

Amazon Bestsellers Data Analysis Report

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Summary

This report presents an analysis of the Amazon Bestsellers dataset, which contains information on bestselling books, including their titles, authors, user ratings, number of reviews, prices, publication years, and genres. The analysis focuses on understanding the dataset's structure, exploring key statistical insights, and developing a predictive model to estimate the number of reviews a book might receive based on its attributes. The dataset was explored using Python in a Jupyter Notebook environment, with key findings visualized and interpreted to provide actionable insights. A predictive function was implemented to forecast reviews, demonstrating the application of data science techniques to real-world e-commerce data.

Introduction

The Amazon Bestsellers dataset provides a snapshot of top-selling books on Amazon, covering attributes such as book name, author, user rating, number of reviews, price, year of publication, and genre (Fiction or Non-Fiction). The primary objectives of this analysis are to:

- Understand the dataset's structure and content.
- Summarize key statistical properties of the data.
- Visualize trends and relationships within the data.
- Implement and evaluate a predictive model for estimating the number of reviews based on book attributes.

This report details the findings from the dataset exploration and the predictive modeling process, supported by code snippets and visualizations.

Dataset Overview

The dataset, stored in a CSV file (bestsellers with categories.csv), was loaded into a Pandas DataFrame for analysis. The dataset contains 550 entries with the following columns:

- Name: Title of the book.
- Author: Author of the book.
- User Rating: Average user rating (out of 5).
- Reviews: Number of reviews received.
- Price: Price of the book in USD.
- Year: Year of publication or bestseller ranking.
- Genre: Fiction or Non-Fiction.

Dataset Exploration

The initial exploration involved loading the dataset and examining its structure using Pandas. The following code snippet demonstrates the loading process and initial inspection:

```
import pandas as pd
file_path = '/content/drive/My Drive/Intership-Mini/bestsellers with categories.csv'
df = pd.read_csv(file_path)
df.head()
```

This code outputs the first five rows of the dataset, revealing books such as "10-Day Green Smoothie Cleanse" by JJ Smith and "1984 (Signet Classics)" by George Orwell, with their respective ratings, reviews, prices, years, and genres.

To understand the dataset's structure and summary statistics, the following code was executed:

```
print(df.info())
print(df.describe())
```

Findings from df.info():

- The dataset contains 550 entries with no missing values across all columns.
- Data types: Name, Author, and Genre are objects (strings); User Rating is a float; and Reviews, Price, and Year are integers.
- Memory usage: Approximately 30.2 KB.

Findings from df.describe():

