

# **Technical Approaches to Recommendation System**

Alex

# Recommendation System : Various Approaches

## 1. Rule-Based System (Deterministic Logic)



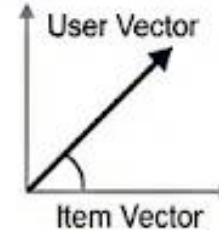
- Explicit IF-THEN rules.
- Filter: Season, Gender.
- Outcome: Predictable, explainable matches based on hard constraints.



## 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)



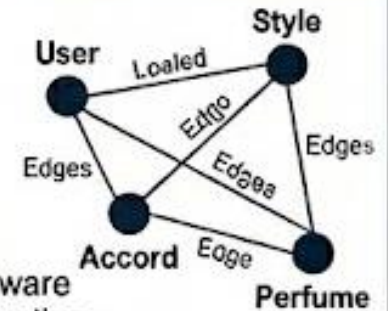
- Analyzes visual context (fashion, scene).
- Fusion: Image + Text data.
- Outcome: Matches olfactory profiles to visual aesthetics and mood.



## 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

Pre-defined Mapping Table

Sequential Candidate Narrowing

**STEP 3: FINAL RECOMMENDATION & RATIONALE**  
(Outcome)

**Top Recommendation**

**Perfume:** Miss Dior Blooming Bouquet

**Rule Match**

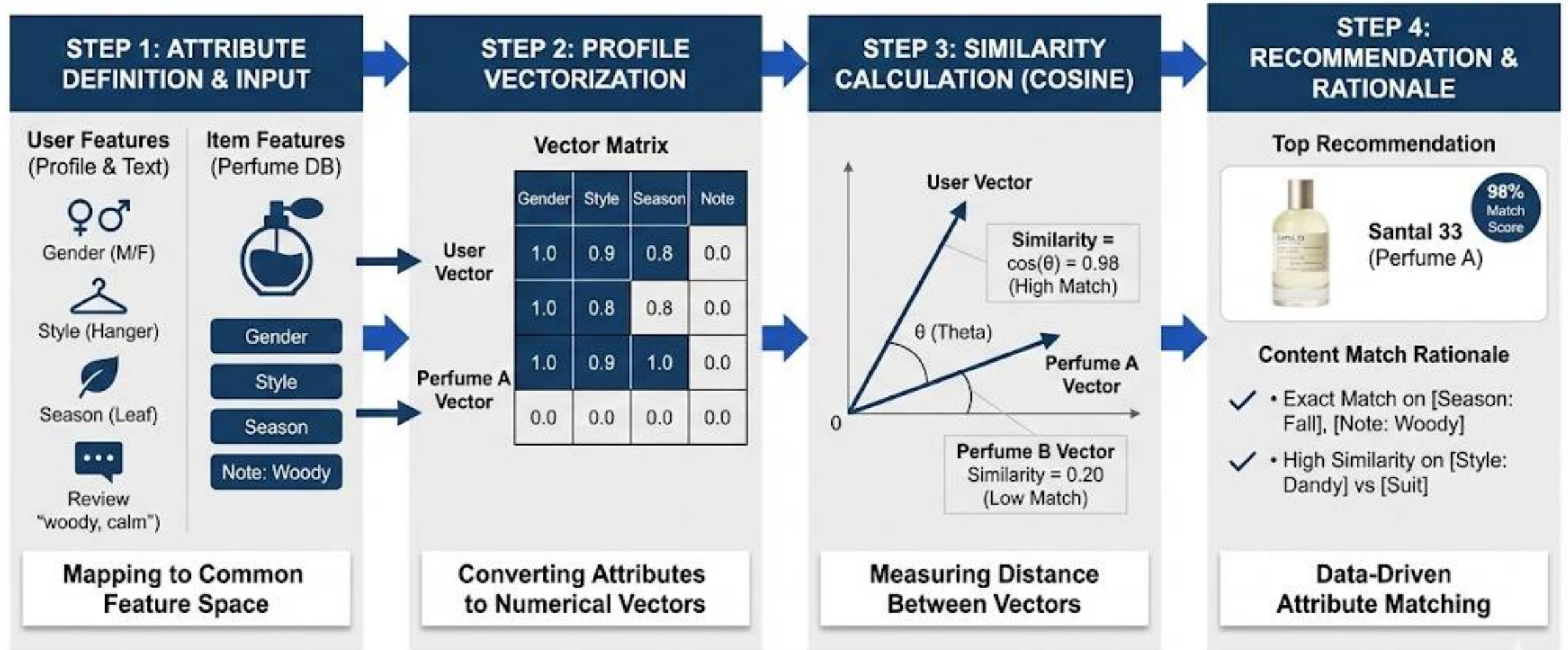
**Rule Rationale**  
(Explainable Logic)

