Job–Applicant Recommendation System

Problem Statement

Recruiters struggle to efficiently match applicants with jobs because manual screening is **time-consuming, inconsistent, and error-prone**. This leads to missed talent, delayed hiring cycles, and poor candidate experience. An automated, intelligent recommendation system is needed.

Objectives

- Automate **job–applicant matching** using AI.
- Convert job and applicant **skills into vector embeddings** with SentenceTransformer (all-MiniLM-L6-v2).
- Compute **cosine similarity** for skills and align with **experience requirements**.
- Apply a **weighted scoring system** (70% skills, 30% experience).
- Provide **explainable feedback** (matched/missing skills, experience gaps).

Methodology

1. **Skill Similarity (70%)**
    - Job and applicant skills → embeddings (384-dim vectors).
    - Cosine similarity used to score overlap.
2. **Experience Score (30%)**
    - Applicant's experience compared to job's min–max range.
    - Full points if within range, scaled down if under/over.
3. **Final Match %**

    Score=(0.7×Skill Similarity)+(0.3×Experience Score)
4. **Penalty System**
    - Missing required skills → reduce similarity score.
    - Underqualified experience → stronger penalty than overqualified.
    - Extra unrelated skills → ignored (no bonus).

Model Building at Startup

Steps:

1. **Fetch Job Data**
   - The system queries the PostgreSQL database and retrieves all job postings, including job IDs, titles, required skills, and experience ranges.

2. **Skill Embedding Conversion**
   - Required job skills are processed using the SentenceTransformer model (all-MiniLM-L6-v2).
   - Each job's skills are converted into a 384-dimensional embedding vector.

3. **Build Job Embedding Matrix**
   - All job vectors are stacked into a matrix (using NumPy/Pandas) for fast similarity calculations.
   - This acts as the feature space for job–applicant matching.

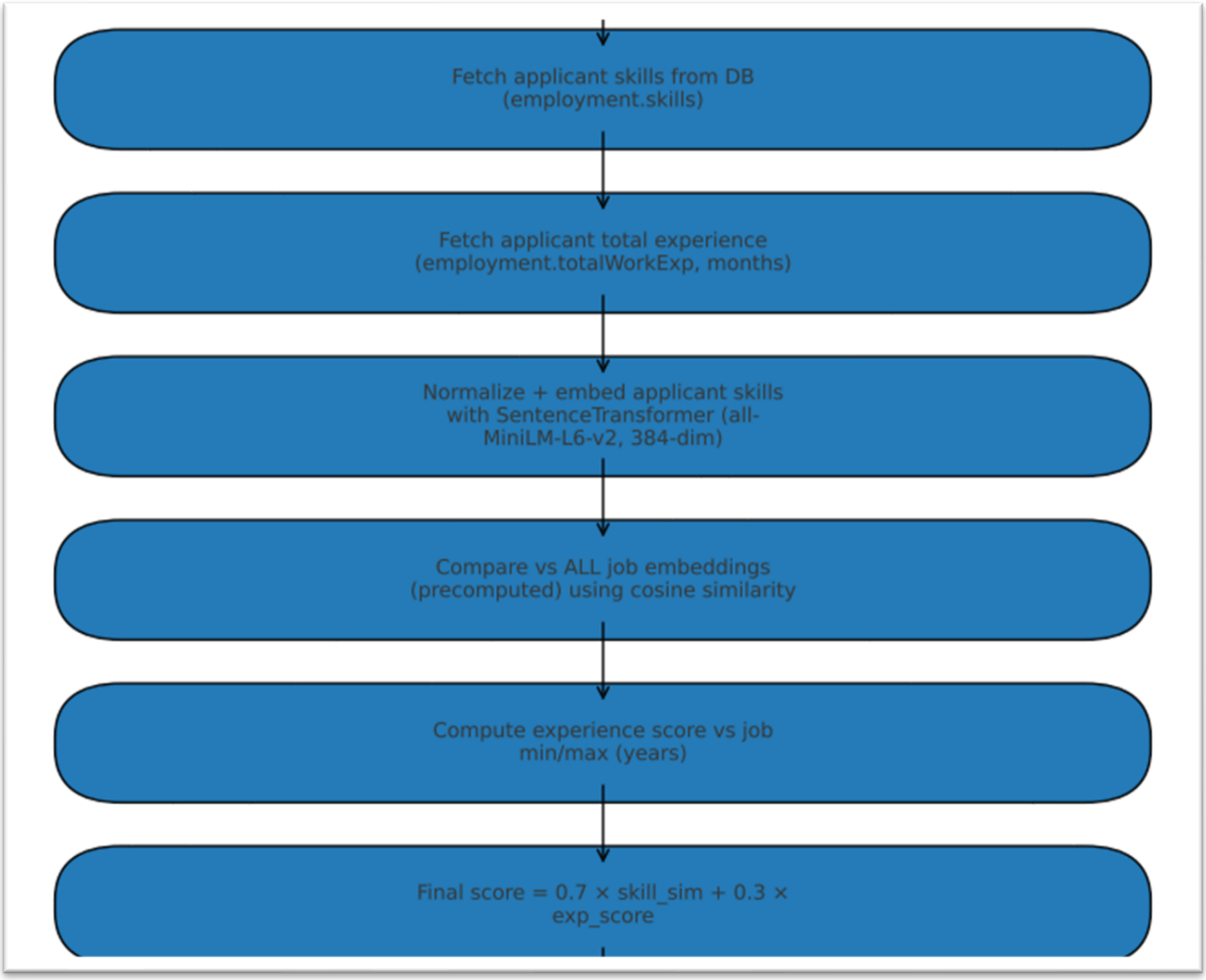
4. **Initialize Job Matching Model**
   - The JobMatchingModel class is initialized with:
     - Job metadata (ID, title, min/max experience).
     - Precomputed skill embeddings.