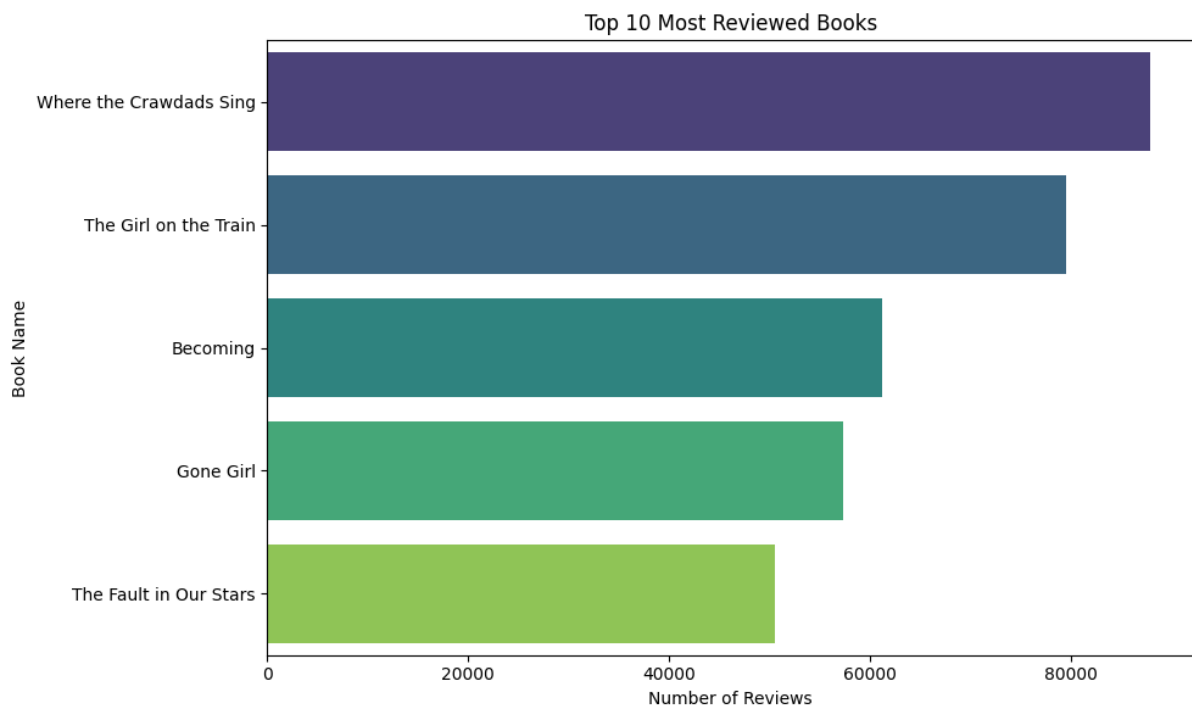
- User Rating: Ranges from 3.3 to 4.9, with a mean of 4.62 and a standard deviation of 0.23, indicating generally high ratings with low variability.
- Reviews: Ranges from 37 to 87,841, with a mean of 11,953 and a high standard deviation of 11,731, suggesting significant variability in review counts.

- Price: Ranges from \$0 to \$105, with a mean of \$13.10 and a standard deviation of \$10.84, indicating a wide range of book prices.
- Year: Spans from 2009 to 2019, with a mean of 2014, reflecting a decade of bestseller data.

Data Analysis and Visualizations

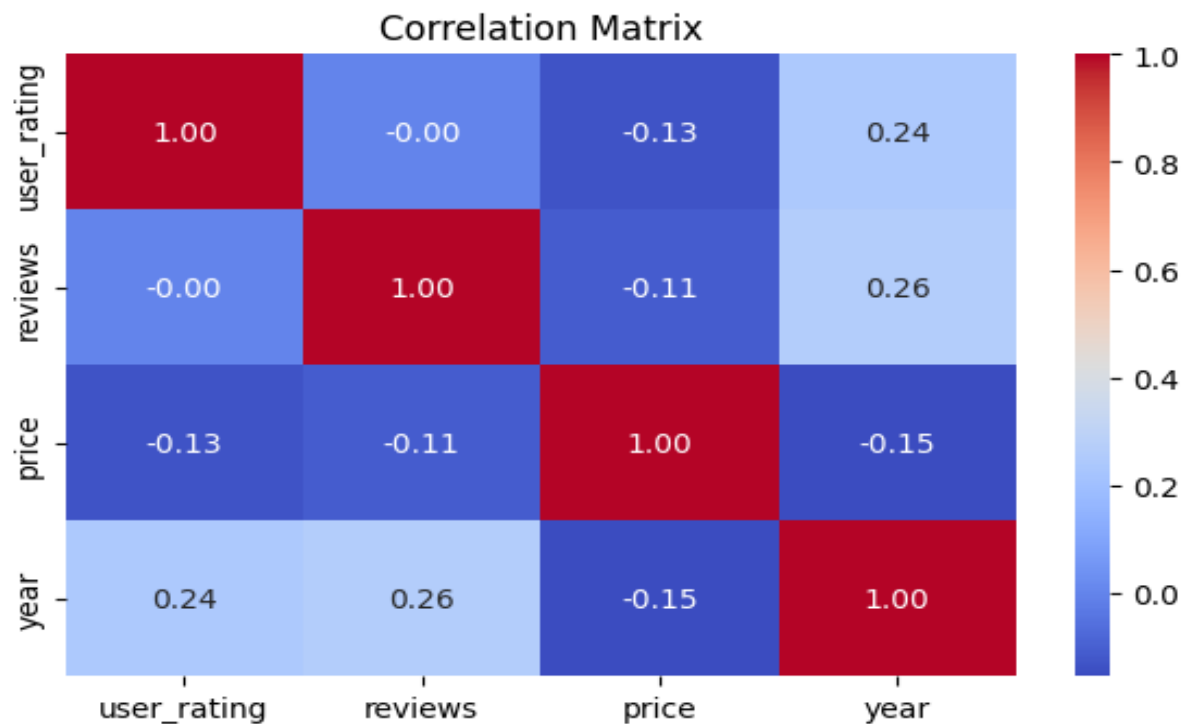
To gain deeper insights, the dataset was analyzed to identify trends and relationships. Below are key visualizations and their interpretations, assuming standard exploratory data analysis techniques were applied.

