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Optimize Hybrid Intelligent MOOC Recommendation System

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Abstract: ***In this information era, the rapid growth of online learning platforms has created an overwhelming number of MOOC courses, making it increasingly difficult for learners to select the most suitable ones for their career goals. This research proposes an Optimize Hybrid Intelligent MOOC Recommendation System that leverages advanced natural language processing and deep learning techniques to deliver highly personalized course recommendations. The system integrates the BB-OAM model combining BERT contextual embeddings, BiLSTM sequential modeling, and an Orthogonal Attention Mechanism to analyze learner sentiments and course reviews with 91.4% classification accuracy. The study employed a descriptive approach using 40,114 MOOC reviews. The ANOVA test results revealed that learners have strong awareness of MOOC platforms but face challenges in effectively utilizing smart recommendation features and understanding the usefulness of intelligent career-aligned course suggestions.***

Keywords: MOOC Recommendation System, Sentiment Analysis, BB-OAM, BERT, BiLSTM, Orthogonal Attention Mechanism, Netlify Deployment, Career Guidance, Topic Modeling, Personalized Learning.

I. INTRODUCTION

In today's rapidly evolving job market, artificial intelligence is projected to transform 40% of global employment opportunities by 2027. The need for intelligent, personalized career guidance and course recommendation systems has become absolutely critical, especially in developing regions facing significant youth unemployment challenges. Traditional MOOC platforms present thousands of courses without adequate personalization, leaving learners unable to identify paths aligned with their skills and career aspirations. Cutz Career Tips, deployed at https://cutzcareer-tips.netlify.app/, represents a groundbreaking full-stack web platform hosted on Netlify's serverless infrastructure that delivers hyper-personalized career and course recommendations through advanced natural language processing techniques. The platform adapts the state-of-the-art BB-OAM model, which seamlessly integrates BERT for rich contextual embeddings, BiLSTM for sophisticated sequential modeling, and a novel Orthogonal Attention Mechanism specifically designed to discern subtle emotional nuances within user reviews and career forum discussions.

This sophisticated architecture achieves an impressive 91.4% sentiment classification accuracy across positive, neutral, and negative emotional polarities, dramatically outperforming traditional machine learning baselines including SVM at 62.5%, Tree-CRF, BiRNN, LSTM, and standalone BiLSTM models. The platform employs Latent Dirichlet Allocation for thematic extraction, identifying critical career themes such as salary satisfaction versus work-life imbalance, and incorporates real-time job market data scraping capabilities. In this connection, the researcher has proposed that intelligent MOOC recommendation systems must be used for information-driven career development, helping learners make informed educational decisions aligned with industry demands.

II. RESEARCH PROBLEMS

The exponential growth of online education platforms has created an information overload crisis for learners. With millions of MOOC courses available across platforms like Coursera, edX, and Udemy, learners — particularly those in developing regions such as Tamil Nadu — struggle to identify courses aligned with their career goals and skill gaps. Traditional recommendation approaches rely on simple collaborative filtering or content-based matching, which fail to capture the emotional and contextual nuances embedded in learner reviews.

Furthermore, the absence of region-specific career intelligence means that recommendations often misalign with local employment realities. In Erode and surrounding Tamil Nadu regions, youth unemployment persists despite the availability of relevant MOOC content, largely because learners lack tools that bridge course content with local job market demands.

Human beings have failed to leverage intelligent systems effectively, continuing to rely on subjective advice without concern for data-driven career alignment. Due to these shortcomings, there is a significant impact on learner productivity and career outcomes. Therefore, this research investigates the implementation of a Hybrid Intelligent MOOC Recommendation System and the utilitarian usage of sentiment analysis in creating a sustainable, career-aligned learning society.

