AI-Based Resume Analyzer Using NLP and Machine Learning

Amal Antony Alex

Email: *work.amalantonyalex@gmail.com*

Abstract

The rapid growth of online recruitment platforms has led to an exponential increase in job applications, making manual resume screening inefficient and error-prone. This paper presents an AI-based Resume Analyzer that employs Natural Language Processing (NLP) and Machine Learning (ML) techniques to automatically parse resumes, predict suitable job roles, determine experience levels, and evaluate resume alignment with job descriptions. The system utilizes TF-IDF vectorization and cosine similarity for semantic matching and performs skill gap analysis to provide actionable recommendations. Visual analytics are incorporated to enhance explainability and user comprehension. Experimental results demonstrate the effectiveness of the system in delivering accurate, interpretable, and scalable resume analysis for recruitment assistance.

Keywords— Resume Analysis, Natural Language Processing, Machine Learning, TF-IDF, Cosine Similarity, Skill Gap Analysis, Explainable AI

I. INTRODUCTION

Recruitment is a critical process for organizations, yet traditional resume screening methods are time-consuming and susceptible to human bias. With the increasing volume of applicants, recruiters rely on automated systems to streamline candidate evaluation. Artificial Intelligence (AI) and Natural Language Processing (NLP) provide powerful tools to analyze unstructured textual data such as resumes.

This work proposes an AI-driven resume analyzer capable of extracting structured information, predicting job roles, assessing experience levels, and matching resumes with job descriptions. The system aims to assist both recruiters and job seekers by providing objective insights and improvement recommendations.

II. PROBLEM STATEMENT

Manual resume screening faces several challenges:

- High time consumption for large applicant pools
- Inconsistent evaluation criteria

- Lack of personalized feedback for candidates

Existing automated systems often lack transparency and explainability. Therefore, there is a need for an intelligent, explainable, and scalable resume analysis system.

III. OBJECTIVES

The primary objectives of this project are:

1. To automatically extract structured information from resumes
2. To predict suitable job roles using machine learning
3. To classify candidate experience levels
4. To measure resume–job description similarity
5. To identify skill gaps and recommend improvements
6. To provide explainable visual analytics

IV. SYSTEM ARCHITECTURE

The proposed system follows a modular architecture consisting of:

- Resume Parsing Module
- NLP Feature Extraction Layer
- Machine Learning Prediction Models
- Job Description Matching Engine
- Skill Gap Analysis Module
- Visualization and Recommendation Layer

Each module operates independently, ensuring scalability and maintainability.

V. METHODOLOGY

A. Resume Parsing

PDF resumes are converted into raw text using PDFMiner. A custom NLP-based parser extracts candidate name, email address, and technical skills without relying on deprecated third-party libraries.

B. Feature Extraction

TF-IDF (Term Frequency–Inverse Document Frequency) is used to convert textual data into numerical feature vectors, capturing the importance of terms relative to the document corpus.

C. Job Role and Experience Prediction

Supervised machine learning classifiers are trained on labeled resume datasets to predict:

- Job Role (e.g., Data Science, Web Development)
- Experience Level (Fresher, Intermediate, Experienced)

D. Resume–Job Description Matching

Cosine similarity is applied to TF-IDF vectors of the resume and job description to quantify semantic similarity.

E. Skill Gap Analysis

Extracted resume skills are compared with job description requirements to identify matched and missing skills.

VI. VISUAL ANALYTICS

To improve explainability, the system presents:

- Resume–JD match percentage via progress bars
- Skill coverage percentage metrics
- Bar charts for matched vs missing skills
- Pie charts for skill distribution
- Confidence indicators for predictions

These visualizations enable intuitive understanding of AI-driven decisions.

VII. RESULTS AND DISCUSSION

Experimental evaluation demonstrates that the system accurately predicts job roles and experience levels while providing realistic resume–JD match scores. Lower similarity scores effectively highlight skill gaps rather than indicating system failure. The visual analytics layer enhances transparency and user trust.

