IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, January 2026
Impact Factor: 7.67

Career Prediction Application

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Abstract: *The widening gap between academic curricula and evolving industry requirements often leaves engineering graduates uncertain about their optimal career paths, leading to underemployment and inefficient recruitment processes. This paper presents the Student Career Prediction Application, a web-based platform designed to bridge this gap by automating the assessment of student employability. The system utilizes a multi-criteria weighted scoring algorithm to evaluate candidates across fifteen distinct technical and soft skill parameters— including algorithms, programming languages, and communication skills. Unlike generic aptitude tests, this application maps student inputs against pre-defined industry profiles (such as Data Scientist, Backend Engineer, and Product Manager) to calculate a specific "Match Confidence" percentage and a categorical "Readiness Level" (e.g., Industry Ready vs. Beginner). The architecture features a dual-interface design: a student portal that visualizes skill gaps using radar charts, and a recruiter dashboard that enables data-driven candidate filtering based on predicted roles and competency scores. By converting subjective self-assessments into objective, quantifiable data, the proposed system provides students with actionable upskilling roadmaps while significantly reducing the screening latency for talent acquisition teams.*

Keywords: Career Prediction System, Skill Gap Analysis, Weighted Scoring Model, Automated Recruitment, Employability Assessment, Web-Based Expert System, Role Recommendation

I. INTRODUCTION

The rapid evolution of the technology sector has created a diverse array of specialized career paths, ranging from Data Science to Full Stack Development. Despite having foundational knowledge, engineering graduates often struggle to align their academic skills with specific industry requirements, leading to a significant "skills gap" and underemployment. Simultaneously, recruitment teams face the challenge of manually screening high volumes of candidates to identify those who possess not just generic degrees, but role-specific competencies.

To address these challenges, this paper presents the Student Career Prediction Application, a web-based expert system designed to automate the career profiling process. Unlike traditional aptitude tests that provide generic feedback, this system employs a multi-criteria weighted scoring algorithm to evaluate candidates based on fifteen distinct technical and soft skill parameters—including algorithms, statistics, programming languages (Python/Java), and communication skills.

The primary objective of this application is to translate subjective self-assessments into objective, actionable data. The system takes student inputs on a scale of 0 to 10 and maps them against five pre-defined industry profiles: Data Scientist, Backend Engineer, Frontend Developer, Full Stack Developer, and Product Manager. By applying role-specific weightage—such as prioritizing "Statistics" for Data Scientists or "Design Interest" for Frontend Developers—the system calculates a precise Match Confidence percentage. Furthermore, it categorizes candidates into distinct Readiness Levels (e.g., "Industry Ready," "Job Ready," or "Beginner"), providing an immediate metric of employability.

Beyond individual assessment, the application features a dual-interface architecture tailored for two distinct user groups. For students, it provides visualization tools, including radar charts, to identify skill gaps and generate downloadable performance reports. For recruiters, it offers a centralized dashboard capable of filtering candidates by

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predicted role and score thresholds, thereby streamlining the talent acquisition lifecycle. This paper discusses the design, implementation, and algorithmic logic of the system, demonstrating its potential to enhance graduate employability and recruitment efficiency.

II. EASE OF USE

The Student Career Prediction Application is designed with a user-centric approach, prioritizing intuitive navigation and minimal cognitive load. The system features a responsive "Three-Tier" interface (Login, Student Dashboard, Recruiter Dashboard) built using Tailwind CSS, ensuring accessibility across devices ranging from desktops to mobile phones.

A. Intuitive Student Assessment Interface

Slider-Based Input Mechanism: Unlike traditional forms that require tedious manual data entry, the application utilizes interactive range sliders (0–10 scale) for skill assessment. This design choice reduces user effort and standardizes input data for the backend algorithm.

Logical Categorization: To prevent user fatigue, the fifteen input parameters are organized into clear, logical clusters: Core CS, Programming, Web & Data, and Soft Skills. This structured layout guides the user through the assessment process systematically.

Visual Feedback & Interpretation: Upon analysis, the system does not merely present raw numbers. Instead, it generates a dynamic Radar Chart (Spider Web Chart) that allows students to visualize the "shape" of their skills instantly. Furthermore, complex algorithmic results are simplified into color-coded readiness badges (e.g., Green for "Industry Ready," Yellow for "Job Ready"), enabling users to understand their standing at a glance.

One-Click Reporting: The inclusion of a "Download Report" feature allows users to generate and save a comprehensive PDF of their career profile with a single interaction, facilitating easy sharing with mentors or potential employers.

