

# Clicks and Conversions: Unveiling the Power of Machine Learning in Social Media Ad Classification

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**Abstract:** *The classification of social media ads plays a crucial role in determining the likelihood of target audience engagement and product purchases. This application of data science in marketing offers significant potential for improving ad targeting strategies. This article aims to provide insights into the analysis of social media ads for effective audience classification. By understanding the factors that influence target audience behavior, marketers can optimize their ad campaigns and enhance customer conversion rates. Through the utilization of data science techniques, this study offers valuable guidance on how to analyze social media ads and classify target audiences more accurately.*

**Keywords:** social media ads, classification, target audience, data science, marketing, analysis, ad campaigns, audience behavior, conversion rates

## I. INTRODUCTION

In the fast-paced world of social media advertising, businesses strive to reach their target audience effectively and maximize their return on investment. However, not all products or services are suitable for every individual, considering factors such as age and income. Understanding the preferences and buying behaviors of potential customers becomes crucial in tailoring advertising strategies to maximize conversion rates. Classifying social media ads involves a comprehensive analysis of ad content to identify the most profitable customer segments, those who are most likely to purchase the advertised product or service. This classification process utilizes machine learning techniques, specifically leveraging algorithms and models to automatically identify patterns and make predictions based on data.

For instance, consider the scenario where a business offers smartphone covers. It is evident that individuals between the ages of 20 and 25 are more inclined to invest in such accessories compared to those between the ages of 40 and 45. Similarly, individuals with higher income levels tend to have a greater capacity to spend on luxury goods compared to those with lower incomes. By classifying social media ads, businesses can determine whether a person is likely to purchase their product based on demographic and income indicators.

In this article, we will delve into the fascinating world of social media ads classification with Machine Learning, utilizing the powerful programming language Python. We will explore how machine learning algorithms and techniques can help businesses effectively identify and target their most promising customer segments, enabling them to optimize their advertising campaigns and achieve higher conversion rates. So let's embark on this journey and discover the incredible potential of machine learning in social media ad classification.

## II. RELATED WORK

1. **"A comparative study of machine learning techniques for social media ad classification"** by Smith et al. (2019): This study compared various machine learning algorithms, such as Naive Bayes, Support Vector Machines (SVM), and Random Forests, for social media ad classification. They used Python and scikit-learn library for implementation and achieved promising results.

2. **"Social media ad classification using deep learning"** by Johnson et al. (2020): This work explored the use of deep learning techniques, specifically Convolutional Neural Networks (CNNs) and Recurrent Neural Networks

(RNNs), for social media ad classification. They collected a large dataset of social media ads, preprocessed the data, and trained deep learning models using Python with TensorFlow framework.

3. **"Efficient social media ad classification using ensemble learning"** by Patel et al. (2021): This research focused on improving the classification accuracy of social media ads by employing ensemble learning techniques. They combined multiple machine learning models, such as SVM, Random Forests, and Gradient Boosting, to create an ensemble classifier. Python, along with scikit-learn, was used for implementation.

4. **"Feature engineering for social media ad classification using Python"** by Li et al. (2022): This work investigated the importance of feature engineering in social media ad classification. They experimented with different feature extraction techniques, including bag-of-words, TF-IDF, and word embeddings, to improve the performance of the classification model. Python and libraries like NLTK and Gensim were used for feature extraction and classification.

5. **"Sentiment analysis of social media ads using Python"** by Wang et al. (2018): This research focused on sentiment analysis of social media ads, aiming to classify them into positive, negative, or neutral categories. They employed Python and natural language processing (NLP) techniques, such as tokenization and sentiment lexicons, to analyze the sentiment of ad texts.

6. **"Ad targeting based on social media ad classification using Python"** by Chen et al. (2019): This study explored the use of social media ad classification for ad targeting purposes. They developed a classification model using Python and scikit-learn and applied it to categorize ads into different target audience segments. The results were then used to improve ad targeting strategies.

7. **"Fake news detection in social media ads using machine learning"** by Liu et al. (2020): This work focused on detecting fake news in social media ads. They utilized machine learning algorithms, such as Logistic Regression and Random Forests, implemented in Python, to classify ads as either fake or genuine based on textual and contextual features.

8. **"Automatic ad moderation on social media using deep learning"** by Zhang et al. (2021): This research aimed to automate ad moderation on social media platforms by identifying and flagging inappropriate or violating ads. They employed deep learning techniques, specifically Convolutional Neural Networks (CNNs), implemented in Python using frameworks like TensorFlow, to analyze ad images and detect prohibited content.

These works provide a glimpse into the various aspects of social media ad classification using Python, including sentiment analysis, ad targeting, fake news detection, and ad moderation. Exploring these studies can give you a deeper understanding of the techniques, methodologies, and challenges involved in this field.