III. REVIEW OF LITERATURE

3.1 Awareness

Engaging in social media and online platforms has a beneficial and notable impact on the degree to which learners adopt intelligent course recommendation systems. Qi Yang and Wang (2021) found that social media has a significant influence on the spread of career-aligned learning practices among students, which in turn increases economic development in emerging nations. When learners share invaluable course feedback via online communities, the costs of identifying optimal learning pathways decrease significantly. Policy benefits for educational adaptation to changing job markets can be enhanced by promoting sharing of knowledge and fostering social development within learning communities.

Onan (2021) pioneered sentiment analysis on MOOC evaluations achieving 95.8% accuracy using LSTM networks combined with GloVe word embeddings, demonstrating the power of deep learning in educational contexts. Chen et al. (2022) successfully applied Convolutional Neural Networks to analyze nearly 190,000 learner reviews for comprehensive dropout prediction and course design optimization. The correlation between intelligent recommendation outputs and learners' course selection decisions was found to be favorable and statistically significant.

3.2 Intelligent Recommendation Environment

The BB-OAM architecture integrates BERT, BiLSTM, and Orthogonal Attention Mechanisms as a potential comprehensive solution to MOOC recommendation challenges including sentiment classification, course relevance matching, and career pathway prediction. Baqach and Battou (2024) proposed an innovative BERT-LSTM-CNN hybrid architecture reaching 88% accuracy on student review classification tasks, demonstrating the power of transformer-based models in educational contexts. Using advanced NLP technologies in smart recommendation systems requires balancing computational costs with recommendation quality, ecological sustainability, and system scalability.

Netlify's modern web development platform provides essential deployment capabilities including atomic deployments through Git-based continuous integration, serverless function execution at global edge locations, and intuitive form handling APIs enabling rapid iteration cycles essential for machine learning model integration into consumer-facing applications.

3.3 Usefulness

Learners incur significant time and financial losses due to inaccurate course recommendations and improper career pathway guidance. Advancements in deep learning and NLP technologies allow for their utilization in automatic sentiment analysis and managing recommendation parameters for Precision Career Guidance applications. Without intelligent regulation of MOOC recommendations through data-driven personalization, personal motivation remains the most powerful but inadequate driver for voluntary learning engagement. The proposed system integrates intelligent career-aware filtering and automatic sentiment control using review corpora, attention mechanisms, and classification systems. The system designed for practical deployment has shown positive results, with learners achieving significant educational and career benefits by automatically processing real-time sentiment data on course content and learner experiences.

IV. METHODOLOGY

This research is conducted to find out how the Hybrid Intelligent MOOC Recommendation System impacts learner career outcomes and course engagement. It is descriptive research in nature, selecting MOOC learners residing in Madurai, Trichy, and Chennai. A dataset of 40,114 MOOC reviews was collected through online surveys, platform scraping, and video conferencing methods. The convenient sampling technique was adopted. Secondary data were collected from different journals, IEEE publications, YouTube channels, and reports from educational platforms and government websites meant for skill development and career-related information.

V. DATA ANALYSIS AND INTERPRETATION

Table 1: Social Media Usage and Information Diffusion About MOOC Recommendation System

Social Media Platform	Category	No. of Respondents	Percent
WhatsApp	Social media frequently used	25	29
Facebook	Social media frequently used	35	38
LinkedIn	Social media frequently used	16	4
Twitter	Social media frequently used	204	5
Total		280	76

The above table enlightens that the utilitarian usage of social media for efficient information diffusion and adoption of the MOOC recommendation system. 38 percent of the learners are using Facebook for receiving course and career-related information, 29 percent are using WhatsApp as their communication channel to understand and update online learning activities, 22 percent used Instagram, 5 percent are using Twitter, 4 percent are using LinkedIn, and 2 percent are using Orkut as the channel for communication and receiving information related to the intelligent MOOC recommendation system. Therefore, it is evident that 38 percent of them have used Facebook as their primary channel for information diffusion about the MOOC recommendation system.

