

Technical Approaches to Recommendation System

Alex

Recommendation System : Various Approaches

1. Rule-Based System (Deterministic Logic)



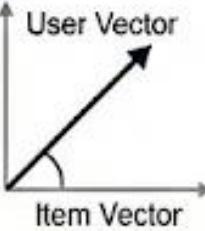
- Explicit IF-THEN rules.
- Filter: Season, Gender.
- Outcome: Predictable, explainable matches based on hard constraints.

Inputs (Season, Gender) → Rule Engine → Matched Perfumes

2. Content-Based Filtering (Attribute Matching)



- User & Item profiles vectorized.
- Similarity: Cosine calculation.
- Outcome: Recommends similar items to past likes based on features (Notes, Style).



3. Collaborative Filtering (Social Proof)



- Leverages similar user behavior.
- Analysis: User-Item Matrix, Neighborhoods.
- Outcome: Suggests items liked by similar users, enabling serendipitous discovery.

4. AI Vision Analysis (Multimodal Perception)



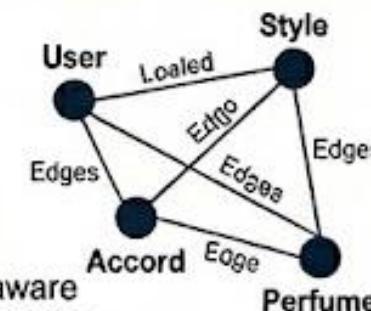
- Analyzes visual context (fashion, scene).
- Fusion: Image + Text data.
- Outcome: Matches olfactory profiles to visual aesthetics and mood.

Photo Input → AI Vision Model → Scent Profile

5. Knowledge Graph (Contextual Reasoning)



- Maps complex relationships (Entities, Edges).
- Reasoning: Graph traversal, inference.
- Outcome: Highly personalized, context-aware recommendations with semantic understanding.



Rule-Based Recommendation Process

STEP 1: STRUCTURED DATA INPUT (Conditions)

Gender
Input: Female

Clothes Style
Input: Romantic (Dress)

Season
Input: Spring

Review Keywords
Input: 'Sweet', 'Light'

Defining Rule Parameters

STEP 2: DETERMINISTIC RULE ENGINE (IF-THEN Logic)

Rule Filtering Pipeline

Rule 1: Basic Filter (Hard)

IF Gender='Female'
AND Season='Spring'
THEN Select 'Floral/Fruity' Group

Rule 2: Style Mapping (Scoring)

IF Style='Romantic'
THEN Boost 'Rose/Peony' Notes



Rule 3: Keyword Match (Final Select)

IF Keywords=['Sweet']
THEN Finalize 'Vanilla/Berry' Candidates

Sequential Candidate Narrowing

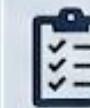
STEP 3: FINAL RECOMMENDATION & RATIONALE (Outcome)

