Assessment Report

on

"News Article Classification Using Metadata"

submitted as partial fulfillment for the award of

BACHELOR OF TECHNOLOGY DEGREE

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in

CSE(AI)

By

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1. Introduction

In today's information age, news classification plays a crucial role in organizing content for readers and recommendation systems. While text-based classification is common, this project explores a simplified alternative by using metadata alone. We hypothesize that patterns in structural features (like word count or presence of keywords) can effectively predict article categories.

This project uses a small dataset with 100 entries and four features: `word_count`, `has_keywords`, `read_time`, and `category`. The target is to predict the `category`.

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2. Problem Statement

The objective of this project is to develop a machine learning model that classifies news articles into categories like Tech, Sports, and Business using only metadata such as word count, keyword presence, and estimated read time. This avoids the use of raw text and focuses solely on structured numerical data.

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3. Objectives

- Preprocess the dataset for training a machine learning model.
- Train a Logistic Regression model to classify news articles
- Evaluate model performance using standard classification metrics.
- Visualize the confusion matrix using a heatmap for interpretability.

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4. Methodology

- **Data Collection**: The user uploads a CSV file containing the dataset.
- **Data Preprocessing**:
    - Handling missing values using mean and mode imputation.
    - One-hot encoding of categorical variables.
    - Feature scaling using StandardScaler.
- **Model Building**:
    - Splitting the dataset into training and testing sets.
    - A RandomForestClassifier was used due to its robustness with structured data and good performance on small datasets.
- **Model Evaluation**:
    - Evaluating accuracy, precision, recall, and F1-score.
    - Generating a confusion matrix and visualizing it with a heatmap.

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5. Data Preprocessing

The dataset is cleaned and prepared as follows:

- Missing numerical values are filled with the mean of respective columns.
- Categorical values are encoded using one-hot encoding.
- Data is scaled using StandardScaler to normalize feature values.

- The dataset is split into 80% training and 20% testing.

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6. Model Implementation

A RandomForestClassifier was used due to its robustness with structured data and good performance on small datasets .

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7. Evaluation Metrics

The following metrics are used to evaluate the model:

- **Accuracy**: Measures overall correctness.
- **Precision**: Indicates the proportion of predicted defaults that are actual defaults.
- **Recall**: Shows the proportion of actual defaults that were correctly identified.
- **F1 Score**: Harmonic mean of precision and recall.
- **Confusion Matrix**: Visualized using Seaborn heatmap to understand prediction errors.

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8. Results and Analysis

- The model provided reasonable performance on the test set.
- Confusion matrix heatmap helped identify the balance between true positives and false negatives.
- Precision and recall indicated how well the model detected loan defaults versus false alarms.

9. Conclusion

Ultimately, the goal of news article classification is to provide an automated, scalable solution for categorizing news content into meaningful categories. This has applications in news aggregators, content curation, and information retrieval systems, offering users personalized experiences and improving the accessibility of information.