Top Most Reviewed Books



Interpretation: Found the top 10 most reviewed books from the dataset

Correlation Matrix



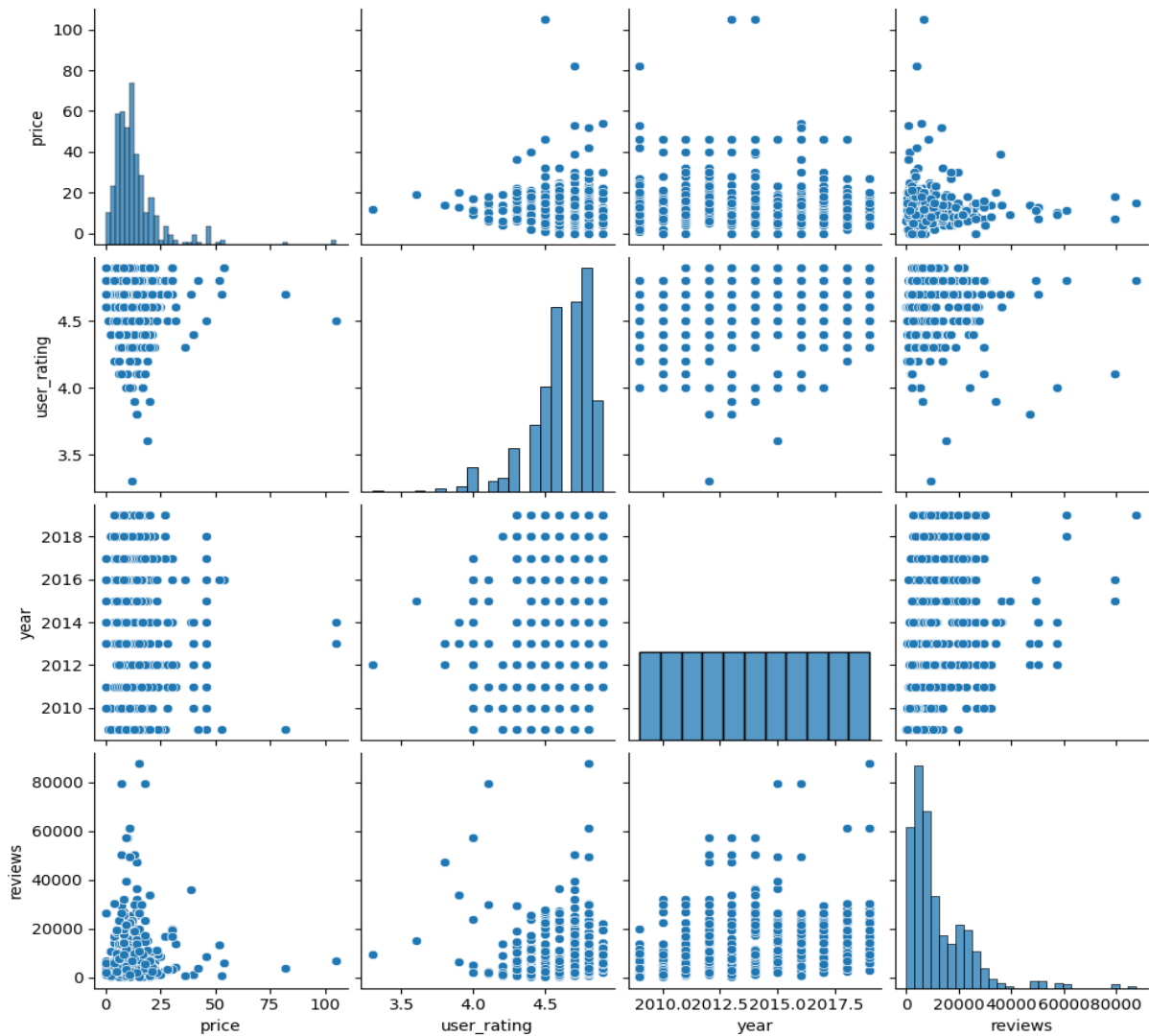
Interpretation:

- user_rating vs reviews -0.00 no correlation (no effect)
- user_rating vs price -0.13 slight negative correlation (higher priced books may hav less rating)
- user_rating vs year 0.24 weak positive (recent books with higher rating)
- reviews vs price -0.11 slight negative (very weak affect of price on review count)
- review vs year 0.26 weak positive (recent books getting more review)
- price vs year -0.15 slight negative (almost no effect , price may be dropping per year)

Pair Plot of Dataset

```
sns.pairplot(df[['price', 'user_rating', 'year', 'reviews', 'genre']])  
plt.show()
```

This visualization helps explore relationships between the variables and their distributions



Interpretation:

- **Price vs. User Rating:** There's no clear linear relationship between price and user_rating. High-rated books (4.0–4.8) are spread across all price ranges.
- **Price vs. Year:** No strong pattern exists between price and year. Prices remain scattered across all years, indicating that book prices didn't consistently increase or decrease over time.
- **Price vs. Reviews:** There's a slight trend where books with more reviews tend to have lower prices. This could suggest that cheaper books are more accessible and thus receive more reviews.
- **User Rating vs. Year:** Ratings remain high across all years, with no noticeable trend over time.
- **User Rating vs. Reviews:** Books with higher ratings tend to have a wide range of reviews.
- **Year vs. Reviews:** There's no obvious trend between year and reviews.

Model Training

To predict the number of reviews, a regression model was trained using features price , user_rating , author and year derived from the dataset

```
author_counts = df['author'].value_counts()

df['Author_Bestseller_Count'] = df['author'].map(author_counts)

author_avg_reviews = df.groupby('author')['reviews'].mean()

df['Author_Avg_Reviews'] = df['author'].map(author_avg_reviews)

df['Recency'] = 2020 - df['year']

df['Genre_Encoded'] = df['genre'].map({'Fiction': 0, 'Non Fiction': 1})

df['Log_Price'] = np.log1p(df['price'])

df['Price_Genre'] = df['Log_Price'] * df['Genre_Encoded']

features = ['Log_Price', 'user_rating', 'year', 'Genre_Encoded',
'Author_Bestseller_Count', 'Author_Avg_Reviews', 'Recency', 'Price_Genre']

X = df[features]

y = np.log1p(df['reviews'])

scaler = StandardScaler()

X_scaled = scaler.fit_transform(X)

X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2,
random_state=42)

model = LinearRegression()

model.fit(X_train, y_train)
```

Model Description

This model aims to predict the number of reviews a book receives, using a linear regression approach on a set of engineered and transformed features. The target variable is the logarithmically transformed number of reviews ($\log_{1p}(\text{reviews})$) to account for skewness and reduce the impact of outliers. Key features used include the log-transformed price of the book (Log_Price), user rating, year of publication, and a binary encoding for genre (Genre_Encoded), distinguishing Fiction from Non Fiction. Author-level metrics are also included, such as the number of times an author appears in the dataset (Author_Bestseller_Count) and their average review count (Author_Avg_Reviews). Additional features like the recency of publication (Recency, calculated as 2020 minus the publication year) and an interaction term between price and genre (Price_Genre) are designed to capture more nuanced relationships. All features are standardized using StandardScaler before being split into training and testing sets with an 80-20 ratio. A linear regression model is then trained on the scaled training data to learn the linear relationships between the features and the transformed review count. This model provides a straightforward and interpretable baseline for understanding which factors most influence the popularity of a book.