Top Recommendation



Perfume: Miss Dior
Blooming Bouquet

Rule Match

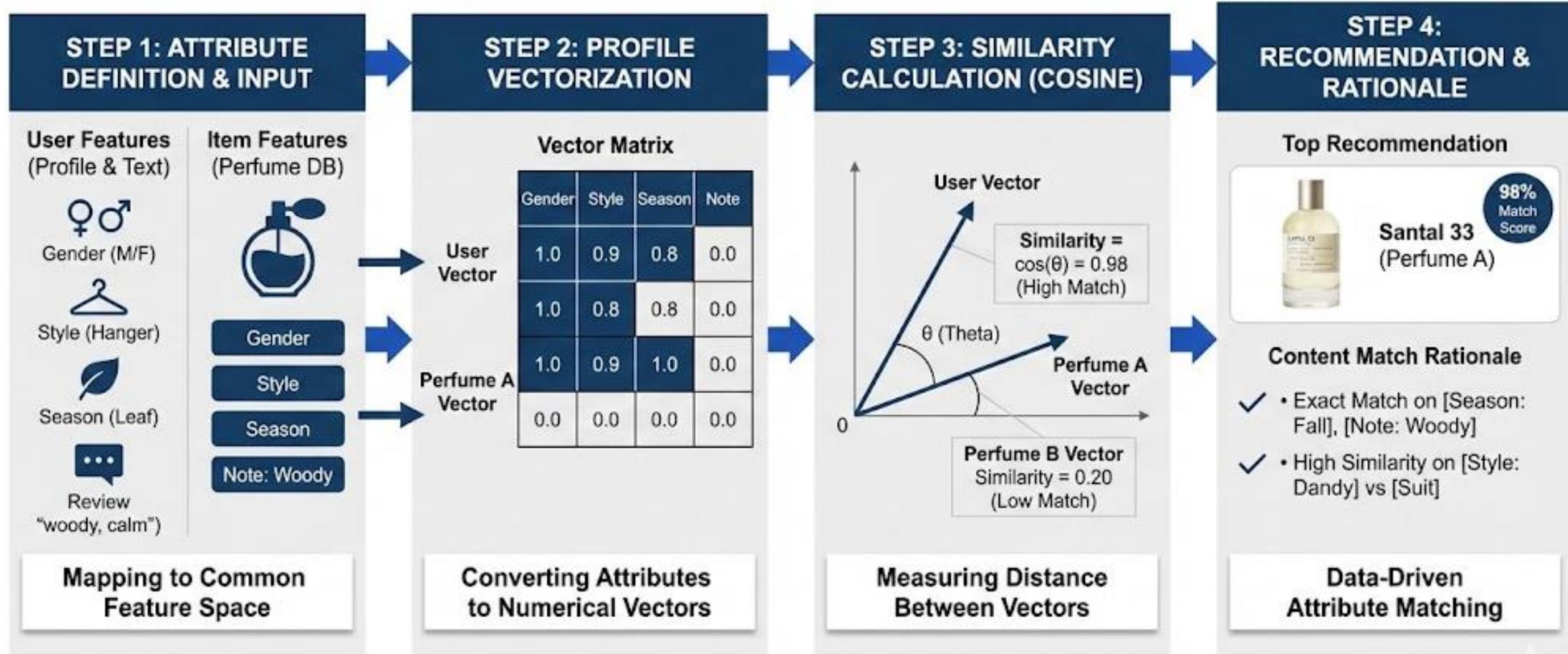


Rule Rationale (Explainable Logic)

