



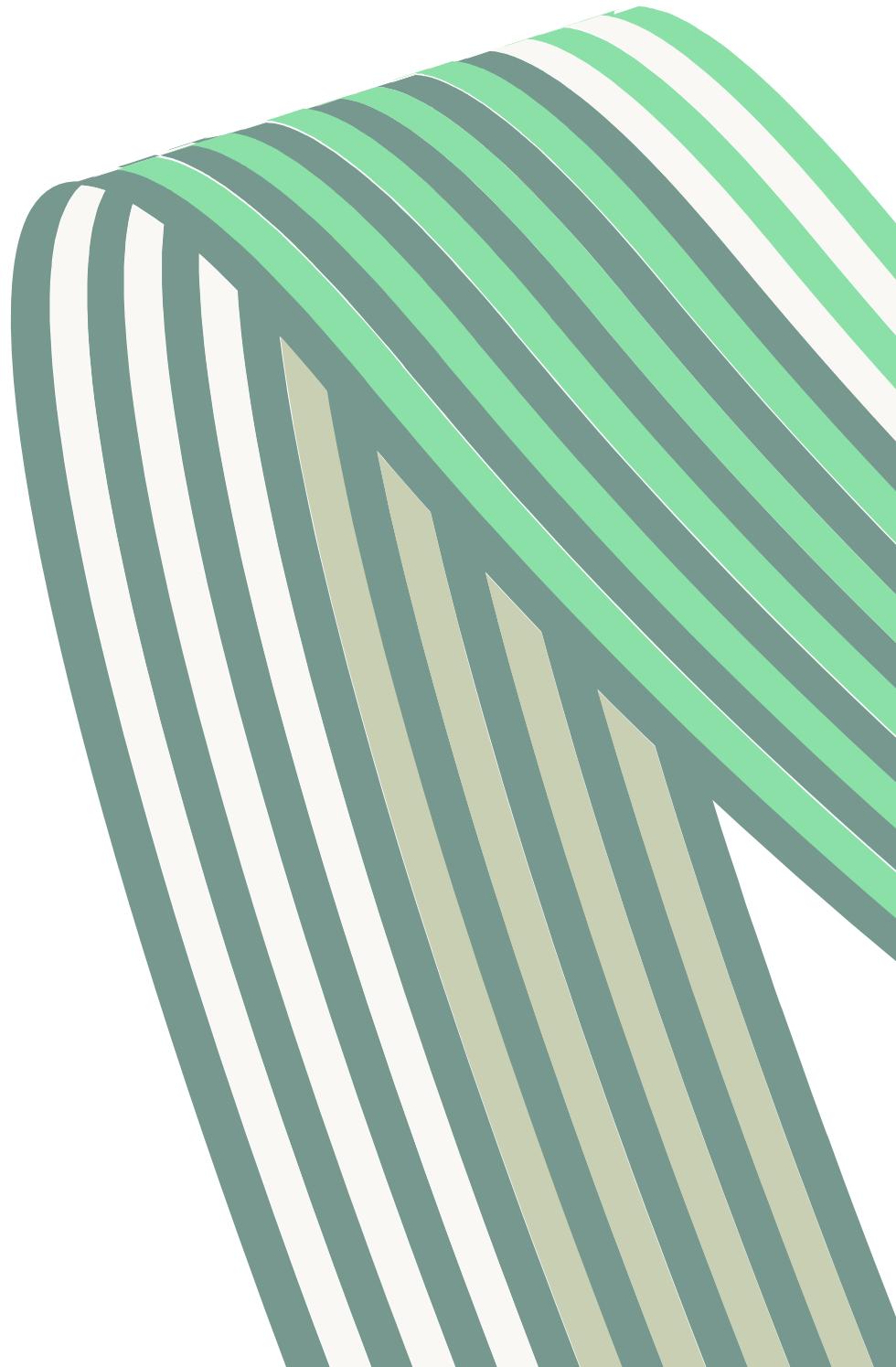
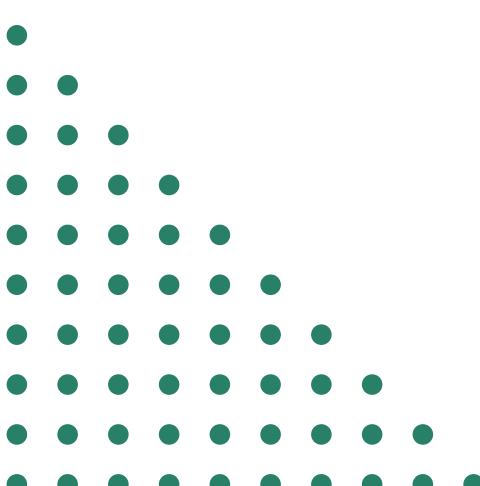
Smart Recruitment Recommendation System KAFAA



