaged.": 5,
  "Their loyalty program is fantastic! I saved so much on my last purchase.":␣
↪4,
  "The store is always clean and well-organized, making shopping a great␣
↪experience.": 5,
  "Their online store is super easy to navigate, making ordering a breeze.":␣
↪4,
  "I always get compliments on the perfumes I buy from here!": 4,
  "The staff really knows their products and gives great recommendations.": 5,
  "One of the best places to buy high-end cosmetics.": 4,
  "Great promotions and discounts throughout the year!": 5,
  "I love that they have testers available for most products.": 5,
  "Everything I buy here is authentic and high-quality.": 5,
  "Such a stylish and luxurious shopping experience!": 4,
  "The consultants helped me find the perfect shade of foundation.": 5,
  "Always a pleasant shopping experience, both in-store and online.": 4,
  "I received my order beautifully packed, perfect for a gift!": 5,
  "They carry exclusive brands that you can't find elsewhere.": 5,
  "Good value for money, especially during sales.": 4,
  "Their skincare selection is impressive, they have everything I need.": 4,
  "I appreciate the wide range of niche perfumes.": 4,
  "Very professional and knowledgeable staff.": 4,
  "Their makeup lasts all day, I'm very satisfied!": 4,
  "Orders always arrive on time with no issues.": 4,
  "Easy returns policy, which is a big plus!": 4,
  "The store is nice, but the prices are a bit high for some items.": 4,
  "Good selection of perfumes, but some popular brands are always sold out.":␣
↪4,
  "Decent shopping experience, but it gets crowded on weekends.": 1,
  "The website is functional but can be slow at times.": 1,
  "Customer service is helpful, but sometimes they seem rushed.": 3,
  "I like the store, but I wish they had more budget-friendly options.": 5,
  "The quality is good, but I have found better deals elsewhere.": 4,
  "Their promotions are good, but not always on the items I want.": 4,
  "Nice store layout, but it's hard to find staff when you need assistance.":␣
↪1,
  "They offer samples with some orders, but not all the time.": 4,
  "Delivery is okay, but sometimes takes a little longer than expected.": 3,
  "Not a bad store, but I wouldn't call it my favorite.": 4,
  "Good selection, but some items go out of stock too quickly.": 4,
  "Their loyalty program is decent, but not the best I've seen.": 4,
  "The foundation I bought is good, but the shade is slightly off.": 3,
  "I like their products, but I wish they offered more discounts.": 4,
  "Great variety, but some items are overpriced.": 5,
  "Consultants are helpful, but sometimes hard to find.": 3,
  "A nice place to shop, but it could be more budget-friendly.": 5,
  "The products are good, but the waiting time at checkout is too long.": 4,
```

```
    "Packaging is nice, but they should improve their shipping protection.": 4,
    "Perfume quality is fine, but the scent fades faster than I expected.": 5,
    "Their makeup is decent, but I have used better brands.": 4,
    "A good store, but they should improve customer service during peak hours.":
↪ 4,
    "The skincare range is great, but it's hard to get advice on what to buy.":␣
↪5,
    "A bit pricey, but they do have some unique brands.": 4,
    "Their online store works fine, but adding more filters would help.": 3,
    "Good experience overall, but nothing exceptional.": 4,
    "The testers are nice, but they don't always have all shades available.": 4,
    "Prices are way too high compared to other stores.": 4,
    "The online store is confusing and hard to navigate.": 1,
    "Delivery was late, and customer service didn't help much.": 4,
    "They ran out of my product after I placed my order, very frustrating!": 4,
    "I bought a perfume here, but it didn't last long at all.": 4,
    "The checkout lines are ridiculously long, even on normal days.": 4,
    "I received a damaged product, and returning it was a hassle.": 1,
    "Customer service is hit or miss-sometimes helpful, sometimes rude.": 3,
    "Some consultants push expensive products instead of helping with my needs.
↪": 1,
    "The testers are dried out, making it hard to choose the right shade.": 1,
    "The website shows one price, but the store charged me more.": 4,
    "Some products are overpriced for the quality they offer.": 1,
    "I bought foundation, but the shade was completely off despite staff␣
↪recommendations.": 4,
    "Their sales are misleading-the discounts are often minimal.": 4,
    "Delivery took longer than expected, with no updates.": 4,
    "I wish they had more affordable brands, everything is too high-end.": 4,
    "Not a great experience-staff ignored me the entire time.": 5,
    "The fragrance I bought smells different from what I tested in the store.":␣
↪4,
    "Their return policy is complicated and not customer-friendly.": 5,
    "I won't shop here again, too many issues with their service.": 4,
    "The store is nice, but they don't always have my favorite products in␣
↪stock.": 4,
    "A decent experience, but not my top choice for beauty products.": 4,
    "The website works fine, but they could improve their mobile version.": 3,
    "Some promotions are great, but they don't apply to all products.": 5,
    "The perfumes are good, but I've found better longevity in other brands.":␣
↪4,
    "Customer service is friendly, but sometimes slow.": 5,
    "Delivery was fine, but I wish it were a bit faster.": 5,
    "Not bad, but not amazing either.": 5,
    "I like the range of products, but some items feel overpriced.": 1,
    "The staff is polite, but sometimes they seem overwhelmed.": 5,
```