5. **Persist Model (Caching)**
   - The trained model object is serialized and stored as job_matching_model.joblib using joblib.
   - This allows quick loading on subsequent restarts without recomputing embeddings.

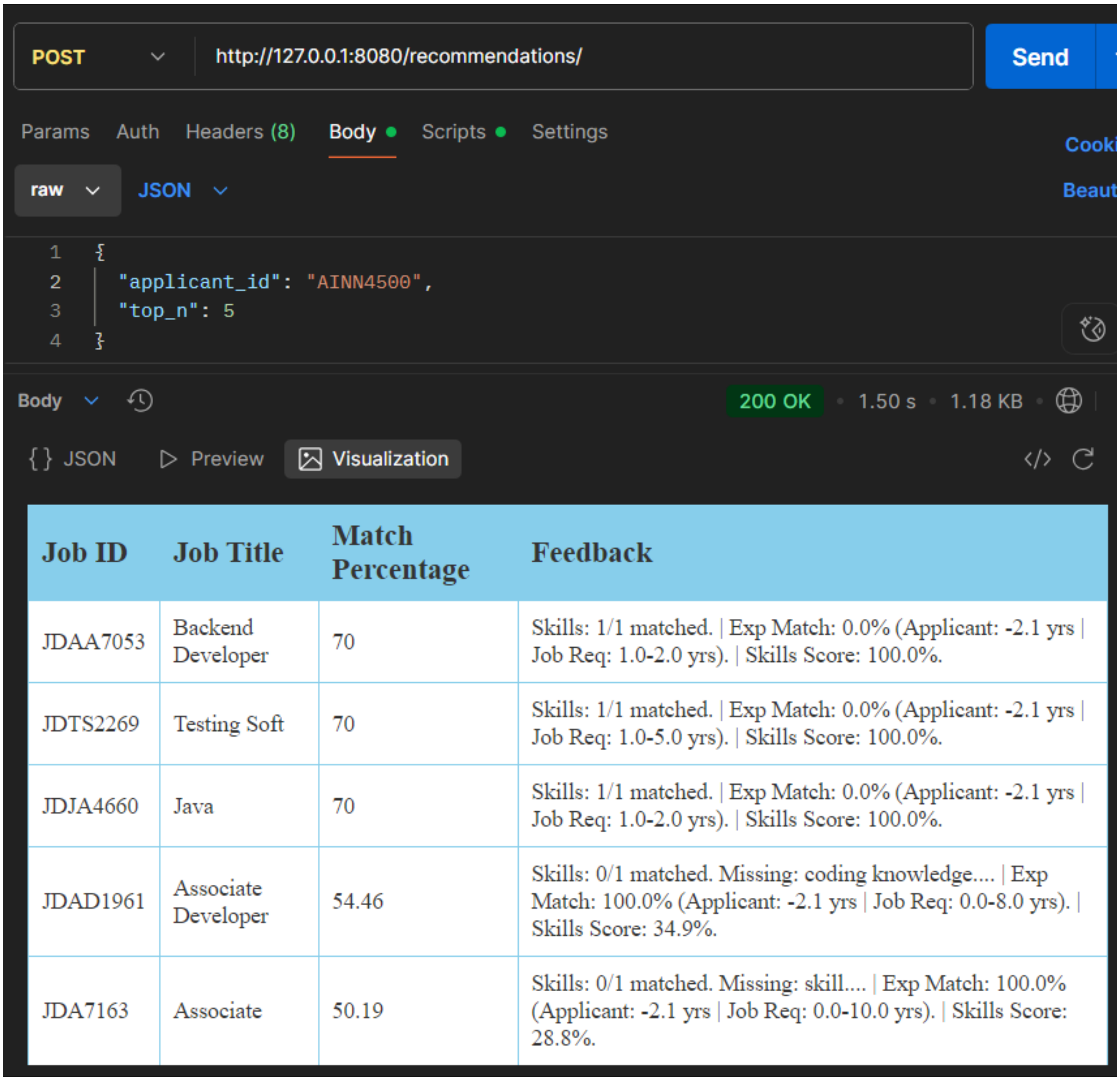
In this project, we have implemented 3 main flows:

Flow 1 (Jobs for an Applicant):

Recommends the top matching jobs for a given applicant based on skill similarity and experience alignment.



OUTPUT:

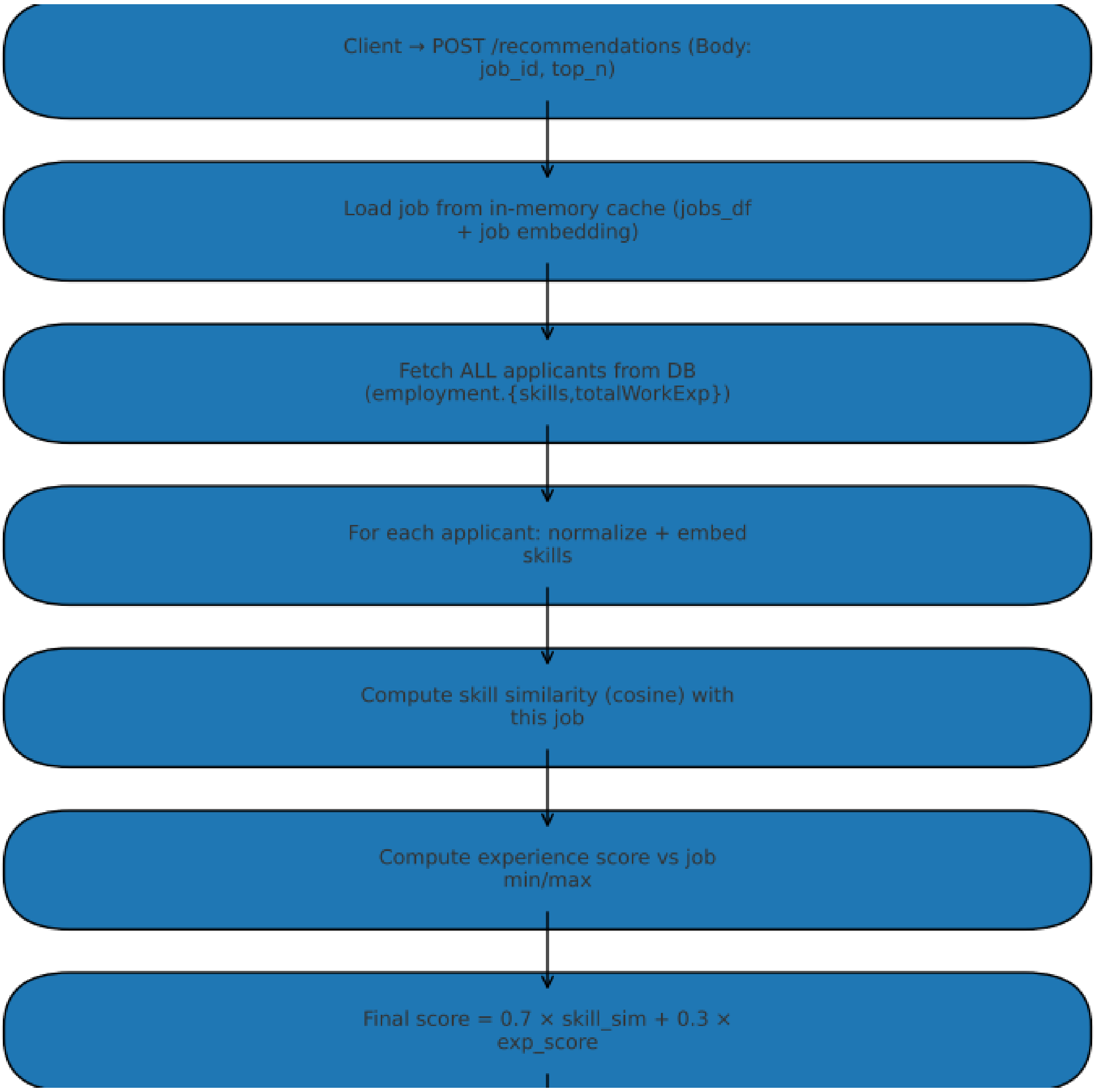


Job ID	Job Title	Match Percentage	Feedback
JDAA7053	Backend Developer	70	Skills: 1/1 matched. | Exp Match: 0.0% (Applicant: -2.1 yrs | Job Req: 1.0-2.0 yrs). | Skills Score: 100.0%.
JDTS2269	Testing Soft	70	Skills: 1/1 matched. | Exp Match: 0.0% (Applicant: -2.1 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 100.0%.
JDJA4660	Java	70	Skills: 1/1 matched. | Exp Match: 0.0% (Applicant: -2.1 yrs | Job Req: 1.0-2.0 yrs). | Skills Score: 100.0%.
JDAD1961	Associate Developer	54.46	Skills: 0/1 matched. Missing: coding knowledge.... | Exp Match: 100.0% (Applicant: -2.1 yrs | Job Req: 0.0-8.0 yrs). | Skills Score: 34.9%.
JDA7163	Associate	50.19	Skills: 0/1 matched. Missing: skill.... | Exp Match: 100.0% (Applicant: -2.1 yrs | Job Req: 0.0-10.0 yrs). | Skills Score: 28.8%.

- Sort by score and select top N jobs.
- Generate readable feedback: matched skills, missing skills, and experience match.
- Return JSON response

Flow 2 (Applicants for a Job):

Finds the most suitable applicants for a specific job using precomputed job embeddings and scoring.