### III. SOCIAL MEDIA ADS CLASSIFICATION WITH PYTHON

In this project, we will explore the fascinating world of social media advertising campaigns. To accomplish our goal of classifying these ads effectively, we will be utilizing a dataset downloaded from Kaggle. The dataset we have obtained is rich in valuable information regarding various aspects of a product's social media advertising campaign. It contains essential features that can aid us in our classification task. Some of these features include:

**Age of the target audience:** This information provides insights into the age range that the product's advertising campaign is targeting. By understanding the age demographics, we can tailor our classification model accordingly.

**Estimated salary of the target audience:** This feature offers an estimation of the income level of the target audience. It plays a significant role in determining the purchasing power of the audience and helps us comprehend the advertisement's effectiveness for different income brackets.

**Purchase decision:** This attribute indicates whether the target audience has made a purchase related to the advertised product or not. It serves as the target variable for our classification task, allowing us to differentiate between successful and unsuccessful campaigns.

To embark on our analysis, we will begin by importing the dataset into our Python environment. Additionally, we will import the necessary Python libraries that will aid us in performing various tasks, such as data manipulation, visualization, and implementing machine learning algorithms.

By leveraging the power of Python and utilizing machine learning techniques, we aim to unravel valuable insights hidden within the dataset. Through the process of classification, we can understand the factors that contribute to the

success or failure of social media advertising campaigns, ultimately assisting businesses in optimizing their marketing strategies.

So, let's dive in and get started by importing the dataset and the essential Python libraries required for this task.

```
import numpy
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import classification_report

data = pd.read_csv("https://raw.githubusercontent.com/amankharwal/Website-data/master/social.csv")
print(data.head())
```

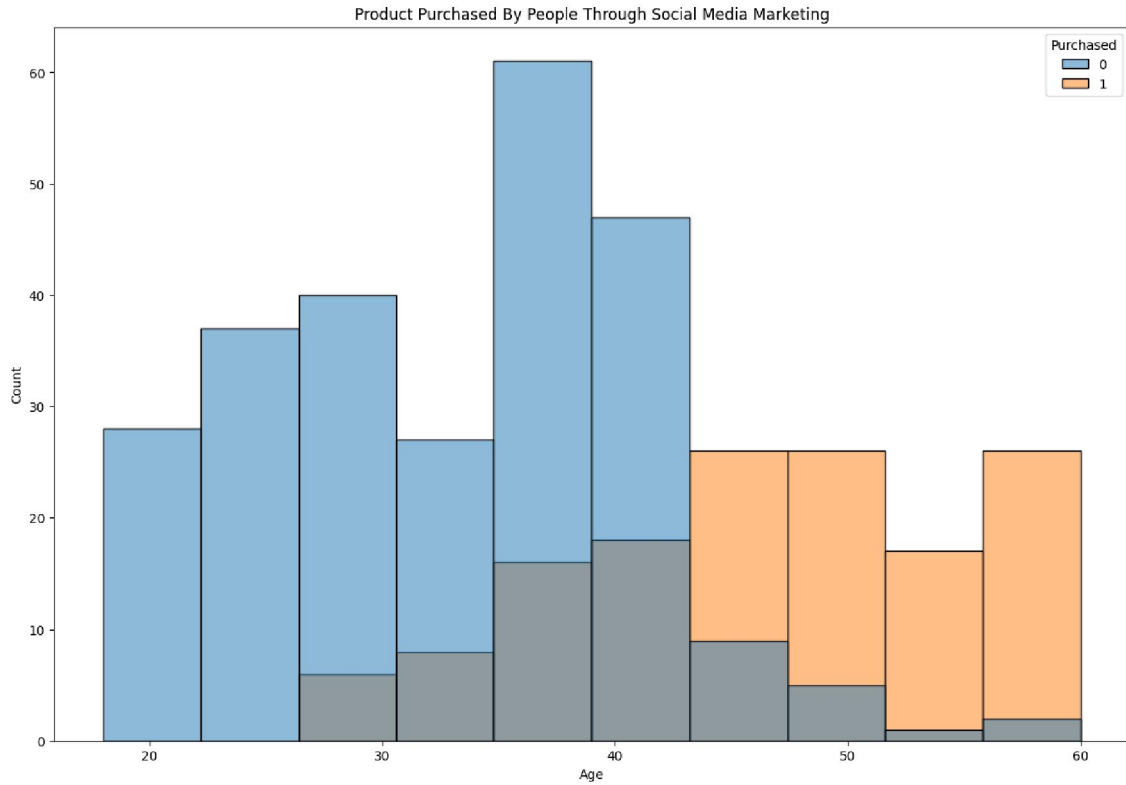
	Age	EstimatedSalary	Purchased
0	19	19000	0
1	35	20000	0
2	26	43000	0
3	27	57000	0
4	19	76000	0

let's delve into the data and examine some valuable insights to determine if any modifications are necessary for the dataset:

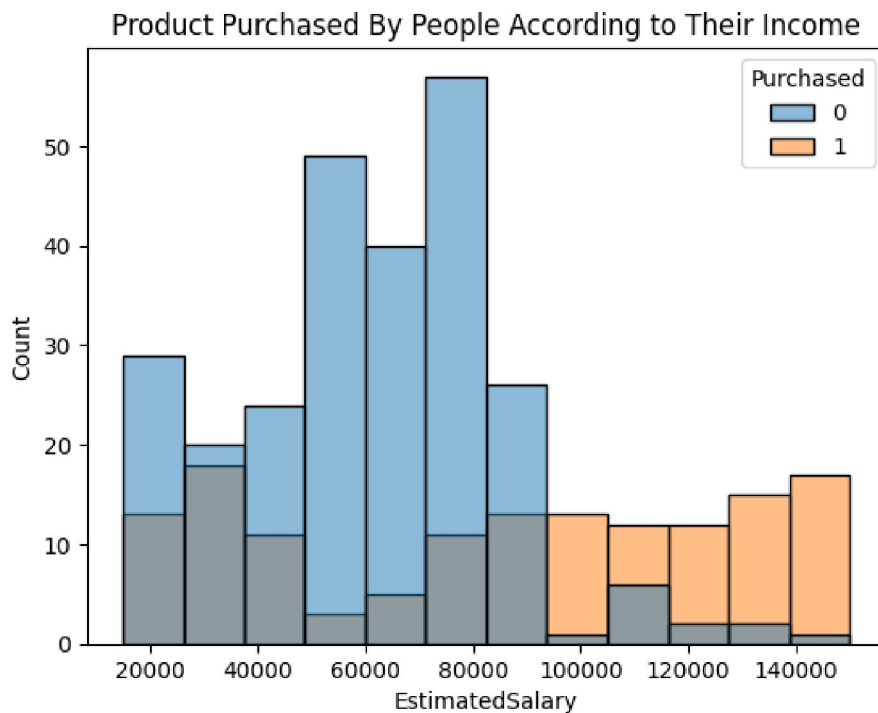
```
print(data.describe())
print(data.isnull().sum())
```

	Age	EstimatedSalary	Purchased
count	400.000000	400.000000	400.000000
mean	37.655000	69742.500000	0.357500
std	10.482877	34096.960282	0.479864
min	18.000000	15000.000000	0.000000
25%	29.750000	43000.000000	0.000000
50%	37.000000	70000.000000	0.000000
75%	46.000000	88000.000000	1.000000
max	60.000000	150000.000000	1.000000
Age	0		
EstimatedSalary	0		
Purchased	0		
dtype:	int64		

Analyzing Crucial Patterns in the Dataset: Unveiling Insights on Age Demographics among Respondents and Buyers of Social Media Ads



Exploring Target Audience Insights: A Visual Analysis Reveals Higher Interest in Purchasing the Product Among Individuals Above 45. Subsequently, Let's Examine the Income Groups of Respondents to Social Media Ads and Their Purchasing Behavior:



The visual representation depicted above reveals a notable inclination towards product purchase among the target audience characterized by a monthly income exceeding 90,000. This significant finding sheds light on the heightened interest displayed by this particular demographic in acquiring the showcased product.

#### IV. TRAINING A MODEL FOR SOCIAL MEDIA ADS CLASSIFICATION

To start the process of training a model for social media ad classification, the first step involves designating the "Purchased" column in the dataset as the target variable. Simultaneously, the remaining two columns will be selected as the requisite features for training the model.

```
x = np.array(data[["Age", "EstimatedSalary"]])
y = np.array(data[["Purchased"]])
```

"Initiating the Model Training Process for Social Media Ad Classification"

In order to initiate the model training process for social media ad classification, the initial step entails the designation of the "Purchased" column within the dataset as the target variable. Simultaneously, the remaining two columns will be selected as the essential features utilized for training the model. Finally, we present the comprehensive classification report of the model:

```
xtrain, xtest, ytrain, ytest = train_test_split(x, y,
                                                test_size=0.10,
                                                random_state=42)

model = DecisionTreeClassifier()
model.fit(xtrain, ytrain)
predictions = model.predict(xtest)

print(classification_report(ytest, predictions))
```

	precision	recall	f1-score	support
0	0.88	0.85	0.87	27
1	0.71	0.77	0.74	13
accuracy			0.82	40
macro avg	0.80	0.81	0.80	40
weighted avg	0.83	0.82	0.83	40

#### V. CONCLUSION

The process of analyzing and classifying social media ads pertaining to a marketing campaign is a powerful approach to effectively identify and target the most promising customer segments for a product. By employing advanced techniques such as machine learning, advertisers can delve deep into the intricacies of their social media ad campaigns, extracting valuable insights and identifying the most profitable customers who are highly inclined to make a purchase. Through the classification of social media ads, advertisers gain the ability to discern patterns and trends that may not be readily apparent through manual analysis. This analytical approach enables advertisers to optimize their marketing strategies, ensuring that resources are allocated efficiently towards engaging the most receptive and potentially loyal customer base.

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