```
    "The gift packaging is nice, but the additional fee is too high.": 4,
    "It's an okay place to shop, but nothing special.": 3,
    "My order arrived correctly, but the box was slightly damaged.": 3,
    "The loyalty program works, but it takes too long to accumulate points.": 4,
    "They have nice limited editions, but they sell out way too fast.": 5,
    "Some of their makeup shades don't match the descriptions online.": 4,
    "Good variety, but I wish they carried more budget-friendly brands.": 5,
    "The quality is great, but not always worth the price.": 5,
    "Consultants are generally helpful, but they're often too busy.": 1,
    "Shipping was on time, but the packaging wasn't very protective.": 4,
    "They offer testers, but I wish they had more of them available.": 4,
    "The store atmosphere is nice, but it's always too crowded.": 1,
    "Their website sometimes glitches during checkout.": 3,
    "Prices are slightly high, but the selection is decent.": 3,
    "An okay shopping experience, but I prefer other beauty stores.": 3,
    "The skincare section is good, but hard to find specific products.": 1,
    "I like their promotions, but they should offer more discounts.": 4,
    "Good store, but not my first choice for cosmetics.": 4,
    "Products are good, but I expected better customer service.": 4,
}
```

```
[15]: more_reviews_with_ratings = {
    "Amazing store! They always have the best selection of beauty products.": 5,
    "I found a rare perfume here that I couldn't get anywhere else.": 5,
    "Staff are super friendly and knowledgeable about the products.": 5,
    "Their discounts and promotions are excellent!": 5,
    "Beautifully packaged orders, I love unboxing them!": 5,
    "Fast delivery and great customer service!": 5,
    "The store layout is perfect, easy to navigate and shop.": 5,
    "Everything I bought here is original and high quality.": 5,
    "Best place to buy luxury cosmetics and fragrances.": 5,
    "Their foundation selection is amazing-so many shades!": 5,
    "They often have exclusive perfumes that are hard to find elsewhere.": 5,
    "I always get compliments on the fragrances I buy here!": 5,
    "Super easy to order online, and the process is smooth.": 5,
    "Love the testers available in-store, it helps a lot when choosing!": 5,
    "Every order comes beautifully packaged, feels like a gift!": 5,
    "Their makeup collection is top-tier, especially their lipsticks.": 5,
    "I appreciate the helpful staff, they really know their stuff.": 5,
    "The store has a very luxurious feel, love shopping here.": 5,
    "Their loyalty program is the best! I get great discounts.": 5,
    "Love how they keep bringing in new brands and products.": 5,
    "The perfumes last all day and smell fantastic!": 5,
    "Fastest delivery ever, I got my order within 24 hours!": 5,
    "Consultants take the time to help you choose the perfect product.": 5,
    "Great experience, both in-store and online!": 5,
    "Superb packaging, makes gift-giving effortless!": 5,
```