VIII. ADVANTAGES

- Reduces recruitment screening time
- Provides objective and consistent evaluation
- Offers actionable feedback to candidates
- Scalable and cost-effective
- Explainable AI-based decision-making

IX. LIMITATIONS

- Performance depends on resume text quality
- Skill matching is primarily lexical
- Domain-specific jargon may affect similarity scores

X. FUTURE ENHANCEMENTS

Future improvements may include:

- Semantic embeddings using BERT or Word2Vec
- Resume ranking and ATS integration
- Multi-language resume support
- Real-time recruiter dashboards

XI. CONCLUSION

This paper presents an AI-based Resume Analyzer that integrates NLP, machine learning, and visual analytics to automate resume screening effectively. The system provides accurate predictions, meaningful insights, and transparent decision-making, making it suitable for real-world recruitment applications.

REFERENCES

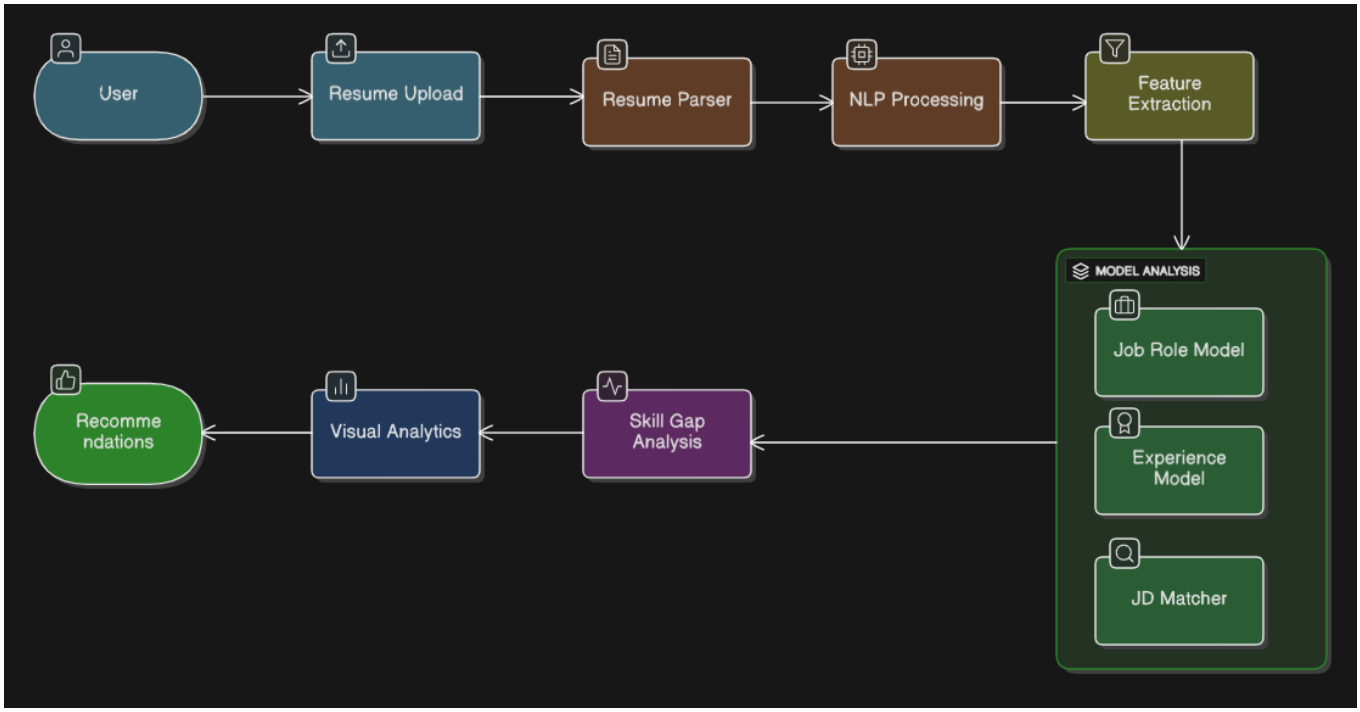
[1] D. Jurafsky and J. H. Martin, *Speech and Language Processing*, Pearson, 2023.
[2] Scikit-learn Documentation, https://scikit-learn.org