presented by

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CONTENT

01

Models Overview

02

Model Building

03

Evaluation

04

Chosen Model

05

System Demonstration

06

Conclusion

07

Future Work

KAFAA is a recruitment system for the Saudi Arabian labor market that streamlines job matching by connecting candidates with roles based on qualifications, experience, and preferences, enhancing recruitment efficiency and enabling data-driven talent acquisition decisions.



Our goal is to improve the hiring process by reducing mismatches between job requirements and applicant skills, and increasing the number of suitable job offers.

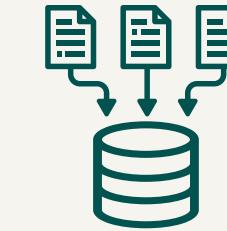
During GP1:



define the project problem, aims, and solutions.



Studied previous recruitment systems, identified gaps



Collected job and candidate data, applied (EDA), cleaned and preprocessed the datasets



Built text embeddings, and prepared features for model training.

INTRODUCTION

This phase presents the technical foundation of KAFAA, focusing on:

- **Model development**
- **Evaluation**
- **Deployment simulation.**

We built and tested four AI-based recommendation models and selected the best-performing one for real-world deployment.

MODEL OVERVIEW

01

User based collaborative filtering with machine learning

02

Content-Based Filtering with TF-IDF + Word2Vec + BERT

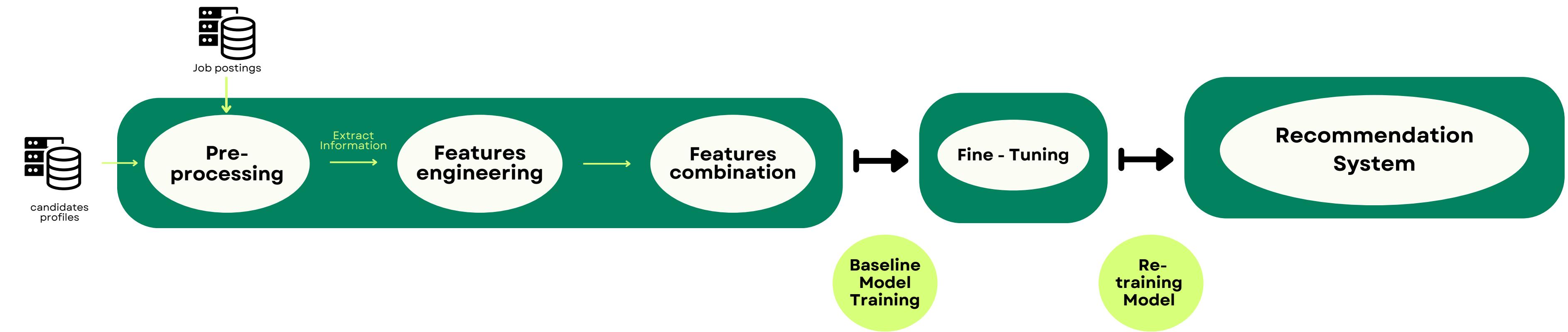
03

Semantic Matching with FAISS & BIRCH

04

Hybrid Content-Based Filtering with machine learning

TEXT-BASED CONTENT FILTERING WITH NLP TECHNIQUES



Text-Based Content Filtering With NLP Techniques

Fine-Tuning Process

Pipeline Model

- 5000 TF-IDF terms, 300D Word2Vec, 768D BERT
- Trained on full dataset (11,511 jobs + 11,511 resumes)