```
    "They even included free samples in my order, such a nice touch!": 5,
    "Such a premium shopping experience, I feel special every time.": 5,
    "Always a pleasure shopping here, they have everything I need.": 5,
    "Good price-to-quality ratio, worth every penny!": 5,
    "I can always find something new and exciting in their collection.": 5,
    "Amazing selection of both budget-friendly and luxury products.": 5,
    "Customer service was extremely patient and kind.": 5,
    "Highly recommend their skincare range-high quality and effective.": 5,
    "Their online store is just as good as the physical one!": 5,
    "I always trust them for my beauty needs, never had a bad experience.": 5,
    "Consultants recommended me the perfect perfume, love it!": 5,
    "Their haircare products work wonders, highly recommend!": 5,
    "The staff is so polite and never pushy!": 5,
    "They really care about customers and provide great service.": 5,
    "Even during sales, they maintain high service standards.": 5,
    "This store is my go-to for gifts, always beautifully wrapped.": 5,
    "Their perfume recommendations are always spot on!": 5,
    "Luxury experience at reasonable prices, best of both worlds!": 5,
    "Shopping here is such a treat, feels like a high-end boutique.": 5,
    "They stock all my favorite niche brands!": 5,
    "Superb shopping experience, I'll be back for sure!": 5,
    "One of the best beauty stores I've ever visited!": 5,
    "Nice store, but it gets too crowded during peak hours.": 3,
    "The selection is good, but some items sell out too quickly.": 3,
    "I like their products, but the prices are a little high.": 3,
    "Good customer service, but they can be slow when busy.": 3,
    "Great range of makeup, but testers aren't always available.": 3,
    "Nice packaging, but I wish they added more free samples.": 3,
    "The quality is good, but I expected a little more for the price.": 3,
    "Online shopping is convenient, but their website lags sometimes.": 3,
    "They have a great range of perfumes, but some are overpriced.": 3,
    "Customer service is helpful, but I had to wait a long time.": 3,
    "Their discounts are nice, but not always on the best products.": 3,
    "Good store, but I wish they had more affordable options.": 3,
    "A decent shopping experience, but nothing special.": 3,
    "Consultants are polite, but not all are knowledgeable.": 3,
    "Delivery was fine, but not the fastest I've seen.": 3,
    "They have a nice loyalty program, but it takes too long to accumulate␣
↪points.": 3,
    "Product range is good, but some shades sell out too fast.": 3,
    "A bit overpriced, but the quality is generally good.": 3,
    "The perfume selection is nice, but some scents don't last long.": 3,
    "Their website is fine, but needs a better filtering system.": 3,
    "They have good gift sets, but they run out of stock quickly.": 3,
    "Nice layout in the store, but they need more checkout counters.": 3,
    "Prices are fair, but not the cheapest option available.": 3,
    "They carry many brands, but not always the latest collections.": 3,
```

```
        "A good store, but I wouldn't call it my favorite.": 3,
        "Packaging was fine, but my box was slightly dented.": 3,
        "The foundation I bought was nice, but not the perfect match.": 3,
        "Not bad, but could be better with more promotions.": 3,
        "I like the selection, but some brands are missing.": 3,
        "Prices are too high for the quality offered.": 1,
        "Their online system is confusing and glitchy.": 1,
        "Delivery was delayed with no updates from customer support.": 1,
        "Ordered a perfume, but the scent didn't last at all.": 1,
        "Customer service was rude when I asked for a refund.": 1,
        "Lines at checkout are way too long!": 1,
        "Consultants kept pushing expensive products on me.": 1,
        "I received a damaged product, and returning it was difficult.": 1,
        "Their website is slow, and placing an order was frustrating.": 1,
        "They advertise discounts, but the actual reductions are tiny.": 1,
        "Customer support barely responds to emails.": 1,
        "My perfume came with a broken cap, very disappointing.": 1,
        "I ordered a lipstick, but the color was completely different from the␣
  ↪picture.": 1,
        "The tester I used in-store smelled different from the actual perfume.": 1,
        "Overpriced products with average quality.": 1,
        "Delivery fees are way too high for the service provided.": 1,
        "They don't let you return makeup, even if it's unused.": 1,
        "Staff was dismissive when I asked for recommendations.": 1,
        "Loyalty points expire too quickly, making them useless.": 1,
        "They need more cash registers, the wait time is unacceptable.": 1,
        "My order was canceled after payment, and I had to fight for a refund.": 1,
        "Too many limited-edition items that sell out immediately.": 1,
        "Website crashes frequently during big sales.": 1,
        "The perfume I bought smelled nice but disappeared in 30 minutes.": 1,
        "Customer service gave me incorrect information about a product.": 1,
        "Some testers are dried out and unusable.": 1,
        "Refund policy is too strict, be careful before buying.": 1,
        "They sent me the wrong shade of foundation and refused an exchange.": 1,
        "Not a great experience, will shop elsewhere next time.": 1,
}
```

[16]:
```python
all_reviews_with_ratings = {}
all_reviews_with_ratings.update(reviews_with_ratings)
all_reviews_with_ratings.update(new_reviews_with_ratings)
all_reviews_with_ratings.update(more_reviews_with_ratings)
```

[17]:
```python
len(all_reviews_with_ratings)
```

[17]: 302

1 Sentiment analysis

