

# Predicting Medicine Effectiveness and Patient Satisfaction

Insights into Factors Influencing  
Satisfaction and Common Side  
Effects



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# AGENDA

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2. Data Overview and Preparation
3. Exploratory Data Analysis (EDA)
4. Model Selection and Implementation
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# Introduction

**Objective:** The aim of this project is to

- predict user satisfaction (measured by Excellent Review %) based on Medicine related features,
- identify common side effects, and
- Determine the factors influencing medicine effectiveness.

# Data Overview

**Dataset:** Contains 11,825 records of medicines with attributes such as:

- Medicine Name
- Composition
- Uses
- Side Effects
- Manufacturer
- Patient Satisfaction Ratings
  - Excellent Review %
  - Average Review %
  - Poor Review %

**Target:** Excellent Review % (user satisfaction)

**Features:** Average Review %, Poor Review %, side effects, manufacturer, and more.

# Data Preparation

**Data Cleaning:** Ensured NO Missing Values.

**Feature Selection:** Focused on Numeric Features such as Average Review % and Poor Review %.

**Scaling:** Applied scaling for features when necessary (for Neural Network model).

**Train - Test Split:** 80% for training, 20% for testing.

# Exploratory Data Analysis (EDA)

## Correlation Analysis:

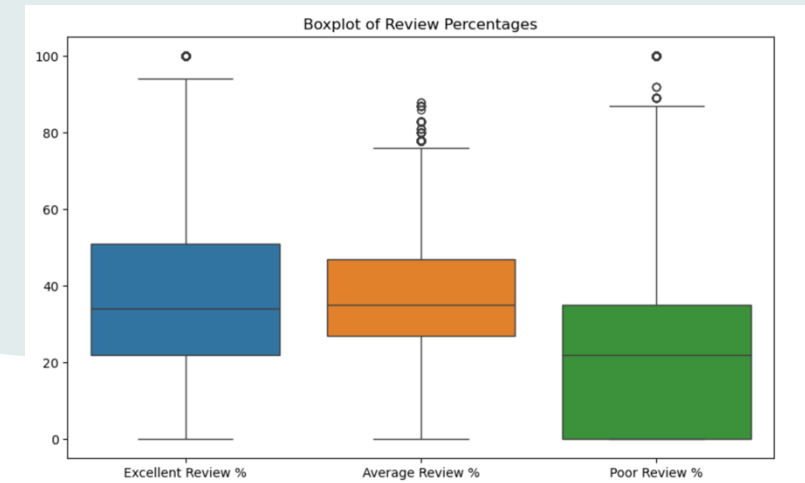
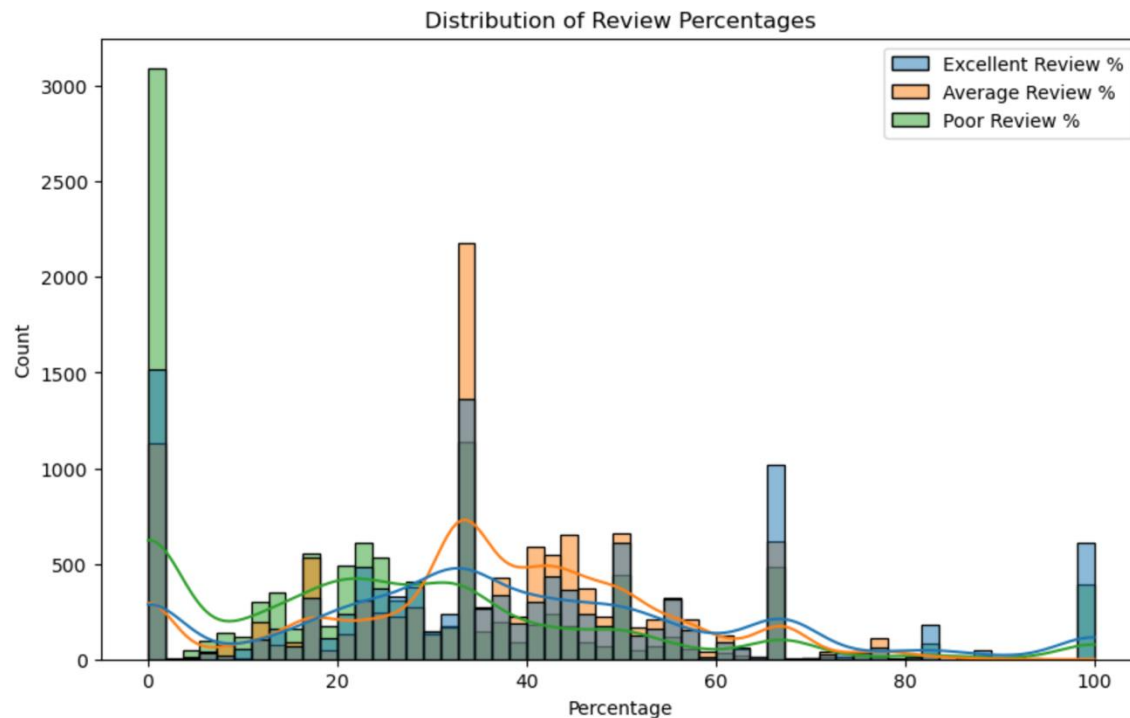
	Excellent Review %	Average Review %	Poor Review %
Excellent Review %	1.000000	-0.427963	-0.725545
Average Review %	-0.427963	1.000000	-0.311464
Poor Review %	-0.725545	-0.311464	1.000000