Hyperparameter Tuning

- KFold Cross-Validation (n=3) + Randomized Grid Search
- Search over weights, relevance threshold (0.3-0.6), Top-N (5, 10)



Best Configuration Found

- Weights: TF-IDF=3.0, Word2Vec=3.0, BERT=3.0
- Relevance Threshold: 0.6 , Top-N: 10



Final Model Training

- Retrained on full dataset
- Retrained using best weights Weights: TF-IDF=3.0, Word2Vec=3.0, BERT=3.0 , Relevance Threshold: 0.6

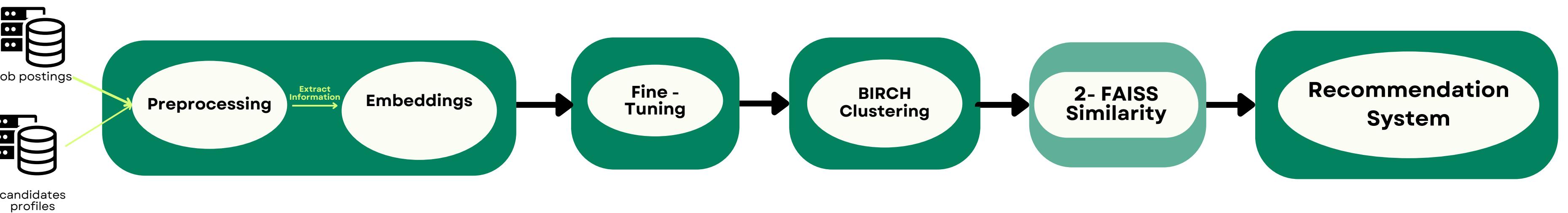


Ready for real-time deployment

Evaluation Metrics Comparison

Metrics	Before Fine-Tuning	After Fine-Tuning
Precision	0.999	0.814
Recall	0.011	0.656
F1-Score	0.018	0.553
MAP	0.011	0.656
Coverage	1.000	1.000
Diversity Ratio	0.343	0.538
Bidirectional Match	0.093	0.114

SEMANTIC AI JOB MATCHING WITH BIRCH AND FAISS



Semantic AI Job Matching with BIRCH and FAISS

Fine-Tuning Process

Pipeline Model

TruncatedSVD, Birch(), all-MiniLM-L6-v2

Hyperparameter Tuning

threshold list: [0.1, 0.3, 0.5, 1.0, 1.5, 2.0, 3.0, 5.0], with a condition to limit clusters between 10 and 3,000

Best Configuration Found

threshold = 0.5
n_cluster= 2495 ,2491

Final Model Training

Retrained the entire pipeline using the best parameters, generating updated similarity scores