```python
from transformers import pipeline
import pandas as pd

sentiment_pipeline = pipeline("sentiment-analysis", model="nlptown/
  ↪bert-base-multilingual-uncased-sentiment")

all_reviews = list(all_reviews_with_ratings.keys())

sentiment_results = sentiment_pipeline(all_reviews)

df_sentiment = pd.DataFrame({
    "Review": all_reviews,
    "Predicted Sentiment": [result["label"] for result in sentiment_results],
    "Confidence Score": [result["score"] for result in sentiment_results],
    'Actual Rating': list(all_reviews_with_ratings.values())
})

df_sentiment
```

```
Device set to use cpu
```

	Review	Predicted Sentiment
0	I always buy perfumes here, great selection an…	5 stars
1	The consultants really know their cosmetics, t…	5 stars
2	I liked the discount system, I can buy my favo…	4 stars
3	Very convenient website, easy to find and orde…	5 stars
4	I love this store for exclusive fragrances tha…	5 stars
..	…	…
297	Customer service gave me incorrect information…	1 star
298	Some testers are dried out and unusable.	2 stars
299	Refund policy is too strict, be careful before…	1 star
300	They sent me the wrong shade of foundation and…	1 star
301	Not a great experience, will shop elsewhere ne…	2 stars

	Confidence Score	Actual Rating
0	0.868498	5
1	0.539682	4
2	0.458273	4
3	0.665177	4
4	0.809355	5
..	…	…
297	0.478129	1
298	0.481462	1
299	0.464113	1
300	0.734445	1

```
301        0.589826                  1
```

`[302 rows x 4 columns]`

```python
from sklearn.metrics import accuracy_score, classification_report

# Convert predicted sentiment labels to numerical ratings
sentiment_mapping = {
    "1 star": 1,
    "2 stars": 2,
    "3 stars": 3,
    "4 stars": 4,
    "5 stars": 5
}

df_sentiment["Predicted Rating"] = df_sentiment["Predicted Sentiment"].
  ↪map(sentiment_mapping)

# Calculate accuracy
accuracy = accuracy_score(df_sentiment["Actual Rating"],␣
  ↪df_sentiment["Predicted Rating"])

# Generate classification report
report = classification_report(df_sentiment["Actual Rating"],␣
  ↪df_sentiment["Predicted Rating"])

# Display metrics
print(f"Accuracy: {accuracy:.4f}")
print("\nClassification Report:\n", report)
```

```
Accuracy: 0.5993

Classification Report:
               precision    recall  f1-score   support

           1       0.91      0.33      0.48        61
           2       0.00      0.00      0.00         0
           3       0.58      0.92      0.71        90
           4       0.43      0.10      0.16        59
           5       0.82      0.78      0.80        92

    accuracy                           0.60       302
   macro avg       0.55      0.43      0.43       302
weighted avg       0.69      0.60      0.59       302
```

```
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565:
UndefinedMetricWarning: Recall is ill-defined and being set to 0.0 in labels
```

```
with no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565:
UndefinedMetricWarning: Recall is ill-defined and being set to 0.0 in labels
with no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/usr/local/lib/python3.11/dist-packages/sklearn/metrics/_classification.py:1565:
UndefinedMetricWarning: Recall is ill-defined and being set to 0.0 in labels
with no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