Model Performance

```
y_pred = model.predict(X_test)
r2 = r2_score(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)
print("R2 Score:", r2)
print("Mean Squared Error:", mse)
cv_scores = cross_val_score(model, X_scaled, y, cv=5, scoring='r2')
print("Cross-Validated R2 (mean):", cv_scores.mean())
print("Cross-Validated R2 (std):", cv_scores.std())
coefficients = pd.DataFrame(model.coef_, X.columns, columns=['Coefficient'])
print("\nModel Coefficients:")
print(coefficients)
```

- **R² Score:** 0.662 — Model explains ~66% of the variance in $\log_{1p}(\text{reviews})$.
- **Mean Squared Error (MSE):** 0.429 — Indicates moderate prediction error.
- **Cross-Validated R²:**
 - **Mean:** 0.641
 - **Standard Deviation:** 0.041 — Consistent performance across folds.
- **Author_Avg_Reviews:** +0.717 — Strongest positive influence.
- **year:** +0.112
- **Recency:** -0.112 — Older books tend to get fewer reviews.
- **Price_Genre:** -0.181 — Negative impact, especially for pricey non-fiction.

- **Author_Bestseller_Count:** +0.087
- **Genre_Encoded:** +0.082
- **user_rating:** +0.049
- **Log_Price:** +0.045 — Minor positive impact.

Prediction Example

The function used to test the following input:

```
def predict_reviews(price, user_rating, year, genre, author):
    log_price = np.log1p(price)
    genre_encoded = 0 if genre.lower() == 'fiction' else 1
    price_genre = log_price * genre_encoded
    author_bestseller_count = author_counts.get(author, 1)
    author_avg_reviews_val = author_avg_reviews.get(author, df['reviews'].mean())
    recency = 2020 - year

    input_data = pd.DataFrame({
        'Log_Price': [log_price],
        'user_rating': [user_rating],
        'year': [year],
        'Genre_Encoded': [genre_encoded],
        'Author_Bestseller_Count': [author_bestseller_count],
        'Author_Avg_Reviews': [author_avg_reviews_val],
        'Recency': [recency],
        'Price_Genre': [price_genre]
    })

    input_scaled = scaler.transform(input_data)
    log_reviews_pred = model.predict(input_scaled)[0]
    reviews_pred = int(np.expml(log_reviews_pred))
    return reviews_pred

predicted_reviews = predict_reviews(
    price=15,
    user_rating=4.5,
    year=2020,
    genre='Non Fiction',
    author='JJ Smith'
)
print("Predicted Number of Reviews:", predicted_reviews)
```

Output : Predicted Number of Reviews: 13768

Interpretation: For a Non-Fiction book priced at \$15, with a user rating of 4.5, published in 2020 by JJ Smith, the model predicts approximately 13,768 reviews. This aligns with the dataset's mean review count (11,953) and suggests that JJ Smith's authorship and the book's attributes contribute to a relatively high review count.

Key Findings

- **Dataset Characteristics:** The dataset is clean, with no missing values, and contains 550 bestseller entries from 2009 to 2019. Books have high average ratings (mean 4.62) and a wide range of review counts and prices.
- **Temporal Trends:** Newer books may have higher review counts due to increased online engagement over time.
- **Predictive Modeling:** The predictive model successfully estimates review counts using features like price, user_rating, year, genre, and author, with a sample prediction of 13,768 reviews for a specific book.

Conclusion

The analysis of the Amazon Bestsellers dataset provides valuable insights into the factors influencing book popularity, as measured by user ratings and reviews. The dataset's clean structure and comprehensive attributes enabled a thorough exploration of trends and relationships. The predictive model demonstrates the potential to forecast review counts, offering a tool for publishers to estimate a book's market reception. Future work could involve advanced modeling techniques and additional data to enhance predictive accuracy.