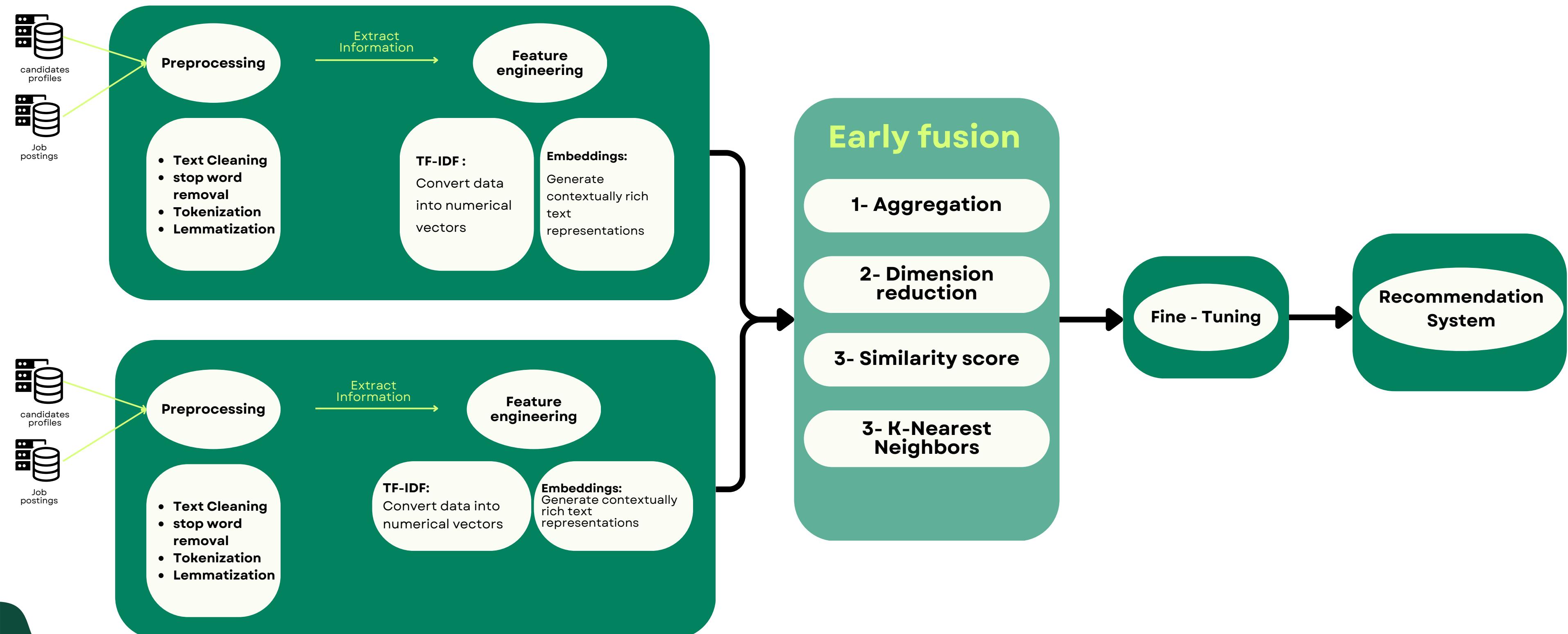


Ready for collaborative filtering in future

Evaluation Metrics Comparison

Metrics	Before Fine-Tuning	After Fine-Tuning
Precision	0.916	0.946
Recall	0.384	0.984
F1-Score	0.376	0.947
MAP	0.384	0.984
Coverage	0.499	0.727
Diversity Ratio	0.499	0.727
Bidirectional Match	0.001	0.587

ADVANCED HYBRID FILTERING WITH NLP AND MACHINE LEARNING



Advanced Hybrid Filtering with NLP and Machine learning

Fine-Tuning Process

Pipeline Model

Built as a scikit-learn pipeline:

HybirdEmbeddingTransformer, TruncatedSVD,
NearstNeighbors

Hyperparameter Tuning

Applied GridSearchCV using a custom scoring
function based on cosine similarity.

Tuned hypereparameters:

svd_n_components , knn_n_neighbors

Best Configuration Found

svd_n_components = 50
knn_n_neighbors = 3

Final Model Training

Retrained the entire pipeline using the best
parameters, generating updated similarity scores