2 Visualizations

```python
[21]: import matplotlib.pyplot as plt
      import seaborn as sns
      import numpy as np
      import pandas as pd
      from sklearn.metrics import confusion_matrix

      sentiment_mapping = {"1 star": 1, "2 stars": 2, "3 stars": 3, "4 stars": 4, "5␣
       ↪stars": 5}
      df_sentiment["Predicted Rating"] = df_sentiment["Predicted Sentiment"].
       ↪map(sentiment_mapping)

      precision = [0.91, 0.00, 0.58, 0.43, 0.82]
      recall = [0.33, 0.00, 0.92, 0.10, 0.78]
      f1_score = [0.48, 0.00, 0.71, 0.16, 0.80]
      ratings = [1, 2, 3, 4, 5]
```
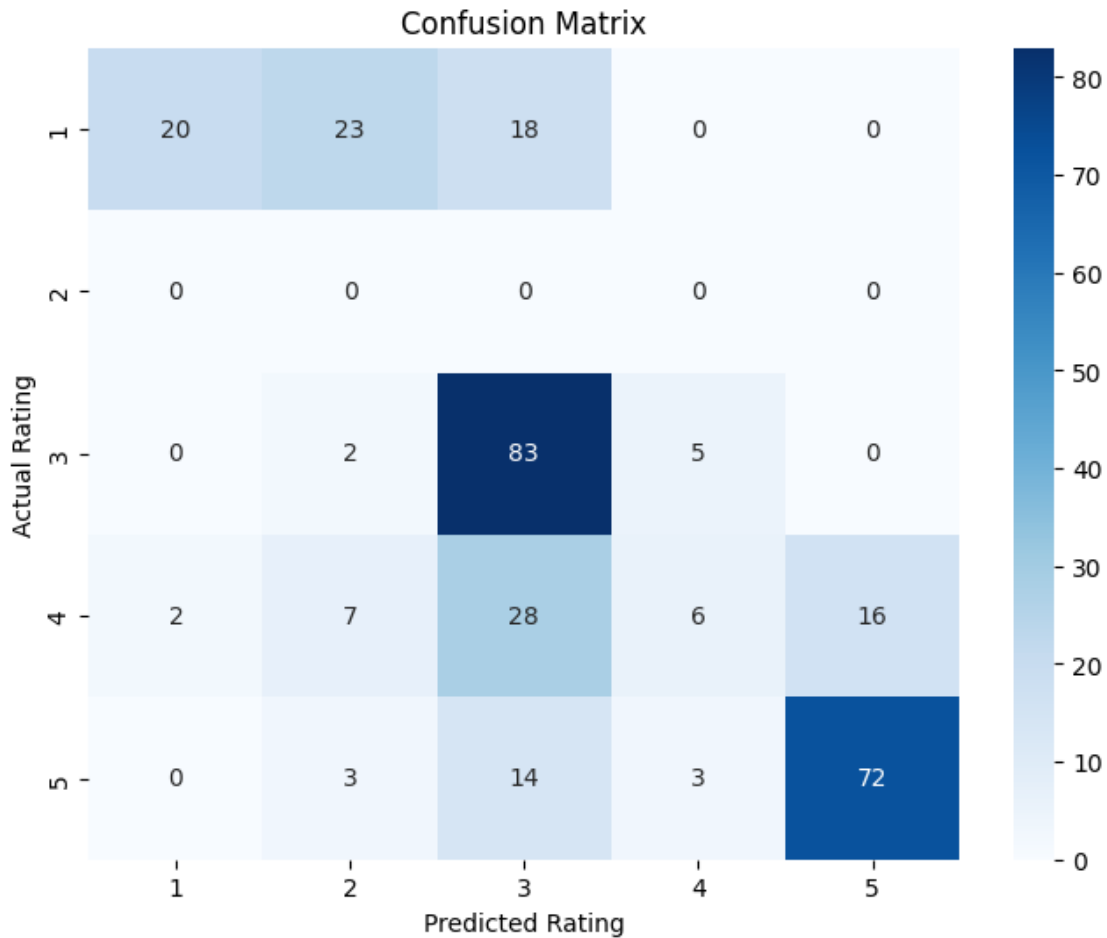
```python
[22]: conf_matrix = confusion_matrix(df_sentiment["Actual Rating"],␣
       ↪df_sentiment["Predicted Rating"])
      plt.figure(figsize=(8,6))
      sns.heatmap(conf_matrix, annot=True, fmt="d", cmap="Blues",␣
       ↪xticklabels=[1,2,3,4,5], yticklabels=[1,2,3,4,5])
      plt.xlabel("Predicted Rating")
      plt.ylabel("Actual Rating")
      plt.title("Confusion Matrix")
      plt.show()
```
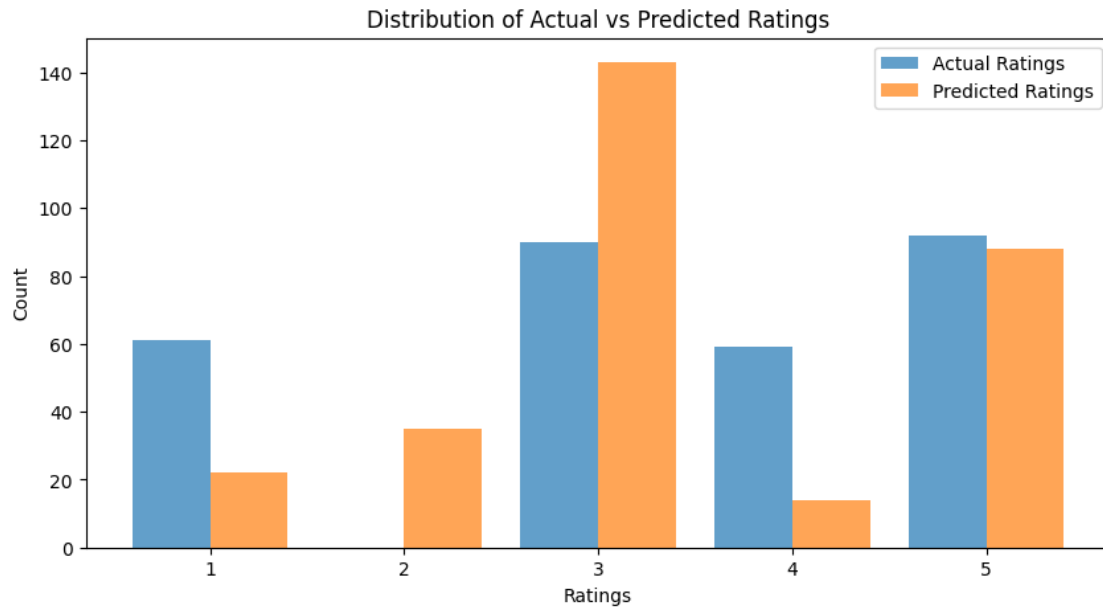
Confusion Matrix