[3] Streamlit Documentation, https://streamlit.io

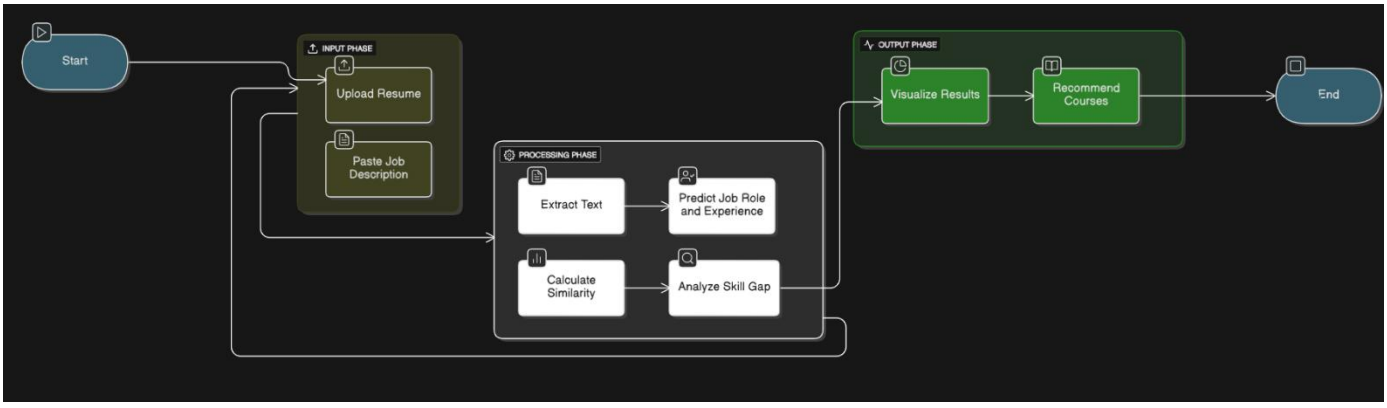
[4] Manning et al., *Introduction to Information Retrieval*, Cambridge University Press.