- 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.

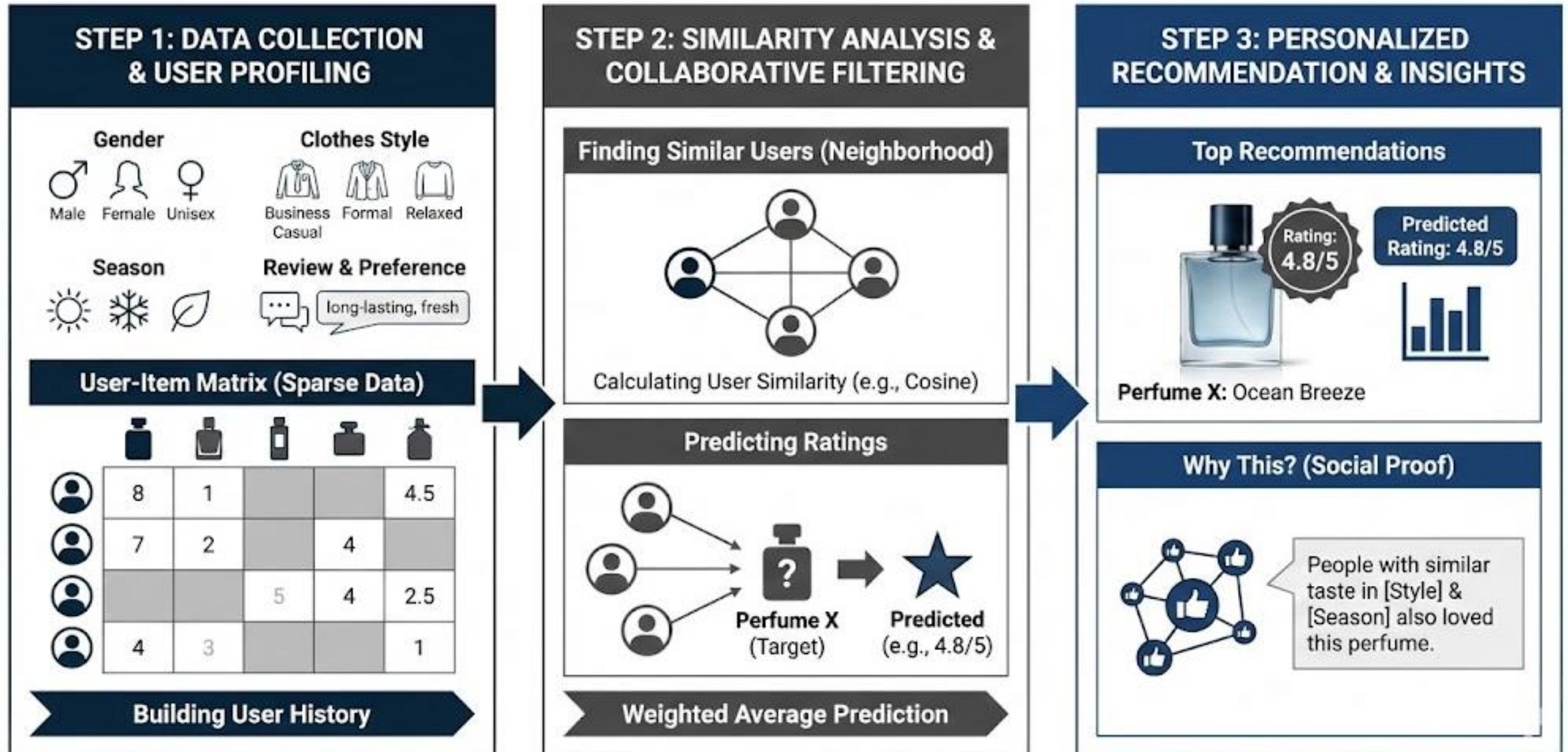
Clear, Evidence-Based Output