	1	2	3	4	5
1	20	23	18	0	0
2	0	0	0	0	0
3	0	2	83	5	0
4	2	7	28	6	16
5	0	3	14	3	72

Actual Rating (vertical axis) / Predicted Rating (horizontal axis)

[23]:
```python
# 2. Distribution of Actual vs Predicted Ratings
plt.figure(figsize=(10,5))
bar_width = 0.4
x = np.arange(1, 6)

actual_counts = df_sentiment["Actual Rating"].value_counts().reindex([1, 2, 3,
 ↪4, 5], fill_value=0)
predicted_counts = df_sentiment["Predicted Rating"].value_counts().reindex([1,
 ↪2, 3, 4, 5], fill_value=0)

plt.bar(x - bar_width/2, actual_counts, bar_width, label="Actual Ratings",
 ↪alpha=0.7)
plt.bar(x + bar_width/2, predicted_counts, bar_width, label="Predicted
 ↪Ratings", alpha=0.7)
plt.xlabel("Ratings")
plt.ylabel("Count")
plt.xticks(x)
```
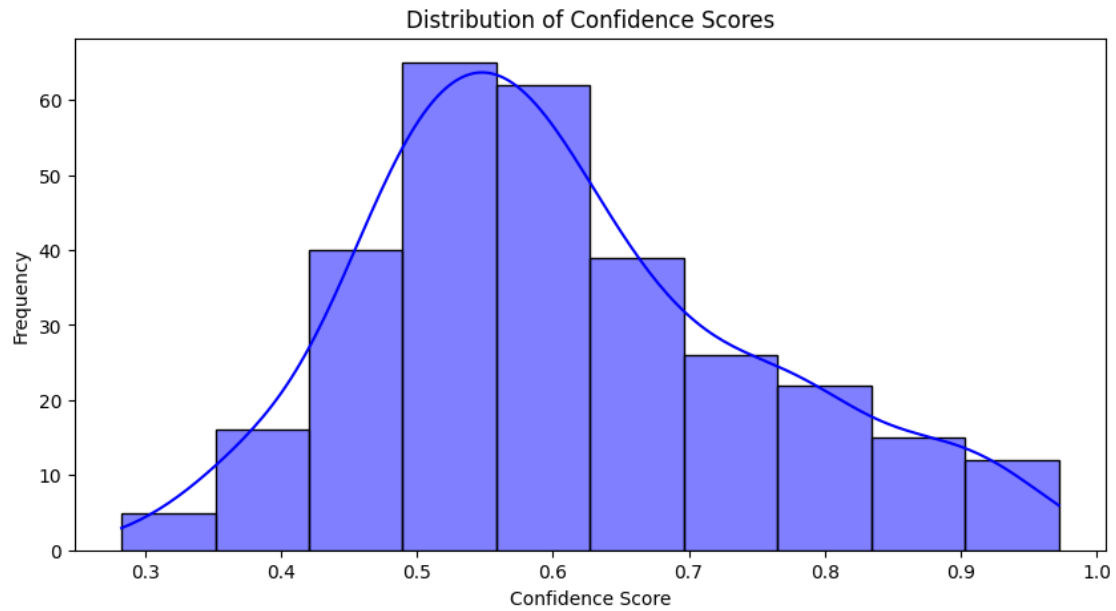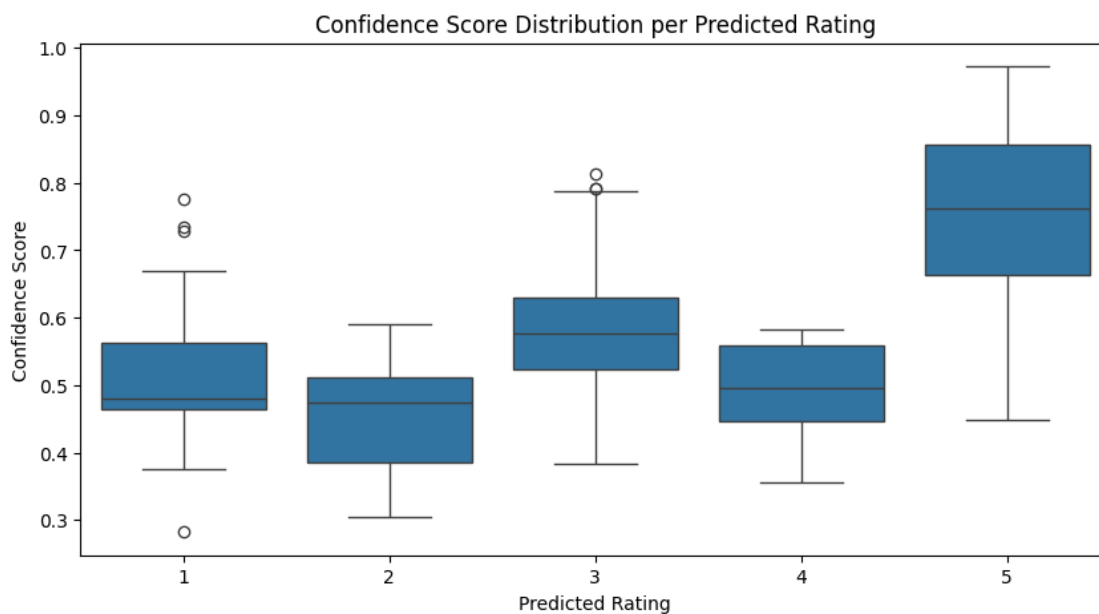