Fig: Correlation Analysis

- Strong Negative correlation between Excellent Review % and Poor Review % (- 0.72).
- Moderate Negative correlation between Excellent Review % and Average Review % (- 0.43)

# Exploratory Data Analysis (EDA)

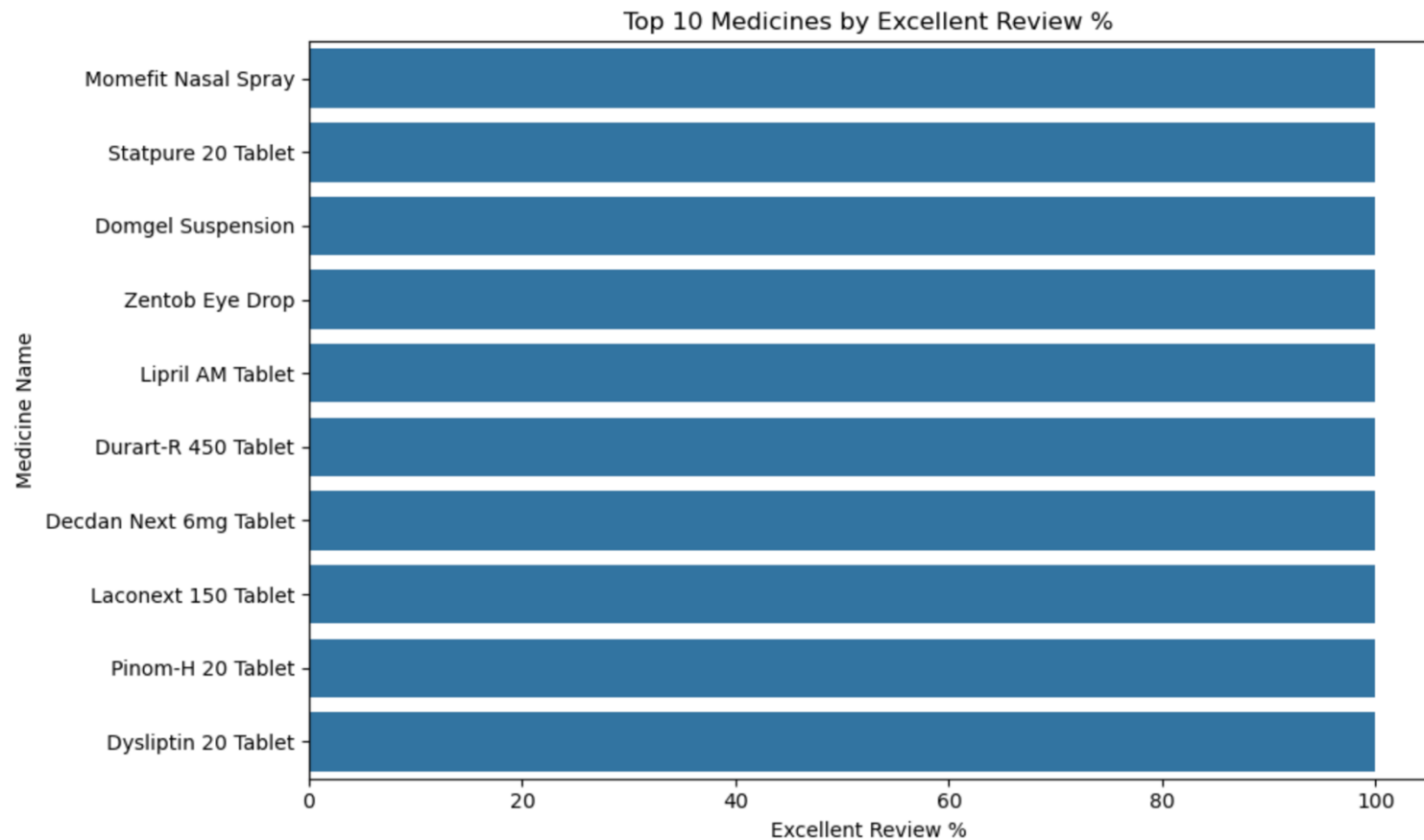
## Visualization:



- The distribution of review percentage shows a skew towards medicine with middle range reviews.
- Medicines with a higher Excellent Review % have significantly lower Poor Review %.

# Exploratory Data Analysis (EDA)

## Visualization:





# Common Side Effects and Associated Medicines

## Top 5 Common Side Effects

	Side Effect	Count
9	Application site reactions burning irritation ...	390
99	Hypoglycemia low blood glucose level Headache ...	173
30	No common side effects seen	149
88	Dizziness Sleepiness Tiredness Uncoordinated b...	126
374	Application site reactions burning irritation ...	118
178	Nausea Abdominal pain Constipation Dizziness H...	112
119	Limited data available	98
112	Skin peeling Application site reactions burnin...	95
107	Nausea Diarrhea Abdominal pain Hypoglycemia lo...	86
194	Muscle pain Weakness Headache Abdominal pain D...	82

1. Application site reactions burning irritation itching and redness.
2. Hypoglycemia low blood glucose level Headache Nausea Dizziness Weakness.
3. No common side effects.
4. Dizziness Sleepiness Tiredness Uncoordinated body movements.
5. Nausea Abdominal pain Diarrhea.
6. Skin peeling Erythema skin redness Itching Dry skin Burning sensation at the site of application.

# Common Side Effects and Associated Medicines

## Associated Medicines

	Medicine Name	Side_effects
11	Anovate Cream	Application site reactions burning irritation ...
43	Aquasol A Capsule	No common side effects seen
60	Aziderm 20% Cream	Application site reactions burning irritation ...
68	Acivir Cream	Application site reactions burning irritation ...
77	Alciflox D Eye/Ear Drops	Application site reactions burning irritation ...
...	...	...
11802	Zerostiff Sachet Orange Pineapple	No common side effects seen
11806	Zuemeth Tablet	No common side effects seen
11819	Zenegra Lido Spray	Allergic reaction Application site reactions b...
11823	Zedruff Shampoo	Application site reactions burning irritation ...
11824	Zedruff Shampoo	Application site reactions burning irritation ...

Medicines like

1. Azilide 500 Tablet,
2. Augmentin 625 Duo Tablet, and
3. Adalene Nanogel Gel.

Were frequently associated with these side effects.

Insight:

- Medicines with fewer side effects are more likely to receive higher satisfaction scores.

# Model Selection

We implemented three different models to predict Excellent Review % based on the selected features:

1. Linear Regression (Baseline Model)
2. Random Forest Regression (Tree - Based Model)
3. Feedforward Neural Network (Deep Learning Model)

# Model Selection

## Model 1: Linear Regression

A simple linear model to predict Excellent Review % based on Average Review % and Poor Review %.

### Performance

- **Mean Squared Error (MSE):**  $9.013622768639271e-26$
- **R<sup>2</sup> Score:** 1.0

### Takeaway

- This Model serves as a baseline but underperforms on complex patterns in the data.

# Model Selection

## Model 2: Random Forest Regression

An ensemble model that uses multiple decision trees to capture non-linear relationship between features and the target.