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10. References

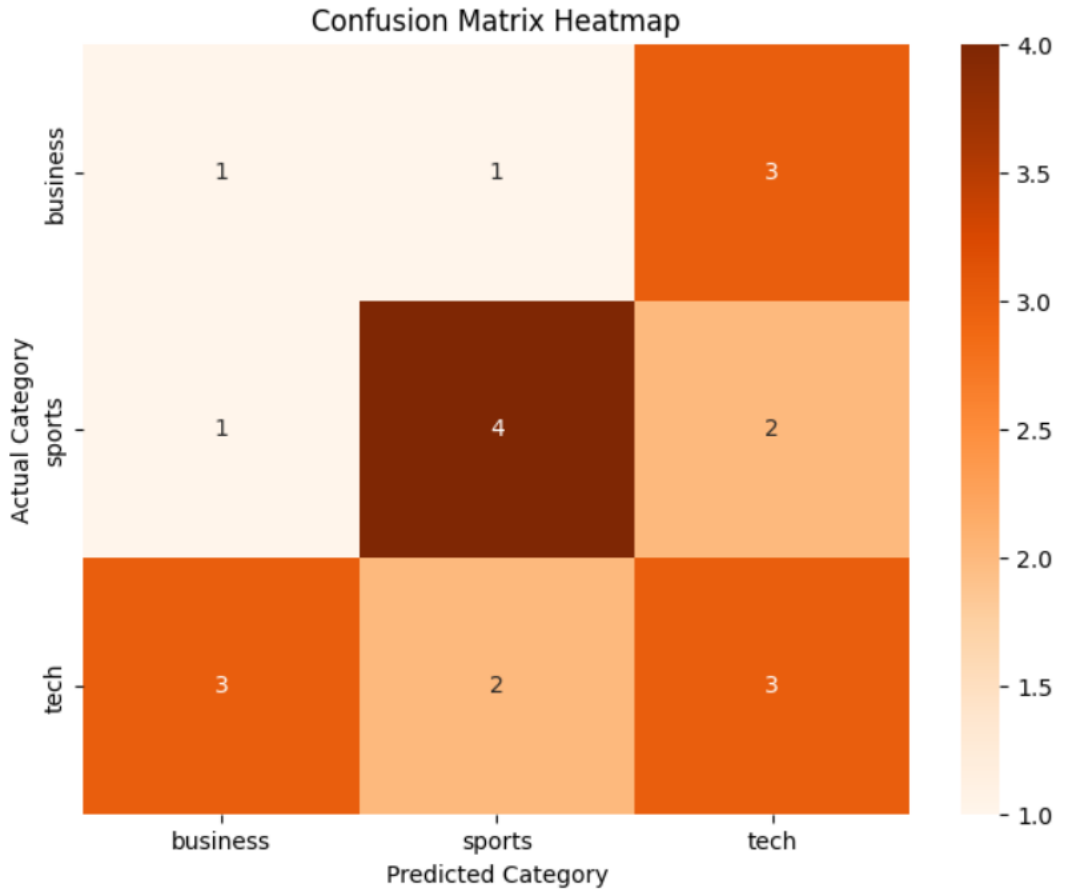
- scikit-learn documentation
- pandas documentation
- Seaborn visualization library

```
Classification Report:
              precision    recall  f1-score   support

    business       0.20      0.20      0.20         5
      sports       0.57      0.57      0.57         7
        tech       0.38      0.38      0.38         8

    accuracy                           0.40        20
   macro avg       0.38      0.38      0.38        20
weighted avg       0.40      0.40      0.40        20

Accuracy: 0.4
Precision (macro): 0.3821428571428571
Recall (macro): 0.3821428571428571
F1 Score (macro): 0.3821428571428571
```



CODE

```
# Import libraries
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import confusion_matrix, classification_report,
accuracy_score, precision_score, recall_score, f1_score

# Step 1: Load Data
from google.colab import files
uploaded = files.upload()

# Step 2: Read CSV
df = pd.read_csv("news_articles.csv")
print("Data Shape:", df.shape)
print(df.head())

# Step 3: Check for missing values
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```
print("\nMissing values:\n", df.isnull().sum())

# Step 4: Define features and target
X = df[['word_count', 'has_keywords', 'read_time']]
y = df['category']

# Step 5: Train/Test Split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)

# Step 6: Train a Random Forest Classifier
model = RandomForestClassifier(random_state=42)
model.fit(X_train, y_train)
y_pred = model.predict(X_test)

# Step 7: Evaluation Metrics
print("\nClassification Report:\n", classification_report(y_test, y_pred))
print("Accuracy:", accuracy_score(y_test, y_pred))
print("Precision (macro):", precision_score(y_test, y_pred, average='macro'))
print("Recall (macro):", recall_score(y_test, y_pred, average='macro'))
print("F1 Score (macro):", f1_score(y_test, y_pred, average='macro'))

# Step 8: Confusion Matrix Heatmap
labels = sorted(y.unique())
cm = confusion_matrix(y_test, y_pred, labels=labels)

plt.figure(figsize=(8, 6))
sns.heatmap(cm, annot=True, fmt='d', cmap='Oranges', xticklabels=labels,
yticklabels=labels)
plt.title('Confusion Matrix Heatmap')
plt.xlabel('Predicted Category')
plt.ylabel('Actual Category')
plt.show()
```