```
plt.legend()
plt.title("Distribution of Actual vs Predicted Ratings")
plt.show()
```


Distribution of Actual vs Predicted Ratings

[24]:
```
# 3. Confidence Score Distribution
plt.figure(figsize=(10,5))
sns.histplot(df_sentiment["Confidence Score"], bins=10, kde=True, color='blue')
plt.xlabel("Confidence Score")
plt.ylabel("Frequency")
plt.title("Distribution of Confidence Scores")
plt.show()
```
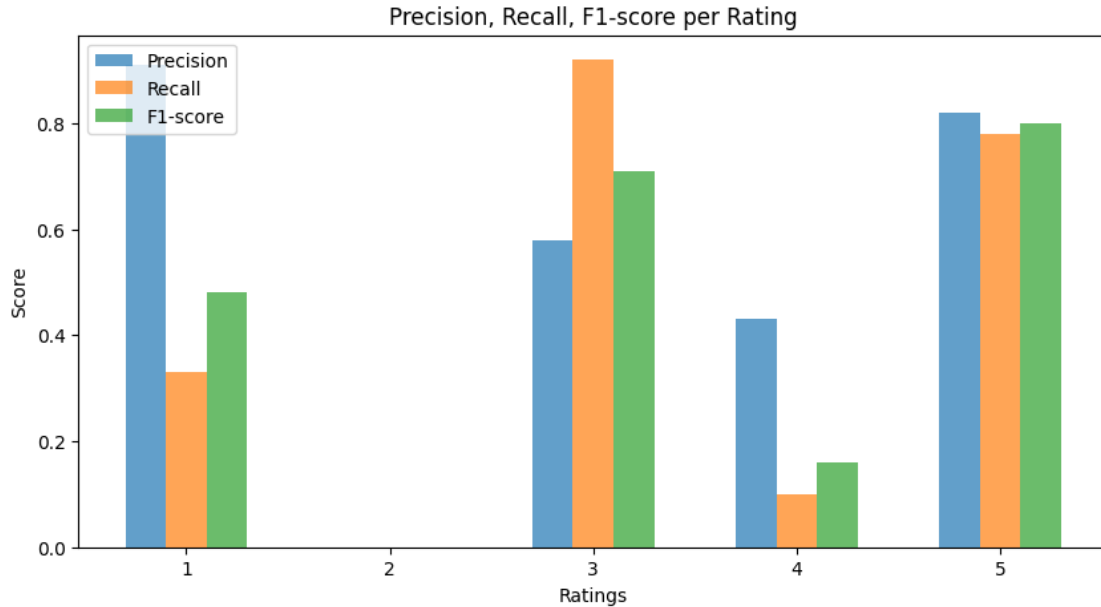
Distribution of Confidence Scores


```
[25]: plt.figure(figsize=(10,5))
      sns.boxplot(x=df_sentiment["Predicted Rating"], y=df_sentiment["Confidence␣
       ↪Score"])
      plt.xlabel("Predicted Rating")
      plt.ylabel("Confidence Score")
      plt.title("Confidence Score Distribution per Predicted Rating")
      plt.show()
```