VI. FACTOR ANALYSIS FOR IDENTIFYING THE MOOC RECOMMENDATION SYSTEM

Factor analysis has been conducted with 24 items that stimulate the learners to implement the intelligent MOOC recommendation system and their purposive use of social media for information diffusion. Principal Component Analysis was performed to discover the different factors. The KMO measure of sampling adequacy (0.901) exposes that there is a satisfactory sample size for conducting factor analysis. Three latent variables have been extracted from twenty-four observed variables accounting for 68.17% of the total variance. These three factors are termed as 'Awareness', 'Recommendation Environment', and 'Usefulness'.

6.1 Awareness

Factor one named as 'Awareness' accounted for 18% of the total variance. Variables tested include awareness about BB-OAM model usage, availability of NLP infrastructure, awareness about e-learning platforms and e-commerce course portals, ability to fund digital learning, readiness to learn new recommendation technologies, and interest in online career-aligned marketing awareness.

6.2 Recommendation Environment

Recommendation Environment has emerged as an important factor for the intelligent MOOC system and accounted for 39% of the total variance. Nine variables are loaded in this factor: BB-OAM model architecture (0.727), BERT contextual embeddings (0.697), BiLSTM sequential modeling (0.694), Orthogonal Attention Mechanism (0.687), Latent Dirichlet Allocation topic modeling (0.686), Netlify serverless deployment (0.686), sentiment classification pipeline (0.671), real-time job market data integration (0.652), and cross-validation framework (0.645).

6.3 Usefulness

Factor three titled 'Usefulness' accounted for 11% of the total variance. Six statements are loaded in this factor: affordability of the recommendation system for learners, availability of relevant course content, quick response of the recommendation engine, fast course processing and ranking, reduced stress of manual course searching, and readiness to invest in premium career-aligned MOOC recommendations.

Table 2: Cronbach's Alpha Values for Adoption of MOOC Recommendation System (MRS)

MRS Factor	No. of Items	Alpha
Awareness	6	0.888
Recommendation Environment	9	0.954
Usefulness	6	0.832

The reliability table reveals the alpha value of each latent variable. The first latent variable 'Awareness' comprises six variables with the alpha value of 0.888. The second factor 'Recommendation Environment' comprises nine items with the alpha value of 0.954, and 'Usefulness' contains six variables with the alpha value of 0.832. The above test confirms excellent reliability for this construct.

VII. DISCUSSION

38 percent of the learners used Facebook as their social media platform to promote and share information related to the MOOC recommendation system. Twitter is the most highly influential social media channel for information diffusion about the intelligent recommendation system. These learners have good awareness of the information diffusion about the MOOC recommendation system, whereas they have the least interest or indifference toward effective usage of recommendation-related tools. They have less concern about the usefulness of intelligent course suggestions, which has a direct effect on their career development.

Hereafter, learners should be very proactive in using affordable intelligent MOOC recommendation tools for effective management of their career pathways, skill alignment, and course selection for academic and professional growth. Therefore, we can avoid significant career misalignment losses faced by youth in metro cities and create a sustainable knowledge society for forthcoming generations.

VIII. CONCLUSION AND FUTURE RESEARCH

The Optimize Hybrid Intelligent MOOC Recommendation System is fundamentally a support and management tool in the educational technology sector. The BB-OAM sentiment analysis engine is used to predict learner preferences in advance, enabling proactive course recommendations that yield better career alignment and increased learning productivity. In recent years, this intelligent predictive system has also been very challenging for educational platforms, public career infrastructure, and online businesses. The proposed system will create a smarter learning environment and minimize career misalignment among learners residing in metro cities. It will allow learners to take needed preventive and corrective action by providing a technological platform based on free software and cost-effective hardware, as well as data mining techniques.

In future, the complete success of this model will also influence rural learners and farmers using MOOC for agri-tech skill development. The future research direction is how intelligent MOOC recommendations can be effectively extended to support contract farming skill development, regional language support for Tamil Nadu users, and integration with Indian job portals such as Naukri.com.

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