### Performance

- **Mean Squared Error (MSE):** 0.18224101479915433
- **R<sup>2</sup> Score:** 0.9997200366871842

### Takeaway

Random Forest performed better than Linear Regression, capturing more complex relationship between features and satisfaction.

# Model Selection

## Model 3: Neural Network (Feedforward)

A deep learning model with multiple hidden layers to predict Excellent Review %.

### Architecture

- 1 input Layer
- 3 Hidden Layers (256, 128, 64 neurons respectively)

### Performance

- **Mean Squared Error (MSE):** 0.0001653805406345694
- **R<sup>2</sup> Score:** 0.9999997459381793

### Takeaway

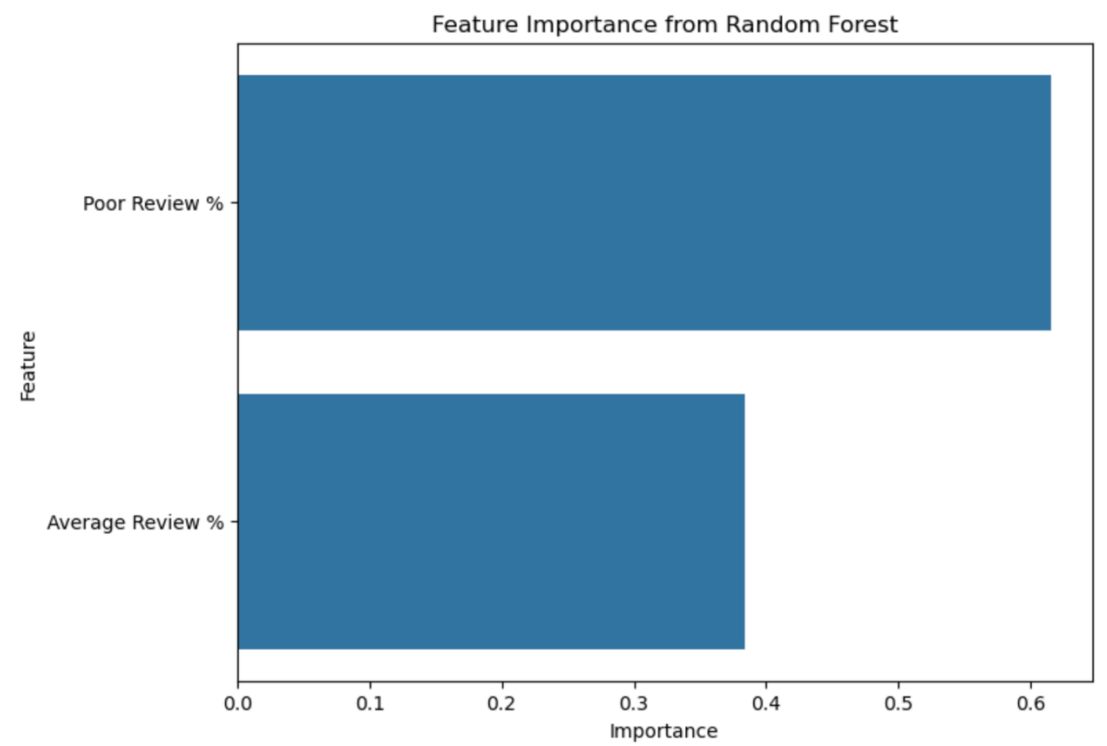
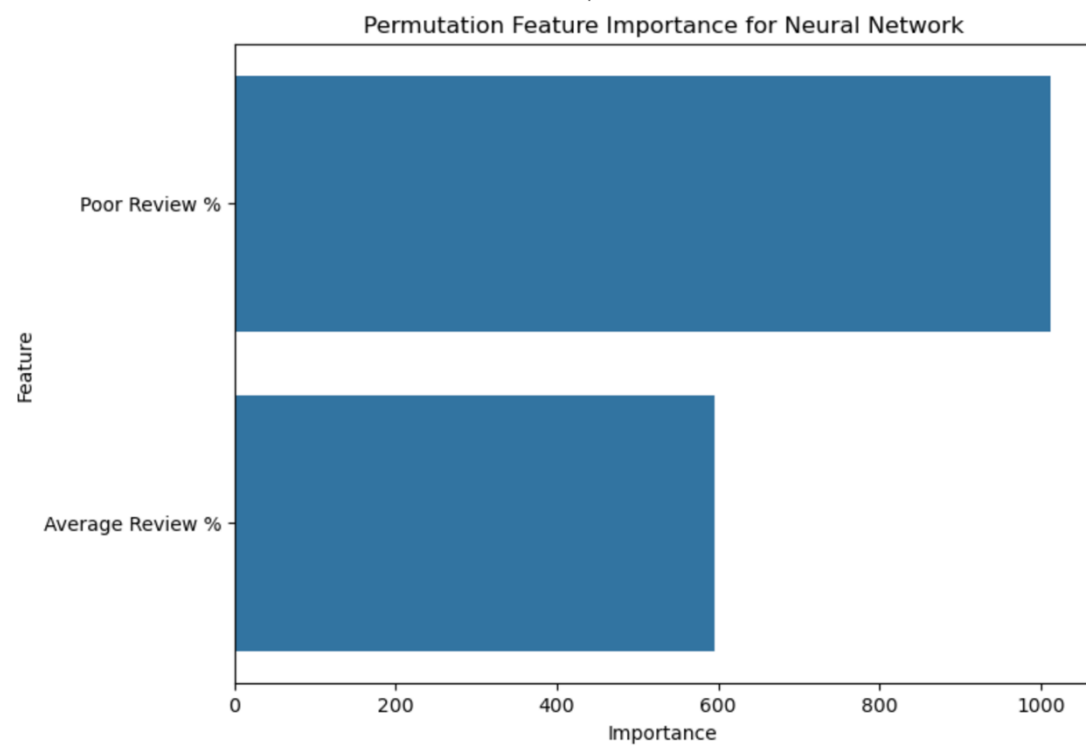
Neural Networks provided the best performance, handling complex interactions between features effectively.