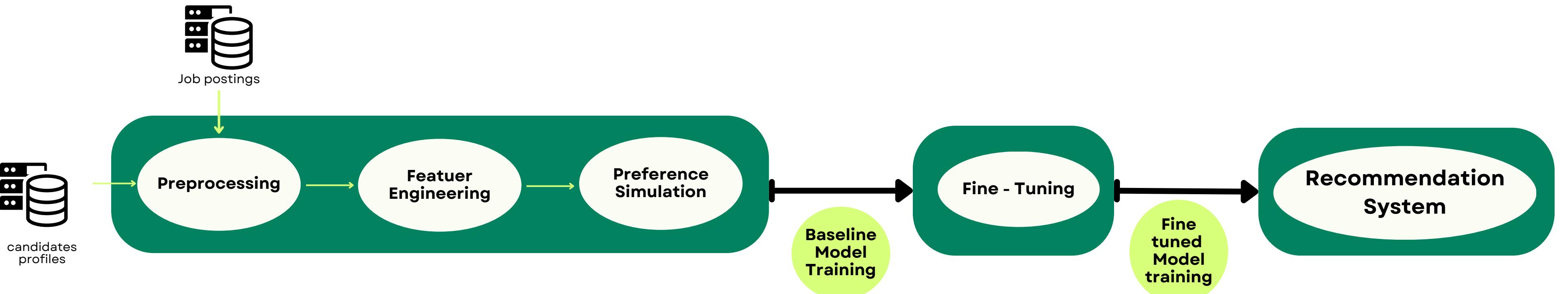


Ready for collaborative filtering in future

Evaluation Metrics Comparison

Metrics	Before Fine-Tuning	After Fine-Tuning
Precision	0.9956	0.9998
Recall	0.0823	0.0184
F1-Score	0.1253	0.0335
MAP	0.0823	0.0184
Coverage	1.0000	1.0000
Diversity Ratio	0.5455	0.5162
Bidirectional Match	0.2062	1.0000

USER-BASED COLLABORATIVE FILTERING WITH MACHINE LEARNING



User-based collaborative filtering with machine learning

Fine-Tuning Process

Baseline Model

Model: LGBMRanker
num_leaves=15, lr =0.1, n_estimators=50
Trained on 552,480 pairwise samples

Hyperparameter Tuning

Method: GroupKFold (n_splits=3)
Search Grid:
num_leaves: [15, 31]
learning_rate: [0.05, 0.1]
n_estimators: [50, 100]

Best Configuration Found

num_leaves=31, learning_rate =01, nst:i=100
Avg. F1-score: 0.29697

Final Model Training

Used full training set (441 candidate)
Inputs: 128D candidate + 128D job + 2⇒25Bt vector
Objective: LambdaRank

✓ Ready for real-time & batch deployment

Evaluation Metrics Comparison

Metric	Before Fine-Tuning	After Fine-Tuning
Precision	0,9474	0,9364
Recall	0,0540	0,1693
F1-Score	0,1022	0,2868
MAP	0,7207	0,7683
Coverage	0,4500	0,4600
Diversity Ratio	0,0066	0,0069
Bidirectional Match	0,7100	0,7700

EVALUATION METRICS

Metrics	Description
Precision	relevant items among the recommended items
Recall	relevant items that were recommended out of all relevant items available
F1 Score	Harmonic mean of precision and recall, balancing both
MAP	Average of the precision scores at the ranks where relevant items occur, averaged across users
Coverage	Proportion of items in the catalog that can be recommended
Diversity	Degree of dissimilarity among recommended items
Bidirectional Match	Mutual job, candidate matches

COMPARING MODELS

	Precision	Recall	F1-score	MAP	Coverage	Diversity Ratio	Bidirectional Match Ratio
Model1	0.936	0.169	0.286	0.768	0.460	0.006	0.770
Model2	0.814	0.656	0.557	0.656	1.000	0.538	0.114
Model3	0.946	0.984	0.947	0.984	0.727	0.727	0.587
Model4	0.999	0.018	0.033	0.018	1.000	0.514	1.000

Model 3 was chosen due to its superior performance across key metrics, including precision (0.946), recall (0.984), and F1-score (0.947), indicating it offers a strong balance between accuracy and recall. Additionally, Model 3 demonstrated solid coverage (0.727) and diversity ratio (0.727), ensuring a comprehensive and varied set of recommendations