Confidence Score Distribution per Predicted Rating

```
[26]: x = np.arange(len(ratings))
      bar_width = 0.2

      plt.figure(figsize=(10,5))
      plt.bar(x - bar_width, precision, bar_width, label="Precision", alpha=0.7)
      plt.bar(x, recall, bar_width, label="Recall", alpha=0.7)
      plt.bar(x + bar_width, f1_score, bar_width, label="F1-score", alpha=0.7)

      plt.xlabel("Ratings")
      plt.ylabel("Score")
      plt.xticks(x, ratings)
      plt.legend()
      plt.title("Precision, Recall, F1-score per Rating")
      plt.show()
```


2.1 Marketing Insights from Sentiment Analysis

2.1.1 1 Brand Perception & Customer Loyalty

Positive Reviews:
- Customers appreciate **exclusive products, premium packaging, and fast delivery**.
- Many **returning customers** highlight the **loyalty program benefits**.
- Customers value **store aesthetics & shopping experience**.

 Marketing Strategy:
- **Emphasize exclusivity** in ads—highlight rare perfumes & limited collections.

- Promote a **VIP loyalty tier** for frequent shoppers.
- Use **customer testimonials** in marketing campaigns.

2.1.2   2 Price Sensitivity & Discounts

Mixed Sentiment in Price Perception:
- Some reviews indicate **pricing is fair for the quality**.
- Others mention that **prices are high compared to competitors**.
- Discount system is liked, but **often doesn't apply to popular products**.

   Marketing Strategy:
- Introduce **tiered pricing models** (budget-friendly & premium options).
- Run **flash sales on popular items** to drive traffic.
- **Highlight value over price** in messaging: emphasize product quality & experience.

2.1.3   3 Customer Engagement & Trust

Consultants & Service:
- Customers **praise staff knowledge** but **some report unhelpful service**.
- Complaints about **staff pushing expensive products** instead of assisting.

   Marketing Strategy:
- Train staff on **customer-first selling techniques**.
- Create **personalized shopping experiences** with AI-driven recommendations.
- Introduce **"Beauty Advisors" live sessions** for online engagement.

2.2   Operational Insights for Improvement

2.2.1   1 Delivery & Supply Chain

Delivery Speed & Stock Issues:
- Many **praise fast delivery**, but **delays occur during peak seasons**.
- Complaints about **items going out of stock too quickly**.

   Operational Fixes:
- Implement **demand forecasting** for popular items.
- Partner with **local couriers for faster fulfillment**.
- Offer **real-time stock updates** on the website.

2.2.2   2 Checkout & Website Experience

Website & In-Store Checkout Complaints:
- Customers report **slow checkout lines** in-store.
- Online store **lags during high traffic**.
- Some reviews mention **confusing return policies**.

   Operational Fixes:
- Enable **self-checkout kiosks** in-store.
- Upgrade website **server capacity** for peak shopping times.
- Simplify **return policies** and provide **instant refund options**.

2.3   Next Steps

Targeted Marketing Campaigns → Focus on exclusivity, loyalty, and value.

Operational Fixes → Improve stock forecasting, website speed, and checkout.

Customer Engagement → Train staff, introduce AI-based recommendations, and improve customer interactions.