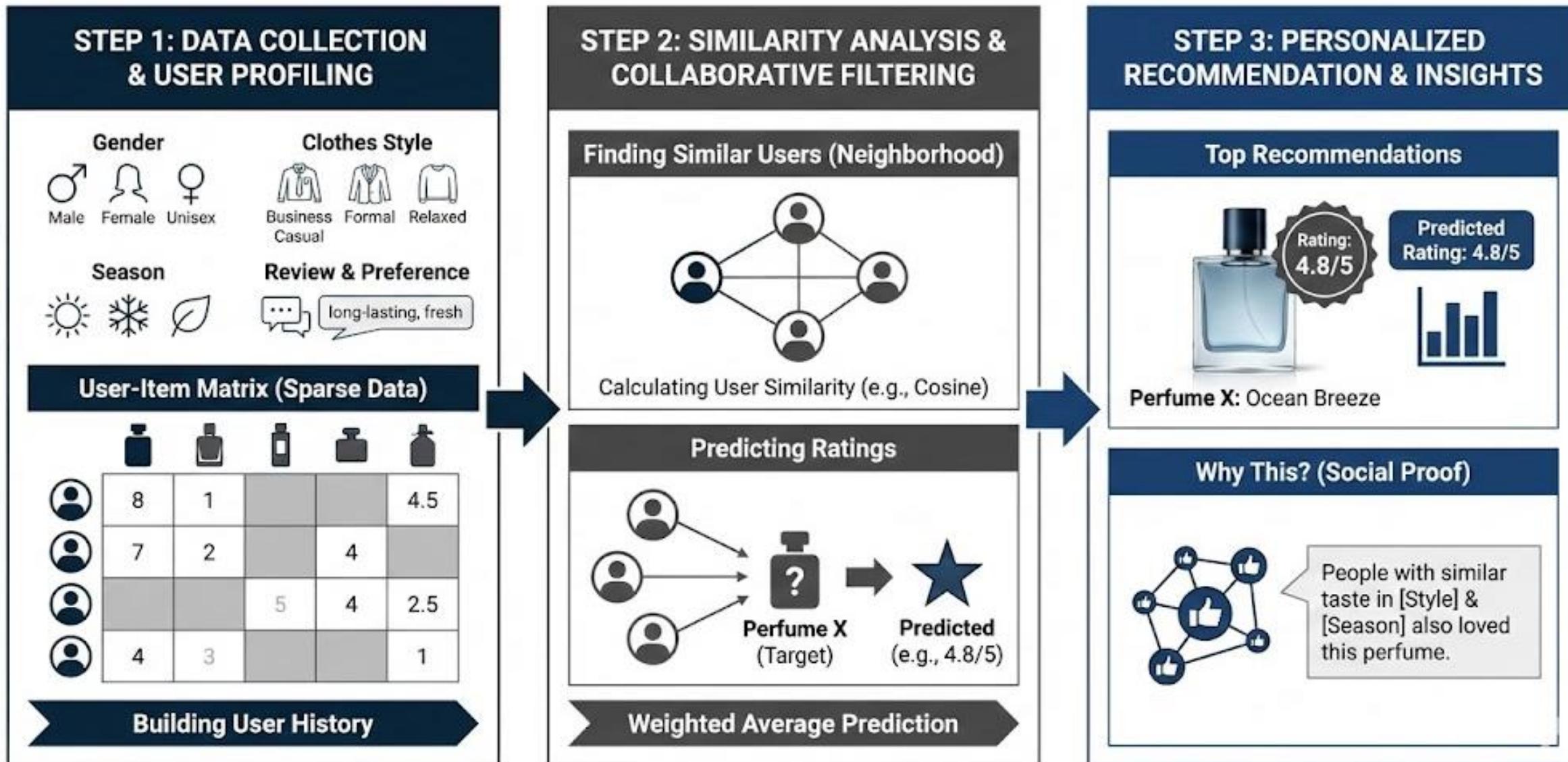
- Rule 1 met: 'Floral' group selected for [Female]/[Spring].
- Rule 2 met: [Romantic Style] mapped to 'Peony' note.
- Rule 3 met: '[Sweet]' keyword finalized the selection.