# Content-Based Recommendation Process

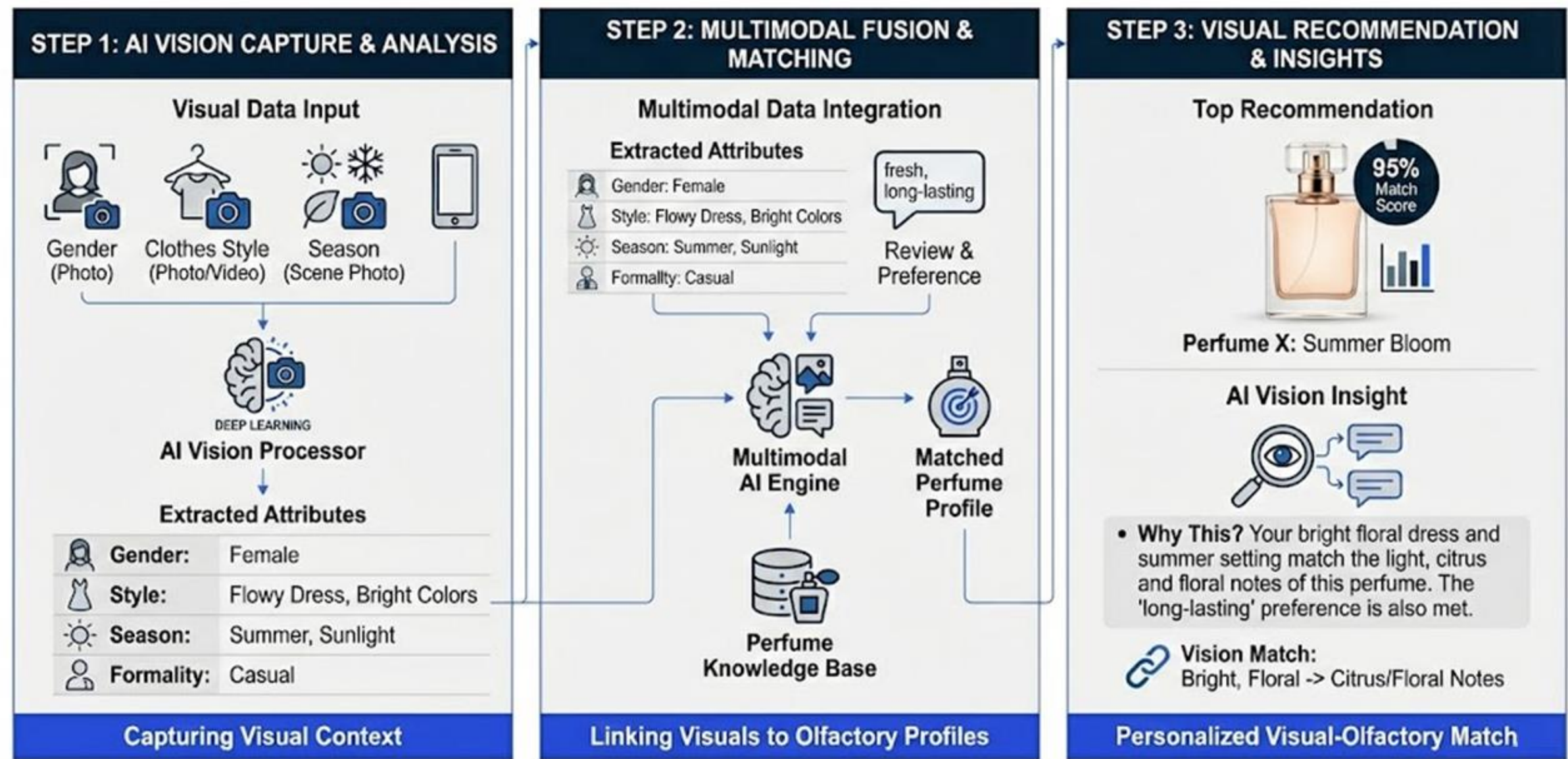


# Collaborative Filtering-Based Recommendation Process