Appendix

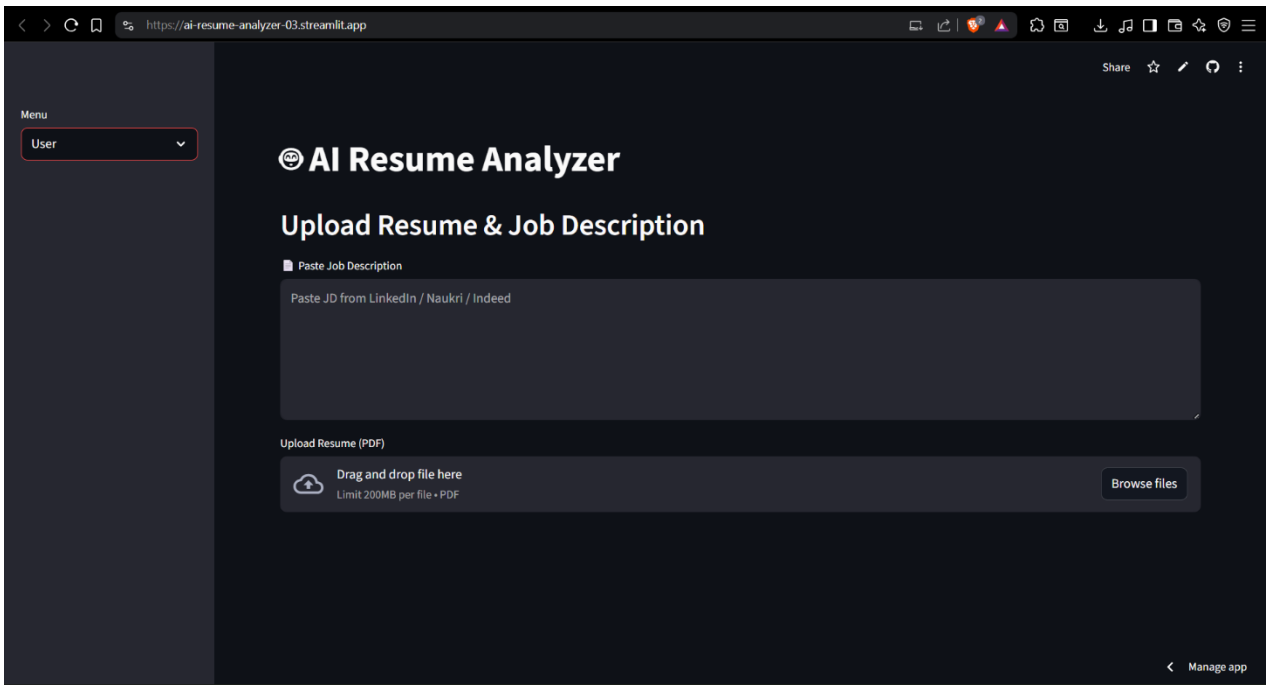
1. System Architecture

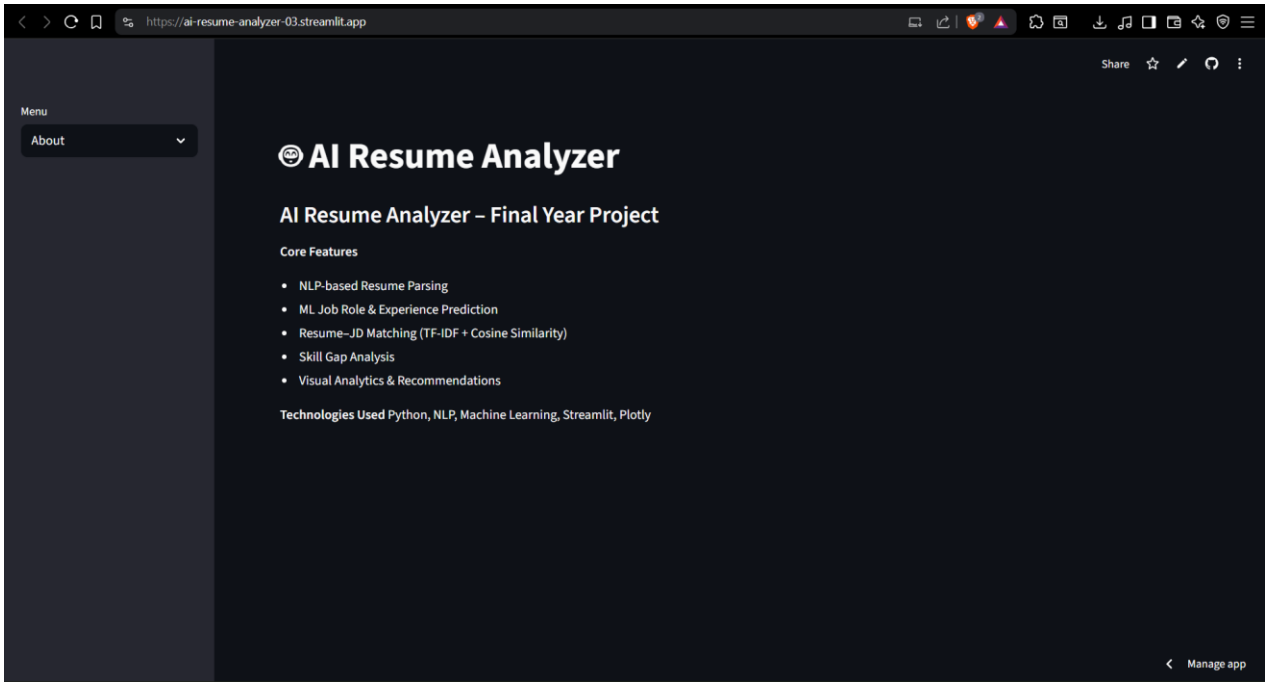


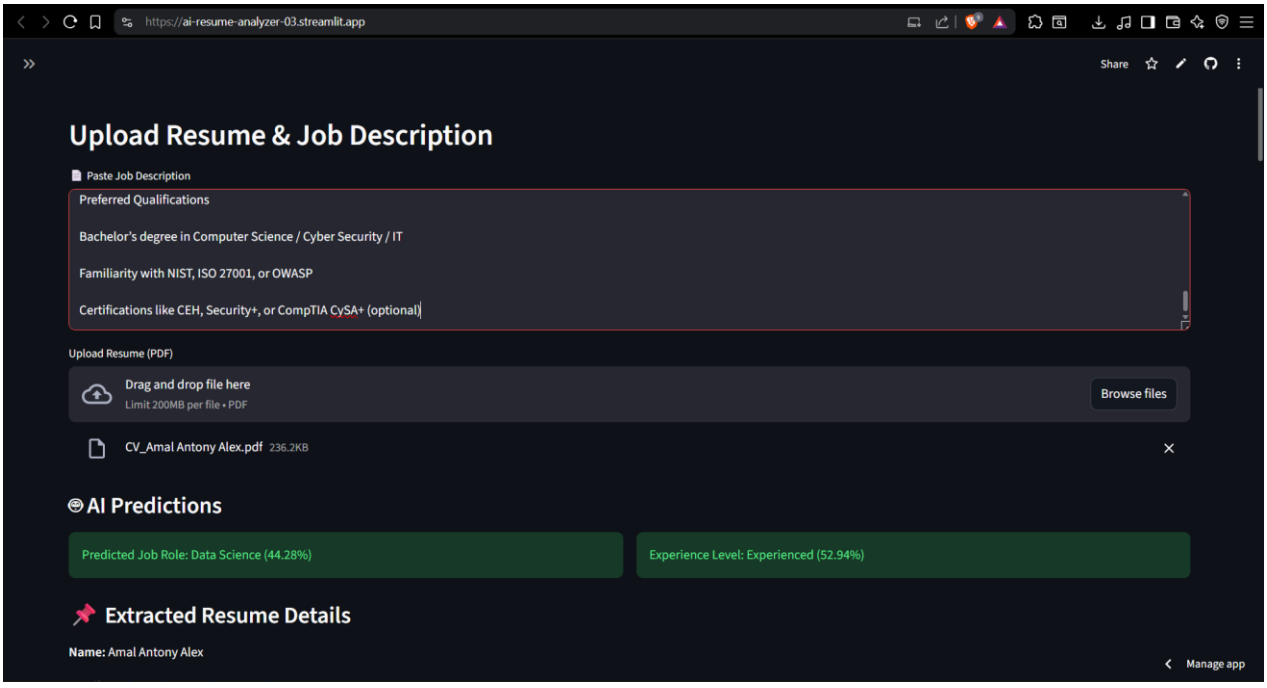
2. Flow Diagram

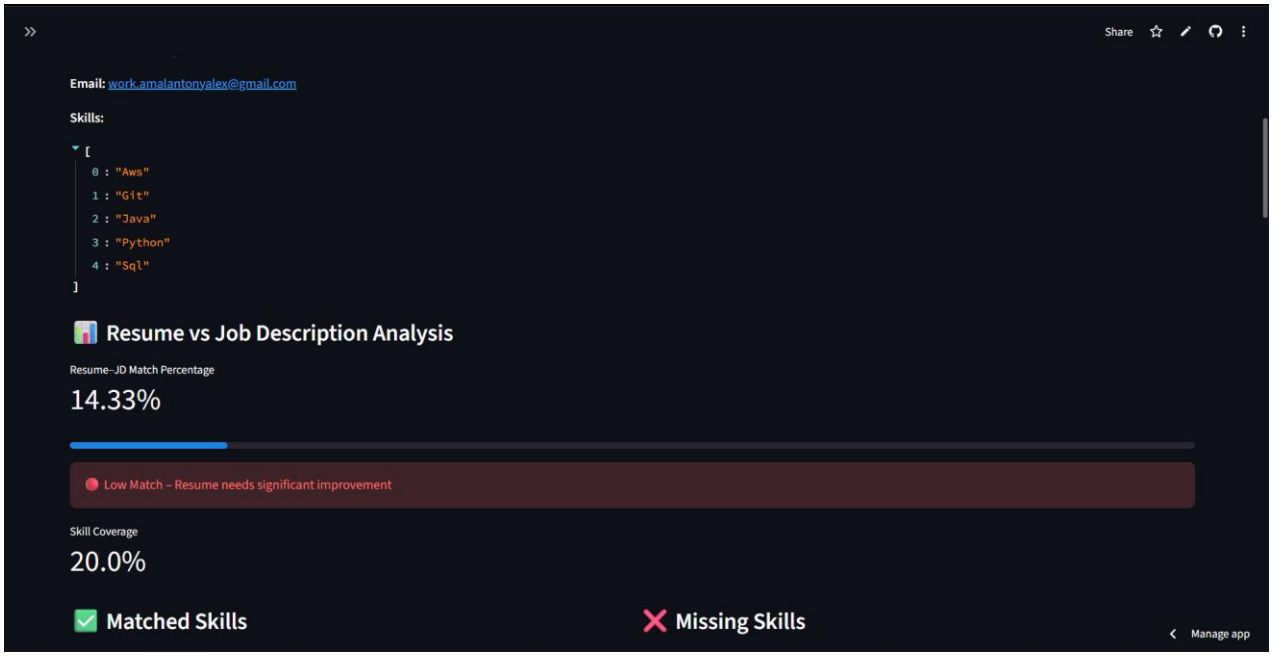


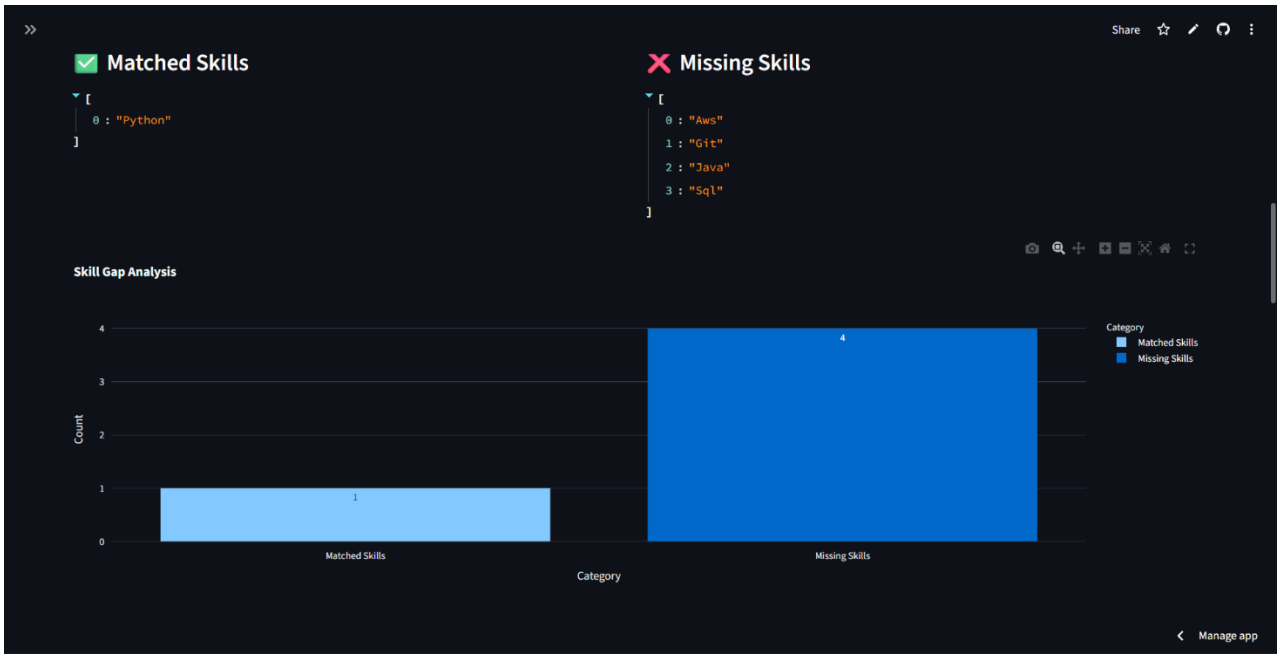