Clear, Evidence-Based Output

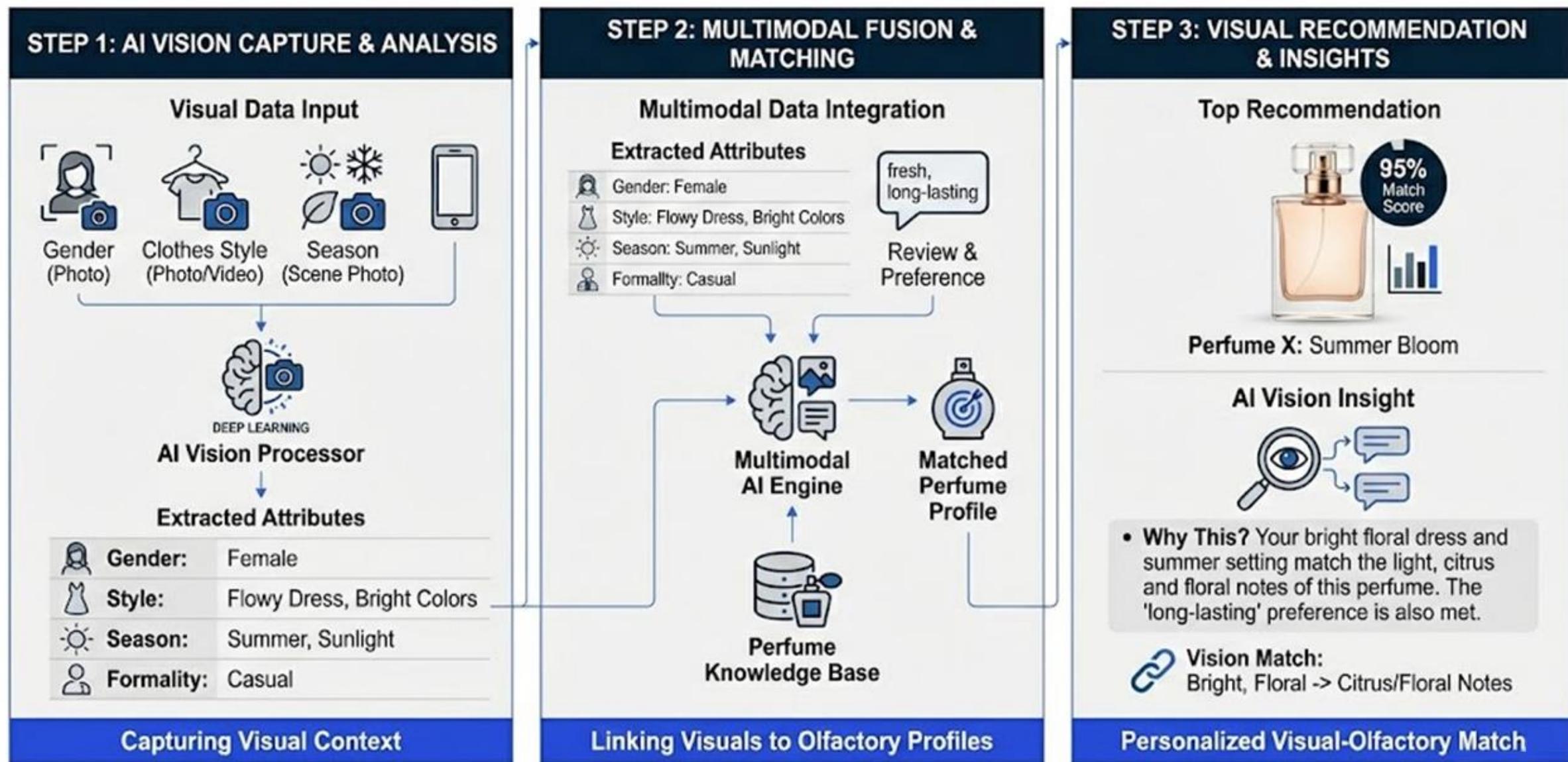
Content-Based Recommendation Process



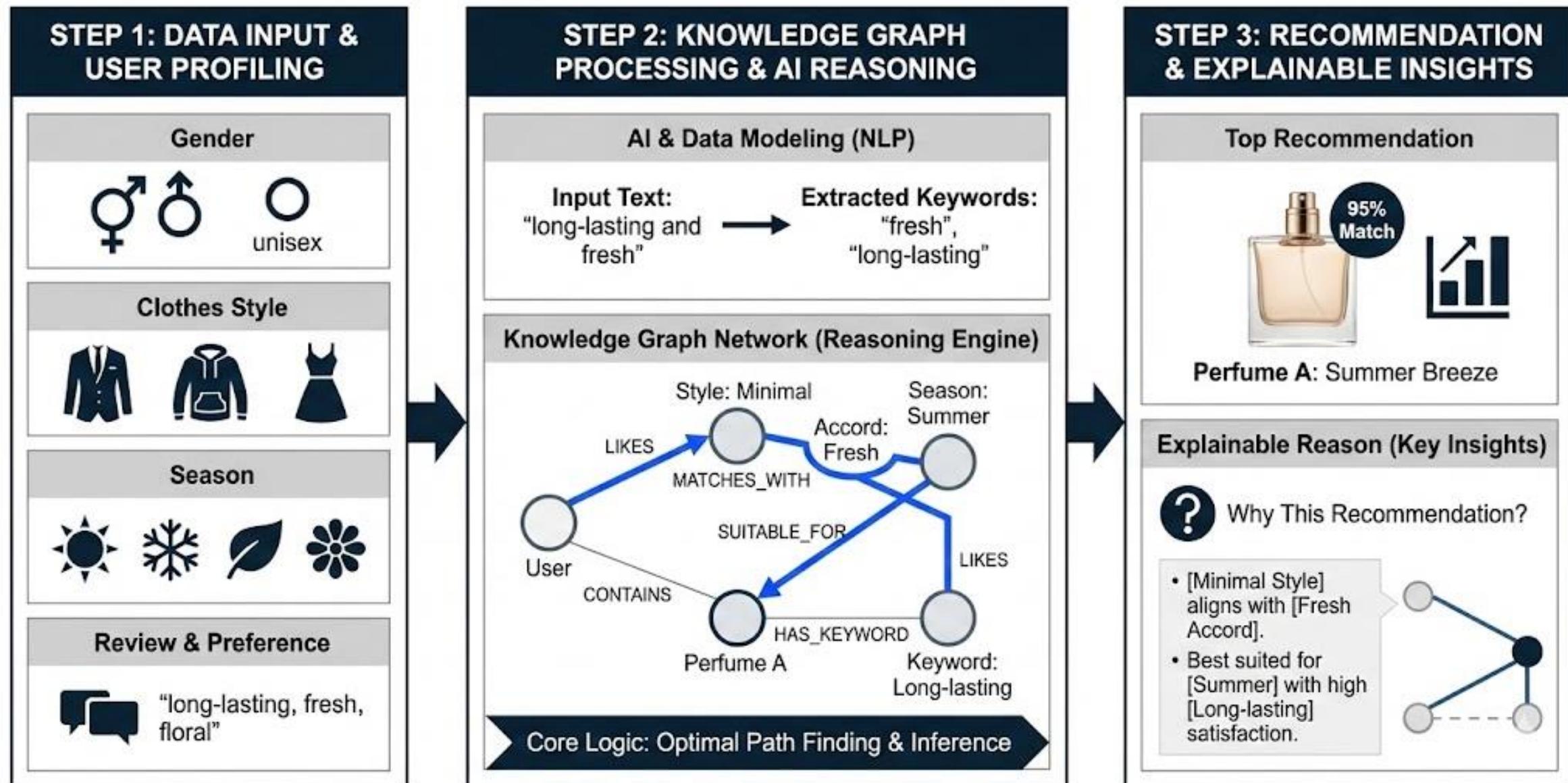
Collaborative Filtering-Based Recommendation Process



AI Vision-Based Recommendation Process



Knowledge Graph-Based Recommendation Process



Comparison of Various Approaches

Approach	Technical Features	Data Collection	Algorithm / Model	Database	Web Service
Rule-based	Matches inputs through expert-defined rules (if –then)	Gender, season, fragrance notes, brand, perfumer knowledge	If–Then Engine, Decision Tree, Drools	Relational DB (MySQL, PostgreSQL)	Simple recommendation API (Flask/Django), rule-editing dashboard
Content-based	Recommends based on similarity between perfume attributes and user preference vectors	Perfume metadata (notes, accords, concentration), user preferences, review text	TF-IDF + Cosine Similarity, KNN, BERT/SBERT Embedding	Document DB (MongoDB), Vector DB (FAISS, Pinecone)	Search/recommendation API, personalized recommendation page based on user profile
Collaborative Filtering	Recommends based on similar user/item interaction patterns	User–perfume rating matrix, click/purchase logs, review data	User/Item-based CF, SVD, ALS, Neural CF (NCF)	NoSQL (Redis, Cassandra), matrix storage	Behavior-log-based recommendation engine, real-time popular/similar item widget
AI Vision-based	Extracts fashion/emotional features from image analysis to match perfumes	Clothing/fashion images, color, season tags, social media style photos	CNN (ResNet, EfficientNet), Vision Transformer (ViT), CLIP	Vector DB (Weaviate, Milvus), Image storage (S3, GCS)	Image-upload-based recommendation web app, style analysis report UI
Knowledge Graph-based	Models relationships among gender, season, style, fragrance notes, brand, and reviews as a graph	Gender, clothing style, season, perfume attributes, brand relations, review keywords	Graph Query (Cypher), Personalized PageRank, GNN (GCN, GraphSAGE)	Graph DB (Neo4j, ArangoDB, JanusGraph)	Relationship exploration/explainable recommendation dashboard, knowledge graph visualization UI