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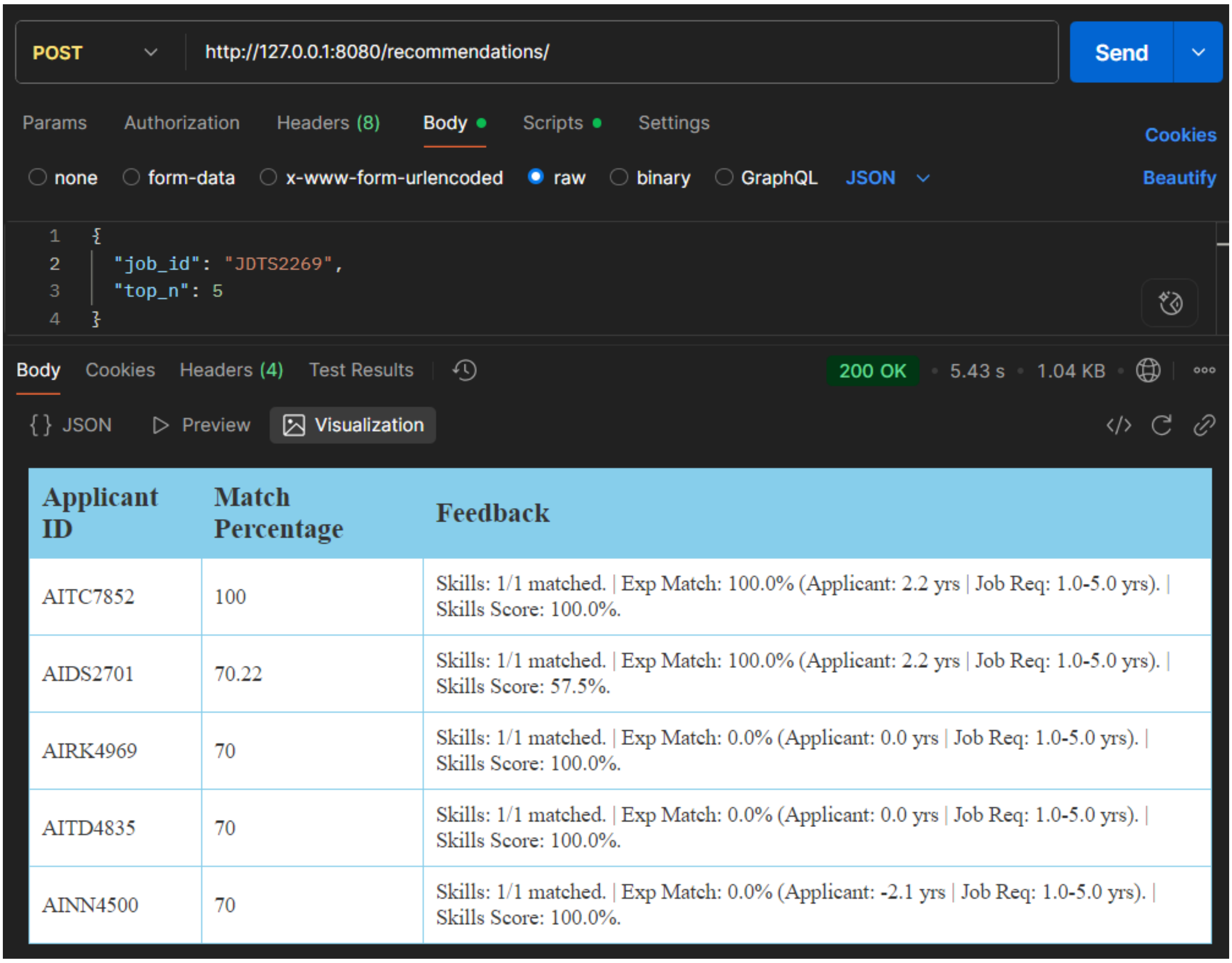