B. Streamlined Recruiter Dashboard

The proposed application revolutionizes the recruitment process by implementing a Centralized Candidate Database, which provides recruiters with a cohesive, table-based interface of all registered applicants. By aggregating data into a single unified view, the system eliminates the administrative burden of manually navigating through fragmented individual profiles. To enhance decision-making efficiency, the dashboard features Real-Time Filtering capabilities. An integrated search engine allows recruiters to dynamically query the dataset based on specific criteria, such as the ‘Predicted Role’ (e.g., Data Scientist, Developer) or a minimum ‘Match Confidence Score.’ This functionality drastically reduces the latency between candidate discovery and shortlisting. Furthermore, the system incorporates Visual Status Indicators, displaying a ‘Readiness Level’ tag for each candidate. This allows recruiters to rapidly distinguish between industry-ready professionals and entry-level beginners at a glance, facilitating a data-driven and agile recruitment workflow.

C. System Responsiveness

The system is engineered for optimal performance, prioritizing System Responsiveness to ensure a seamless user interaction. At the core of this performance is a Low-Latency Processing architecture. The backend, built on the lightweight Flask framework, executes the complex weighted scoring algorithm with near-instantaneous speed. This efficiency eliminates the need for full page reloads, providing users with immediate feedback and maintaining flow during the assessment process. Visually, the application utilizes a modern Adaptive Layout rooted in 'Glassmorphism' design principles. By employing fluid grid systems, the interface dynamically reorganizes content based on the user's device. This ensures that whether accessed on a desktop, tablet, or mobile device, the visual hierarchy remains intact, significantly enhancing readability and interaction comfort.

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III. LITERATURE SURVEY

A. The Evolution of Automated Career Guidance

The domain of automated career guidance and student employability prediction has evolved significantly in recent years, driven by the digital transformation of the educational sector. Historically, career counseling was a manual, resource- intensive process reliant on human intuition and face-to-face interaction. However, as student enrollments have surged and the diversity of technology roles has expanded, traditional methods have proven difficult to scale. This has necessitated a shift toward data-driven automated systems capable of processing vast amounts of academic data to provide personalized guidance. The transition from manual counseling to digital expert systems represents a fundamental paradigm shift, aiming to democratize access to high-quality career advice regardless of institutional resources.

B. Dominance of Machine Learning in Educational Data Mining

A substantial portion of existing research has focused on utilizing supervised Machine Learning (ML) algorithms to predict career paths based on historical academic data. Researchers such as Yadav et al. and Al-Shehri et al. have demonstrated that algorithms like Random Forest and Decision Trees are highly effective for classification tasks in educational settings. These studies typically utilize vast repositories of past student data—analyzing metrics such as semester grades, attendance records, and assignment scores— to identify patterns that correlate with success in specific streams. Similarly, Mishra et al. proposed models using Support Vector Machines (SVM) to classify students into specific job roles with high accuracy, proving that statistical analysis of past performance is a strong predictor of future placement.

C. The "Black Box" Limitation of ML Models

Despite their predictive power, these ML-based approaches often suffer from the "black box" problem, a critical limitation in the context of educational feedback. In complex models like Neural Networks or ensemble methods, the internal logic used to arrive at a recommendation is often opaque to the user. For a student seeking career advice, simply being told they are suited for a role is insufficient; they require an explanation of why specific skills led to that conclusion. Furthermore, these models utilize "correlation" rather than "causation," which can sometimes lead to biased recommendations based on historical anomalies rather than actual student aptitude.

D. Data Dependency and Deployment Challenges

A further challenge with deep learning and complex ML models is their heavy reliance on massive, structured historical datasets. For these models to function effectively, they require thousands of labeled data points from previous academic years. This creates a significant barrier to entry for new institutions or standalone applications where such extensive training data is unavailable. This dependency renders many state-of-the-art research models difficult to deploy in real-world scenarios, particularly for individual students or smaller colleges that lack a centralized data warehouse

E. The Role of Expert Systems and Heuristics

Parallel to machine learning approaches, earlier research explored the use of Expert Systems (ES) and heuristic methods that mimic human decision-making through predefined rules. Unlike the statistical probability used in ML, these systems rely on deterministic logic. Arumugam et al. developed automated guidance systems using Case-Based Reasoning (CBR), which matches students to careers based on their similarity to successful alumni profiles using Euclidean distance. Other researchers, such as Peker et al., have utilized fuzzy logic to handle the inherent uncertainty and subjectivity in student self-assessments. These rule-based systems offer a distinct advantage: they are interpretable and transparent, qualities that are crucial when providing actionable feedback to students regarding their professional development.

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F. Addressing the Skill Gap and Soft Skills

Beyond the technical methodology of prediction, a significant body of literature addresses the "Skill Gap" that leads to unemployment. A systematic review by Osmani et al. identified that soft skills, such as communication, problem-solving, and adaptability, are often weighted equally with technical skills by industry recruiters. However, most academic prediction models fail to integrate these parameters into their analysis, focusing solely on hard technical grades. This oversight results in a disconnect between academic success and employability, as a student with high grades but poor interpersonal skills may still struggle to secure a role.