3. Output

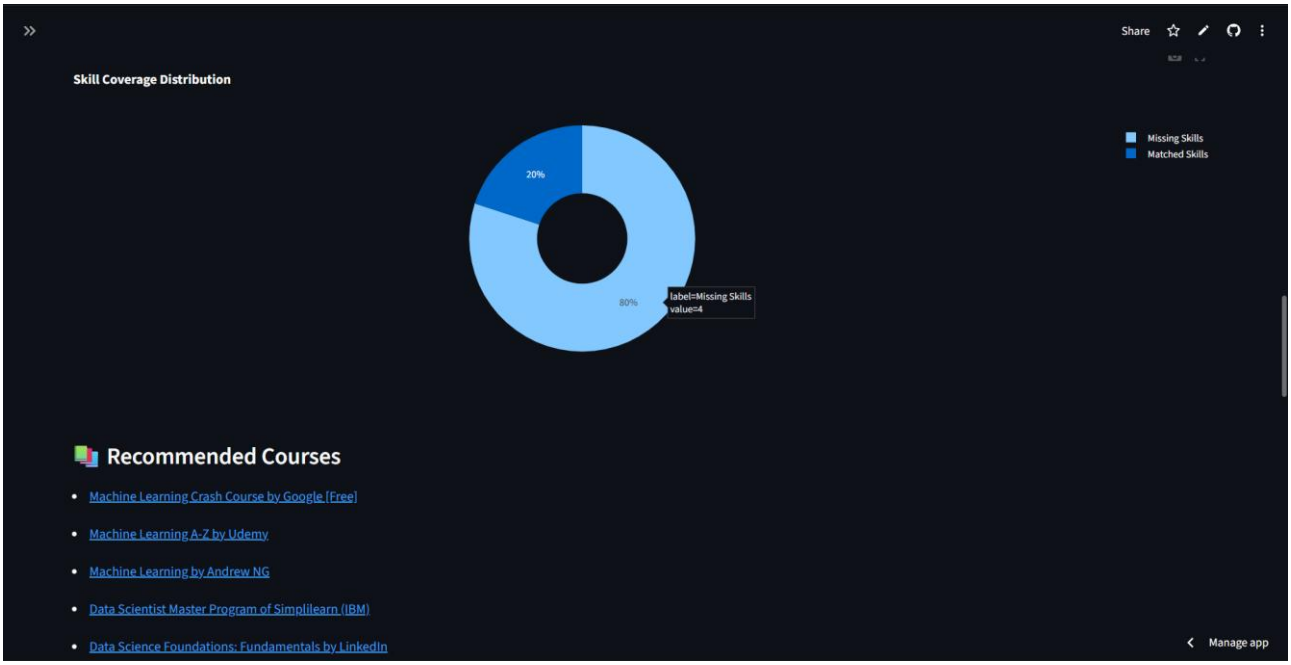

https://ai-resume-analyzer-03.streamlit.app
Share
Menu
User
AI Resume Analyzer
Upload Resume & Job Description
Paste Job Description
Paste JD from LinkedIn / Naukri / Indeed
Upload Resume (PDF)
Drag and drop file here
Limit 200MB per file • PDF
Browse files
Manage app


https://ai-resume-analyzer-03.streamlit.app
Share
Menu
About
AI Resume Analyzer
AI Resume Analyzer – Final Year Project
Core Features
NLP-based Resume Parsing
ML Job Role & Experience Prediction
Resume–JD Matching (TF-IDF + Cosine Similarity)
Skill Gap Analysis
Visual Analytics & Recommendations
Technologies Used Python, NLP, Machine Learning, Streamlit, Plotly
Manage app