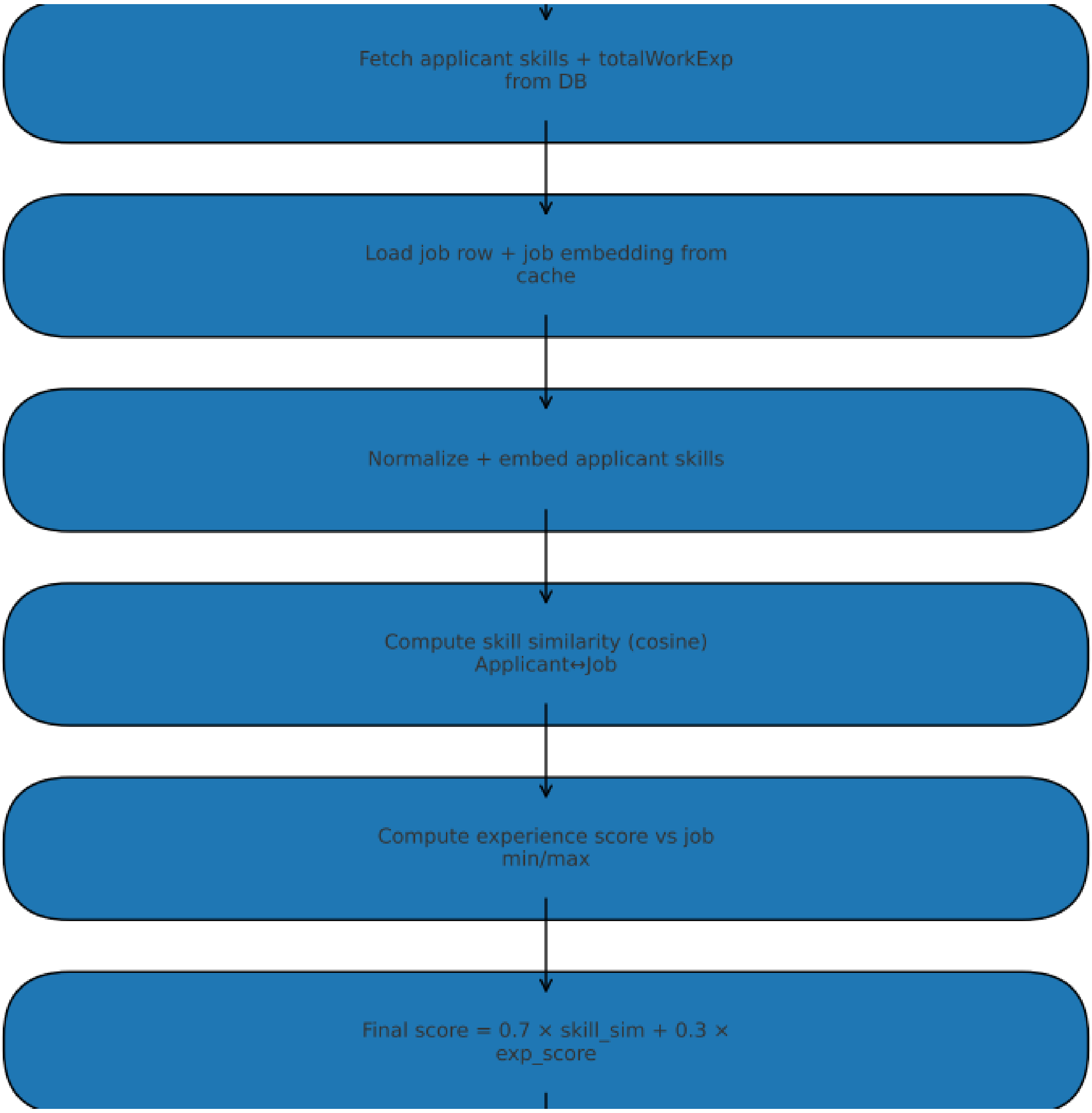
Applicant ID	Match Percentage	Feedback
AITC7852	100	Skills: 1/1 matched. | Exp Match: 100.0% (Applicant: 2.2 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 100.0%.
AIDS2701	70.22	Skills: 1/1 matched. | Exp Match: 100.0% (Applicant: 2.2 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 57.5%.
AIRK4969	70	Skills: 1/1 matched. | Exp Match: 0.0% (Applicant: 0.0 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 100.0%.
AITD4835	70	Skills: 1/1 matched. | Exp Match: 0.0% (Applicant: 0.0 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 100.0%.
AINN4500	70	Skills: 1/1 matched. | Exp Match: 0.0% (Applicant: -2.1 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 100.0%.