# Comparing Model Performance

Model	MSE	R <sup>2</sup> Score
Linear Regression	9.013622768639271e-26	1.0
Random Forest	0.18224101479915433	0.9997200366871842
Neural Network	0.0001653805406345694	0.9999997459381793

The Neural Network achieved the best accuracy, followed by Random Forest.

# Feature Importance





# Feature Importance

## 1. **Poor Review % is the key driver:**

- Both Models (Random Forest and Neural Network) agree that reducing Poor Review % has the highest impact on predicting a higher Excellent Review %. This implies that minimizing negative experiences with medicine can significantly boost patient satisfaction.

## 2. **Average Review % is secondary:**

- This suggests that while average reviews have some influence on satisfaction, extreme negative reviews (Poor Review %) have a much stronger effect.

## 3. **Actionable Strategy:** To improve medicine satisfaction and effectiveness, efforts should focus on reducing the factors that contribute to Poor Reviews, such as minimizing side effects or enhancing the overall effectiveness of the medicine.

# Key Finding

## 1. Factors influencing Satisfaction:

- Higher Excellent Review % is strongly associated with lower Poor Review %.
- Medicines with fewer and less severe side effects tend to receive higher satisfaction.

## 2. Common Side Effects:

- Side effects such as nausea, vomiting, and headache are the most common, often associated with lower satisfaction ratings.

## 3. Best Model:

- The Neural Network model outperformed other models in predicting satisfaction with higher accuracy.

# Recommendations and Way Forward

1. Focus on reducing the frequency and severity of side effects to improve patient satisfaction.
2. Manufacturers should prioritize medicines with fewer side effects to increase Excellent review %.
3. use the satisfaction prediction models to identify medicines or categories that need enhancement. Focus on improving medicines that have a high Poor Review % to boost their overall effectiveness and user satisfaction.
4. Extend the analysis to include new types of medicines, chronic treatments, or rare conditions where patient feedback may differ significantly.

# References

Click the Gdrive link below to find the Jupyter Notebook for the Above Analysis.

[https://drive.google.com/file/d/1onGpBZeZ-2cj24hHqPtiwf86dvJjeUSq/view?usp=drive\\_link](https://drive.google.com/file/d/1onGpBZeZ-2cj24hHqPtiwf86dvJjeUSq/view?usp=drive_link)

Thank you