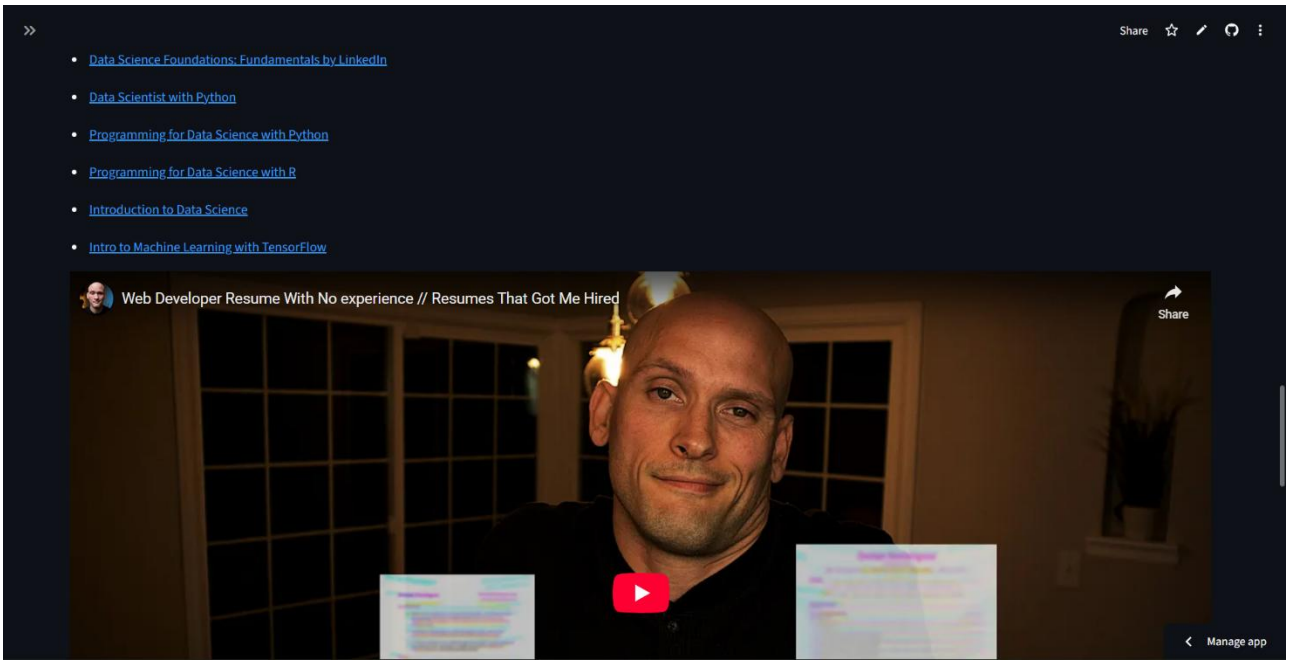

https://ai-resume-analyzer-03.streamlit.app
Share
Upload Resume & Job Description
Paste Job Description
Preferred Qualifications
Bachelor's degree in Computer Science / Cyber Security / IT
Familiarity with NIST, ISO 27001, or OWASP
Certifications like CEH, Security+, or CompTIA CySA+ (optional)
Upload Resume (PDF)
Drag and drop file here
Limit 200MB per file • PDF
Browse files
CV_Amal Antony Alex.pdf 236.2KB
AI Predictions
Predicted Job Role: Data Science (44.28%)
Experience Level: Experienced (52.94%)
Extracted Resume Details
Name: Amal Antony Alex
Manage app


Share
Email: work.amalantonyalex@gmail.com
Skills:
[
0 : "Aws"
1 : "Git"
2 : "Java"
3 : "Python"
4 : "Sql"
]
Resume vs Job Description Analysis
Resume–JD Match Percentage
14.33%
Low Match – Resume needs significant improvement
Skill Coverage
20.0%
Matched Skills
Missing Skills
Manage app


Share
Matched Skills
[
0 : "Python"
]
Missing Skills
[
0 : "Aws"
1 : "Git"
2 : "Java"
3 : "Sql"
]
Skill Gap Analysis
Count
Category
Matched Skills
Missing Skills
Manage app


Share
Skill Coverage Distribution
Missing Skills
Matched Skills
20%
80%
label=Missing Skills
value=4
Recommended Courses
Machine Learning Crash Course by Google [Free]
Machine Learning A-Z by Udemy
Machine Learning by Andrew NG
Data Scientist Master Program of Simplilearn (IBM)
Data Science Foundations: Fundamentals by LinkedIn
Manage app

4.


Share
Data Science Foundations: Fundamentals by LinkedIn
Data Scientist with Python
Programming for Data Science with Python
Programming for Data Science with R
Introduction to Data Science
Intro to Machine Learning with TensorFlow
Web Developer Resume With No experience // Resumes That Got Me Hired
Share
Manage app


Share
[0, 1, 0, 1, 1, 0, 1]
[1, 0, 0, 0, 0, 1, 0]
MEDIUM
Google
Coding
Interview
with
Ben Awad
Watch on YouTube
Manage app

5.