User-Feedback

Candidate → Job Matching Performance per Model

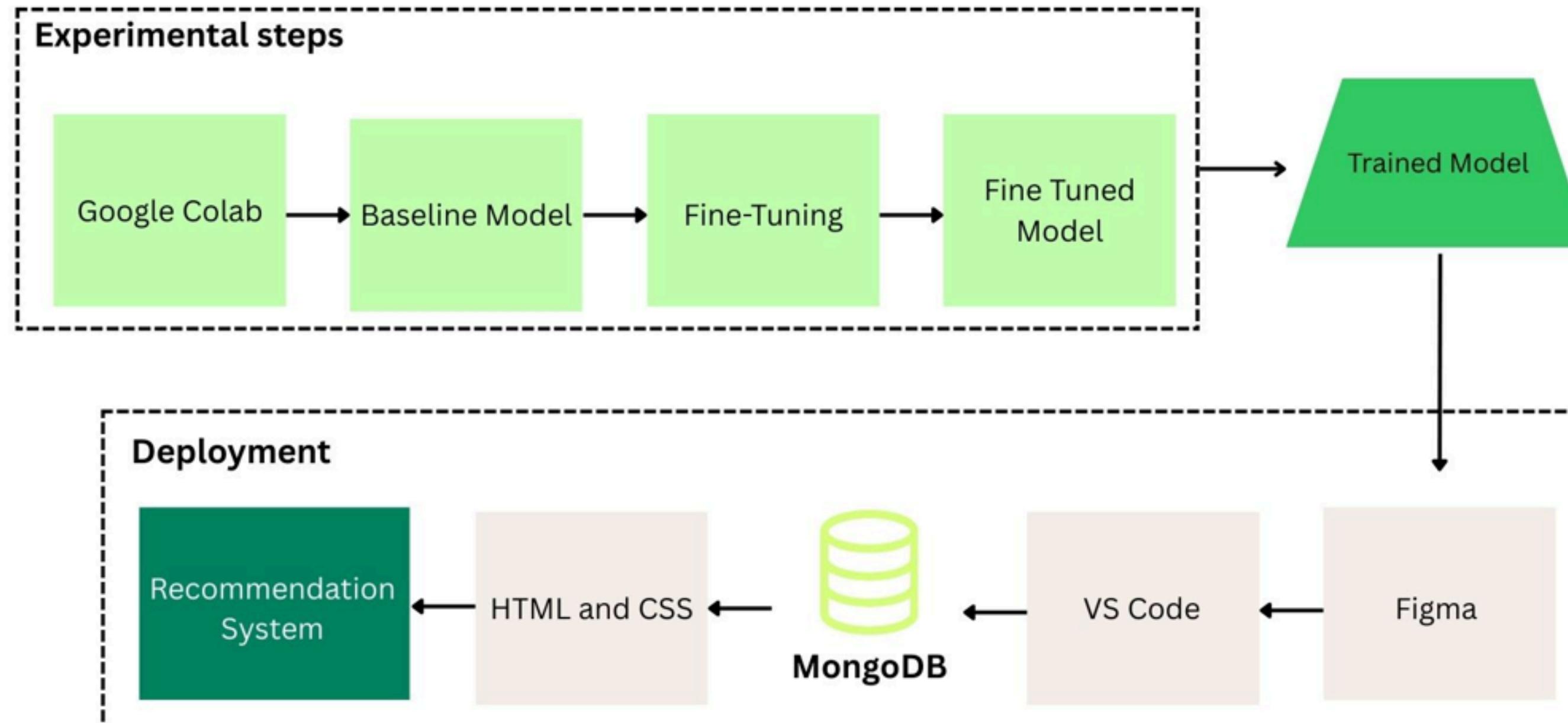
User	Model 1		Model 2		Model 3		Model 4	
	Number of Relevant	Match ratio						
User 1	6 out of 20	0.300	8 out of 20	0.400	14 out of 20	0.700	13 out of 20	0.3882
User 2	6 out of 20	0.300	11 out of 20	0.5500	6 out of 20	0.300	20 out of 20	0.4339
User 3	3 out of 20	0.150	13 out of 20	0.6500	9 out of 20	0.45	19 out of 20	0.4366
User 4	6 out of 20	0.300	11 out of 20	0.5500	11 out of 20	0.55	5 out of 20	0.3713
User 5	2 out of 20	0.100	9 out of 20	0.4500	14 out of 20	0.70	3 out of 20	0.3410
Average Match ratio	0.230		0.520		0.54		0.3942	