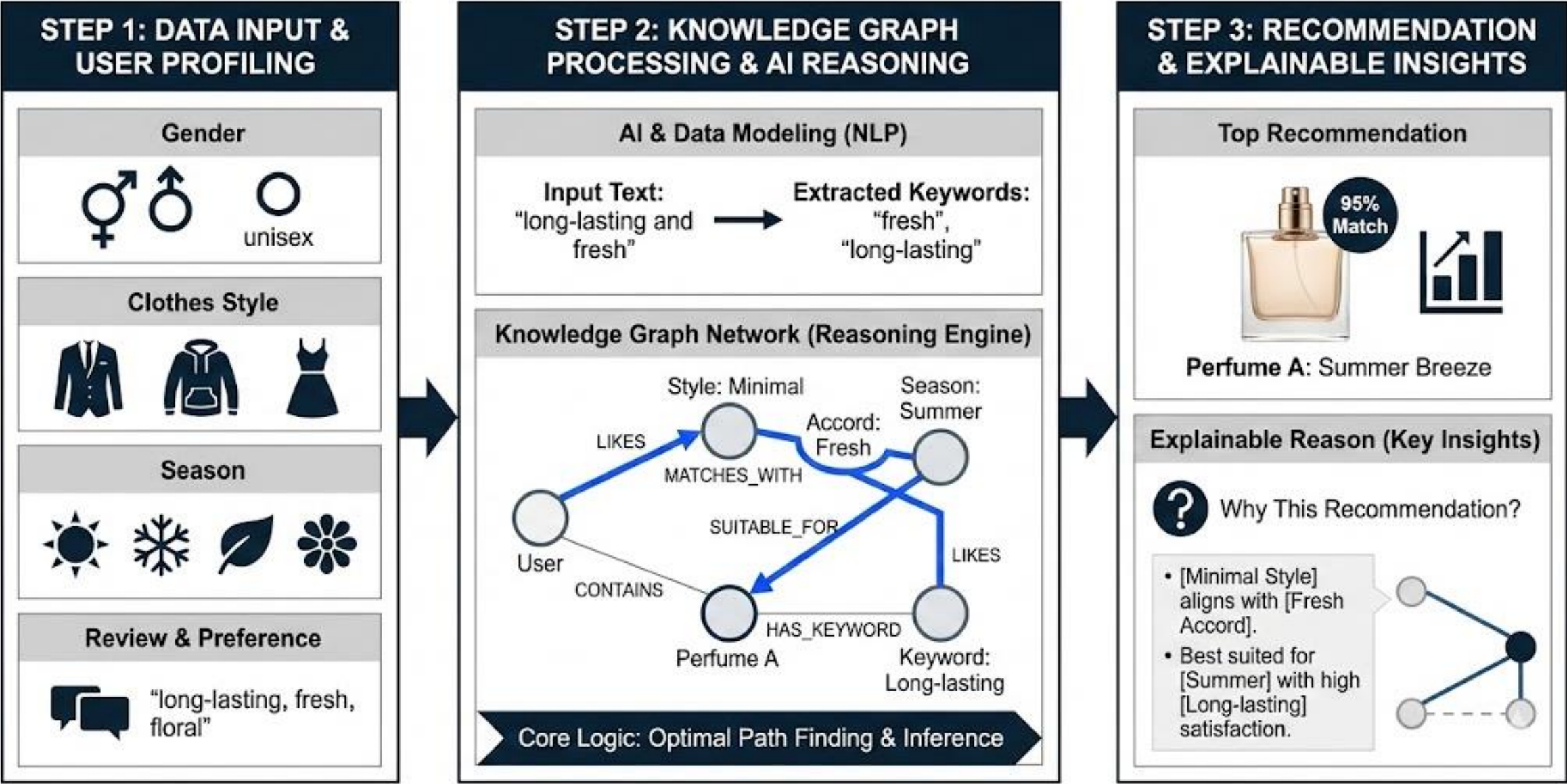




# AI Vision-Based Recommendation Process



# 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