

AI-Powered Task Management System

1. Introduction

In modern software teams, managing tasks effectively is crucial to ensure timely delivery, balanced workloads, and high productivity. Manual task assignment can lead to inefficiencies and bottlenecks. This project proposes an AI-powered task management system that automates task classification and assignment using NLP and machine learning techniques. It demonstrates how data-driven insights can improve real-world task handling.

2. Dataset Creation

A synthetic dataset of 200 realistic software development tasks was generated, with fields including:

- Task_ID
- Description
- Deadline
- Assigned_To
- Priority (High, Medium, Low)
- Completed (Yes/No)

Task descriptions covered a variety of activities such as bug fixes, deployment, UI design, and documentation.

3. Exploratory Data Analysis (EDA)

EDA revealed a slightly imbalanced distribution of priority classes, with 'Medium' being the most frequent. Completion status showed that most tasks were still pending, simulating a real-world backlog. Task assignments were initially random but were later optimized with logic.

Example Insights:

- Medium priority: 99 tasks
- High priority: 54 tasks
- Low priority: 47 tasks
- Most team members had similar workloads after assignment logic was applied.

4. NLP Preprocessing

Task descriptions were cleaned using the following steps:

- Lowercasing text
- Removing punctuation
- Removing stopwords (NLTK)
- Applying TF-IDF vectorization to convert text into numerical features

5. Model Training & Evaluation

Three models were trained to classify task priority based on the text:

- Naive Bayes
- Random Forest
- VotingClassifier (Random Forest + Logistic Regression)

The short length of task descriptions made accurate classification challenging, especially for the 'High' class. However, the ensemble model provided the most balanced performance.

Model Comparison Table:

Model	Accuracy	F1 (High)	F1 (Medium)	F1 (Low)
Naive Bayes	42%	0.00	0.59	0.44
Random Forest	42%	0.10	0.63	0.33
VotingClassifier	42%	0.17	0.59	0.42

6. Feature Engineering (Part 5)

Additional structured features were created:

- Days_Left: Number of days until deadline
- Urgent: Boolean flag for tasks due in <5 days
- Completed_Binary: 0 for incomplete, 1 for completed

These were combined with TF-IDF vectors to improve model inputs and represent real-world urgency.

7. Task Assignment Logic (Part 6)

A rule-based assignment logic was implemented to distribute tasks among four team members (Kiran, Sneha, Rohit, Aanya). Each task was assigned to the member with the least current workload, with High priority tasks considered first. This ensured fairness and realistic distribution.

8. Conclusion & Future Scope

This project successfully implemented an AI-driven task classification and assignment system. Key takeaways include the integration of text-based and structured features, the use of ensemble modeling, and heuristic logic for workload balancing.

Future improvements may include:

- Adding BERT embeddings for deeper text understanding
- Integrating user expertise or skill-matching into assignment logic
- Deploying via Streamlit for real-time task planning

by

Ismail N

@ismailnossam01