User-Feedback

Job -> Candidate Matching Performance per Model

User	Model 1		Model 2		Model 3		Model 4	
	Number of Relevant	Match ratio						
User 1	6 out of 20	0.300	18 out of 20	0.9000	13 out of 20	0.65	5 out of 20	0.3251
User 2	6 out of 20	0.300	8 out of 20	0.6000	6 out of 20	0.30	6 out of 20	0.2916
User 3	5 out of 20	0.2500	16 out of 20	0.8000	8 out of 20	0.4	6 out of 20	0.3228
User 4	3 out of 20	0.150	10 out of 20	0.5000	8 out of 20	0.4	4 out of 20	0.3221
User 5	3 out of 20	0.150	18 out of 20	0.9000	12 out of 20	0.6	2 out of 20	0.2818
Average Match ratio	0.230	0.740			0.47		0.3087	

System Demonstration



Top candidate Matches

KAFAA

Job title, keyword

Sign In
Sign In As A Company

Find a job that suits your interest & skills.

Aliquam vivit turpis in diam convallis finibus in at risus. Nullam in scolensque leo, niger soliditudin volt bedibulum.

Job Title, Keyword: Your Location:

Suggestion: Designer, Programming, Digital Marketing, Video, Animation.



Top 10 recommendations:
no recommendation for now, sign in

How KAFAA work

Create account

Creating an account gives you access to personalized job recommendations.

Upload CV/Resume

Upload your updated CV so the system can match you with the most relevant job opportunities.

Find suitable job

Browse through job suggestions based on your skills, experience, and preferences.

Apply job

Submit your application directly through KAFAA.

Top candidate Matches

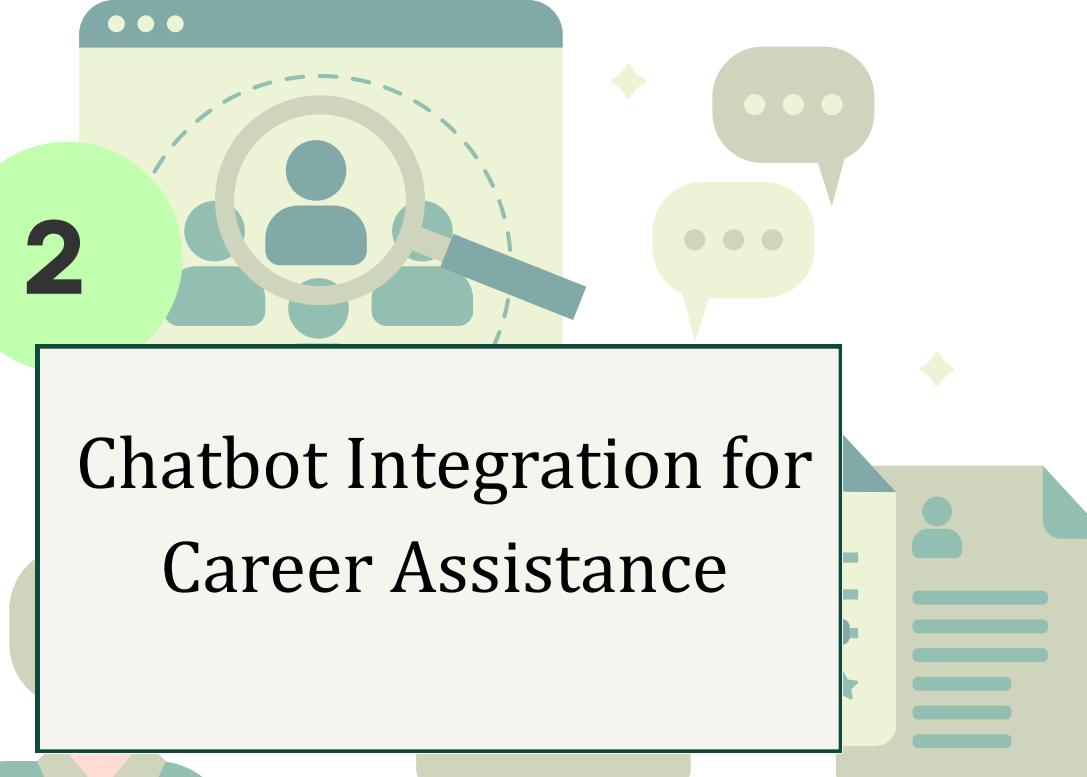
The image displays a user interface for account management. On the left, there is a 'Create account.' form with fields for 'Company Name' (placeholder 'Enter company name...'), 'Email address' (placeholder 'Enter email address...'), 'Password' (placeholder 'Enter password...'), and 'Confirm Password' (placeholder 'Enter password again...'). Below these fields is a dark green button labeled 'Create Account →'. Underneath the button, a link reads 'Already have an account? Log In here' with a cursor icon pointing towards it. Further down are fields for 'Business Email address' (placeholder 'Enter business email address...'), 'Password' (placeholder 'Enter password...'), and a 'Remember Me' checkbox. To the right of these fields is a dark green button labeled 'Log In →'. Next to the 'Log In' button is a link 'Forgot password?'.