- Sort by score and select top N applicants
- Generate feedback for each applicant
- Return JSON

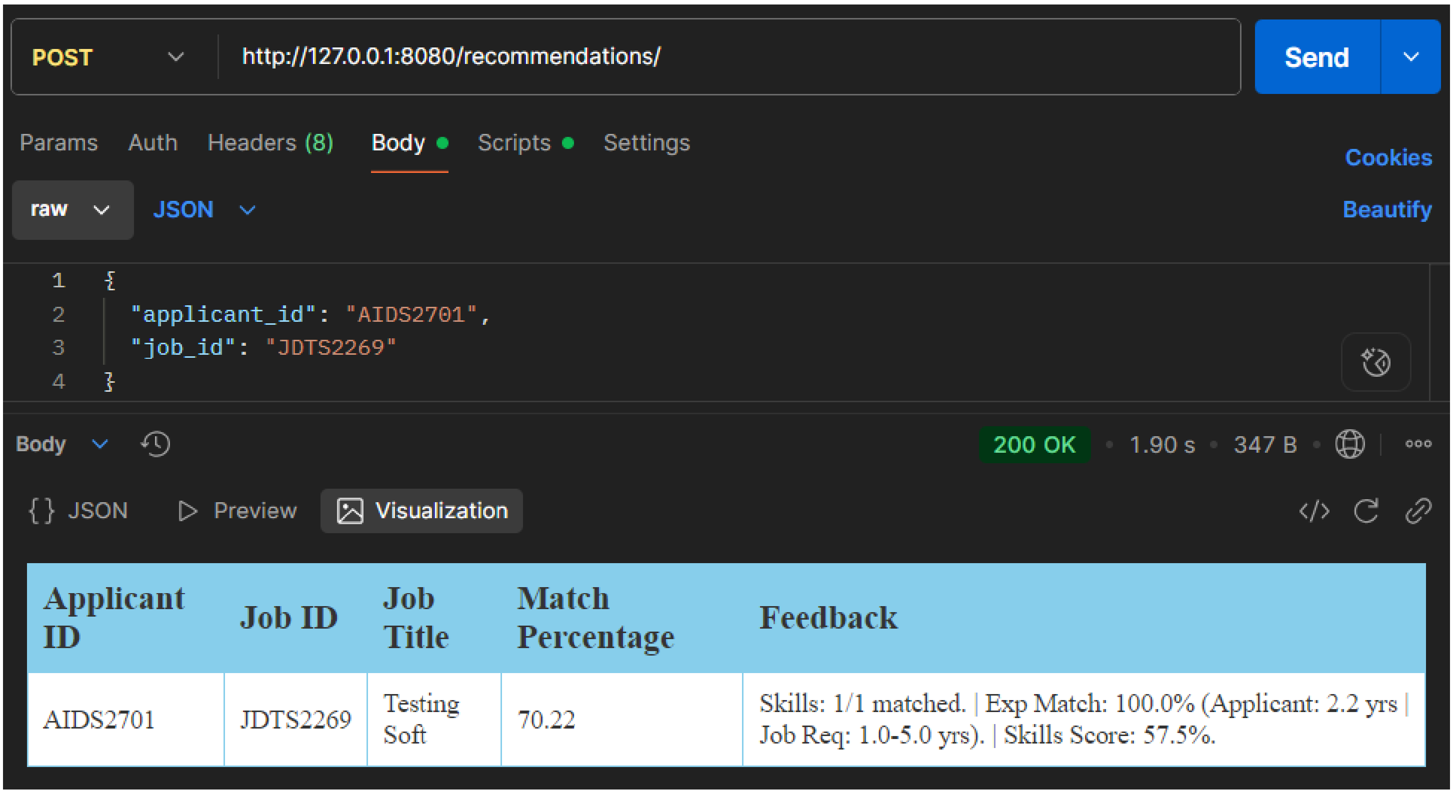
Flow 3 (Applicant vs Job):

Provides a detailed compatibility score and feedback for a single applicant–job pair.

Evaluate One Applicant vs One Job



OUTPUT:



Applicant ID	Job ID	Job Title	Match Percentage	Feedback
AIDS2701	JDTS2269	Testing Soft	70.22	Skills: 1/1 matched. | Exp Match: 100.0% (Applicant: 2.2 yrs | Job Req: 1.0-5.0 yrs). | Skills Score: 57.5%.