G. Recruitment Latency and Industry Readiness

Industry reports on the IT sector highlight that recruitment latency is largely driven by the difficulty in filtering candidates based on actual "Industry Readiness" rather than just academic degrees. Recruiters are often inundated with applications from candidates who possess the required degree but lack the specific competencies needed for the role. This suggests that effective prediction models must move beyond simple grade analysis to encompass a holistic view of technical and interpersonal competencies. Systems that can visualize a candidate's readiness level—distinguishing between an entry-level beginner and an industry-ready professional—are essential for reducing the administrative burden on hiring teams.

IV. METHODOLOGY

The proposed Student Career Prediction Application is architected as a web-based expert system employing a robust Three-Tier Architecture, which strictly separates the presentation, application processing, and data management layers. The presentation layer serves as the client-side interface, developed using HTML5 and Tailwind CSS to ensure responsiveness across devices. Through this interface, the data acquisition module captures student competencies via a structured input vector comprising fifteen distinct parameters. These parameters are logically grouped into four domains: Core Computer Science (including Algorithms, Data Structures, and DBMS), Programming Proficiency (focusing on Python and Java), Web & Data Technologies (covering Frontend, Backend, Machine Learning, and Statistics), and Soft Skills (such as Communication, Problem Solving, and Creativity). To standardize the input for algorithmic processing, users quantify their proficiency in each parameter on a continuous scale of 0 to 10.

The core intelligence of the system resides in the Application Layer, which is powered by a Flask (Python) server acting as a REST API. Unlike opaque machine learning models that often suffer from the "black box" problem and require extensive historical datasets for training, this system implements a Deterministic Weighted Scoring Model (WSM). This heuristic approach mimics the decision- making process of an expert career counselor by defining a set of target roles—specifically Data Scientist, Backend Engineer, Frontend Developer, Full Stack Developer, and Product Manager—and assigning specific importance weights to relevant skills. For instance, the system assigns a weight of 0.25 to Python and 0.20 to Statistics for the "Data Scientist" role, whereas the "Frontend Developer" role prioritizes Frontend skills with a weight of 0.35 and Creativity at 0.20. The prediction engine calculates a Match Confidence Score by computing the dot product of the student's input vector and the pre-defined weight vector for each role, subsequently identifying the career path that yields the highest cumulative score.

Following the prediction phase, the system applies a threshold-based classification logic to determine the qualitative "Industry Readiness" of the candidate. This classification provides immediate, actionable context to the numerical score; specifically, scores greater than or equal to 85 are classified as "Industry Ready," scores between 70 and 84 are labeled "Job Ready," while lower ranges are marked as "Intermediate" or "Beginner". This logic enables the system to filter candidates not just by their technical interest, but by their maturity level in that specific domain. All processed data, including the student's profile, component scores, predicted role, and timestamps, is persisted in a MySQL relational database to facilitate historical tracking and retrieval by the recruiter module. Finally, to enhance user understanding, the results are rendered back to the client using Chart.js, which constructs a dynamic radar chart plotting the student's skill distribution across the five key axes of Code, Data, Web, Soft Skills, and Theory.

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V. CONCLUSION

The development of the Student Career Prediction Application represents a significant step forward in automating the interface between academic preparation and professional recruitment. By implementing a deterministic Weighted Scoring Model within a responsive Three-Tier web architecture, the system successfully translates subjective student self-assessments into objective, quantifiable metrics of employability. Unlike traditional prediction methods that often rely on opaque machine learning algorithms requiring vast historical datasets, this heuristic approach offers immediate, transparent, and interpretable feedback through "Match Confidence" scores and visual radar charts.

The system's dual-interface design effectively addresses the needs of two distinct stakeholders. For students, it provides actionable clarity by categorizing them into distinct "Readiness Levels" (e.g., Industry Ready, Beginner), thereby identifying specific technical areas requiring improvement. For recruiters, the centralized dashboard significantly streamlines the talent acquisition process by enabling data- driven filtering of candidates based on specific role predictions and competency thresholds, rather than generic academic grades. Ultimately, this research demonstrates that a lightweight, rule-based expert system can effectively bridge the widely reported "skills gap" in the technology sector.

Future enhancements to the system could involve the integration of Natural Language Processing (NLP) to parse resumes directly and the transition to a hybrid algorithm that dynamically adjusts skill weights based on real-time feedback from successful hires.

ACKNOWLEDGMENT

We would like to express our deepest sense of gratitude to our project guide and mentor, Prof. Gayatri Fate, Department of Computer Engineering at Pimpri Chinchwad Polytechnic, for her valuable guidance, technical support, and constant encouragement throughout the development of this project. Her insightful suggestions regarding the Weighted Scoring Algorithm and system architecture were instrumental in the successful completion of this work.

We extend a special note of thanks to the team at Digital Forge for their pivotal role in shaping our initial ideas and providing the technical perspective required to bring this project to real life. Their mentorship was crucial in bridging the gap between concept and execution.

We are also thankful to the Head of the Computer Engineering Department and the Principal of Pimpri Chinchwad Polytechnic for providing the necessary laboratory facilities and a conducive environment for learning and development.

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