The right side of the image is a solid dark green vertical bar. At the top of this bar is the 'Kufaa' logo in white, followed by the tagline 'Empowering talent to meet their future.' in a smaller white font.

FUTURE WORK

1

Hybrid Recommendation Engine with Real User Data



2

Chatbot Integration for Career Assistance



3

Analytics Dashboard for Employers



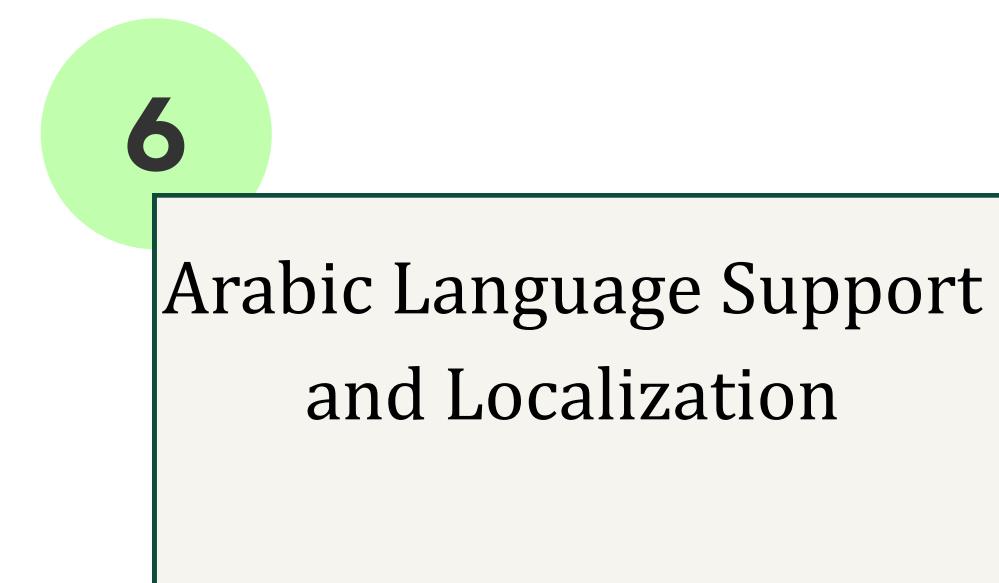
5

Mobile Application Development



4

Production Deployment via REST API and Docker



6

Arabic Language Support and Localization

CONCLUSION

We proudly built KAFAA, a smart matchmaker for jobs and talents in Saudi Arabia!

From defining the problem to testing four powerful AI models, we worked hard to find the best performer: Semantic Matching with BIRCH & FAISS.

Our system boosts precision, recall, and diversity, making hiring smarter, faster, and way more exciting!

But we're not stopping here: future plans include adding real user data, launching a chatbot buddy, giving employers cool dashboards, and even going mobile.

KAFAA is just getting started, and the future looks bright!



CONTACT INFO



THANK YOU