



ADVANCED PYTHON PROGRAMMING

LAB ASSESSMENT 22

WEB APP DEVELOPMENT IN PYTHON USING FLASK

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SKIN CARE PREDICTION AND RECOMMENDATION SYSTEM USING SBERT AND FM MODELS.

MAJOR OBJECTIVE:

The main objective of this project is to develop an intelligent Skin Care Prediction and Recommendation System that leverages SBERT (Sentence-Bidirectional Encoder Representations from Transformers) and Factorization Models to provide personalized cosmetic product suggestions based on individual skin profiles. The system aims to analyse the user's input data — including skin type, concerns, and preferences — and compare it with an existing cosmetic dataset using cosine similarity to measure the closeness between user features and product attributes. By identifying the most similar products in terms of composition and effectiveness, the model recommends the most suitable skincare products for the user. Additionally, the incorporation of factorization models enhances recommendation accuracy by capturing latent relationships and hidden factors influencing user-product interactions. Overall, the objective is to create a data-driven, adaptive, and user-centric skincare recommendation system that

improves the decision-making process for users seeking personalized cosmetic solutions.

KEY TAKEAWAYS:

- The project focuses on developing a Skin Care Prediction and Recommendation System.
- It utilizes SBERT (Sentence-Bidirectional Encoder Representations from Transformers) and Factorization Models.
- Cosine similarity is used to determine the closeness between user input and existing cosmetic product data.
- The system recommends the most suitable skincare products based on user-specific attributes like skin type and concerns.
- Factorization models are employed to uncover hidden patterns and improve recommendation accuracy.
- The goal is to build a personalized, data-driven, and adaptive system for skincare product recommendations.
- The system aims to enhance user experience and assist in informed decision-making for selecting cosmetic products.

CODE:

main.py

```
import os
from fastapi import FastAPI
from fastapi.staticfiles import StaticFiles
from fastapi.responses import FileResponse
from fastapi.middleware.cors import CORSMiddleware
from backend.routes import router as api_router

app = FastAPI()

app.add_middleware(
    CORSMiddleware,
    allow_origins=["*"],
    allow_credentials=True,
    allow_methods=["*"],
    allow_headers=["*"],
)

app.include_router(api_router, prefix="/api")
```

```

BASE_DIR = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
FRONTEND_DIR = os.path.join(BASE_DIR, "frontend")
STATIC_DIR = os.path.join(FRONTEND_DIR, "static")
TEMPLATES_DIR = os.path.join(FRONTEND_DIR, "templates")

app.mount("/static", StaticFiles(directory=STATIC_DIR), name="static")

@app.get("/")
def index():
    return FileResponse(os.path.join(TEMPLATES_DIR, "index.html"))

```

routes.py

```

from fastapi import APIRouter
from backend.services.recommender import recommend_products
from backend.schemas.request_models import RecommendRequest

router = APIRouter()

@router.post("/recommend")
def get_recommendations(req: RecommendRequest):
    results = recommend_products(req)
    return {"recommendations": results}

```

test_verify.py

```

from backend.services.recommender import recommend_products
from backend.schemas.request_models import RecommendRequest

rec = recommend_products()
req = RecommendRequest(
    skin_type="dry",
    concerns=["hydration", "barrier repair"],
    product_type="moisturizer",
    budget_min=300,
    budget_max=1300,
    avoid_ingredients=["fragrance"],
    prefer_ingredients=["ceramide", "hyaluronic acid"],
    top_k=5,
    user_id=None
)
items = rec.recommend(req)
print("Top results (name, price, score):")
for it in items:

```

```
    print(it["name"], it["price"], round(it["score"],4))
```

index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
  <title>Skincare Recommender</title>
  <link rel="stylesheet" href="/static/styles.css">
</head>
<body>
  <div class="container">
    <h1>Find Your Skincare Match</h1>
    <p class="subtitle">No ingredient knowledge needed – answer a few basics and we'll recommend the best fits.</p>

    <form id="rec-form">
      <div class="grid">
        <!-- 1. Product Goal / Type -->
        <label>
          <span>What type of product are you looking for?</span>
          <select name="product_type">
            <option value="">Any</option>
            <option>Cleanser</option>
            <option>Moisturizer</option>
            <option>Serum</option>
            <option>Sunscreen</option>
            <option>Toner</option>
            <option>Face Mask</option>
            <option>Eye Cream</option>
            <option>Other</option>
          </select>
        </label>

        <!-- 2. Skin Type -->
        <label>
          <span>What is your skin type?</span>
          <select name="skin_type">
            <option value="">Not sure</option>
            <option>Dry</option>
            <option>Oily</option>
            <option>Normal</option>
            <option>Combination</option>
            <option>Sensitive</option>
          </select>
        </label>
      </div>
    </form>
  </div>
</body>
```

```
</label>


<label>
    <span>Any skin concerns?</span>
    <select name="concerns" multiple size="5">
        <option>Acne / Breakouts</option>
        <option>Dry patches</option>
        <option>Oiliness / Shine</option>
        <option>Redness / Sensitivity</option>
        <option>Dullness / Uneven tone</option>
    </select>
    <small>Tip: Hold Ctrl/Cmd to select multiple.</small>
</label>


<label>
    <span>What is your budget?</span>
    <select name="budget">
        <option value="">Any</option>
        <option>Less than $10</option>
        <option>$10 - $30</option>
        <option>$30 - $50</option>
        <option>$50+</option>
    </select>
</label>


<label>
    <span>Preferred brand?</span>
    <input name="brand" placeholder="Type brand or leave blank for 'No preference'" />
</label>


<label>
    <span>Ingredient preferences / allergies</span>
    <select name="ingredient_prefs" multiple size="4">
        <option>Fragrance-free</option>
        <option>Paraben-free</option>
        <option>Vegan / Natural</option>
        <option>No preference</option>
    </select>
</label>


<label>
    <span>Specific product name (optional)</span>
```

```

        <input name="product_name" placeholder="e.g., 'Niacinamide Serum'"/>
    </label>

    <!-- 7. Priority / Focus -->
    <label>
        <span>What matters most?</span>
        <select name="priority">
            <option value="">No specific priority</option>
            <option>Hydration / Moisturization</option>
            <option>Anti-aging / Wrinkle reduction</option>
            <option>Oil control / Matte finish</option>
            <option>Brightening / Even skin tone</option>
            <option>Sensitive skin friendly</option>
        </select>
    </label>

    <!-- Top K -->
    <label>
        <span>How many results?</span>
        <select name="top_k">
            <option>5</option>
            <option selected>10</option>
        </select>
    </label>
</div>

<button type="submit">Get Recommendations</button>
</form>

<div id="results" class="cards"></div>
</div>

<script src="/static/app.js"></script>
</body>
</html>

```

styles.css

```

body {
    background-image: url('images.jpg');
    background-size: cover;
    background-position: center;
    background-repeat: no-repeat;
    background-attachment: fixed;
    color: #e0e0ff;
}

```

```
    font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;
}

header {
    background: rgba(30, 30, 47, 0.8);
    backdrop-filter: blur(10px);
    border-radius: 20px;
    padding: 2rem;
    margin-bottom: 2rem;
    box-shadow: 0 8px 32px rgba(0, 0, 0, 0.7);
}

h1 {
    background: linear-gradient(45deg, #a855f7, #7c3aed);
    -webkit-background-clip: text;
    -webkit-text-fill-color: transparent;
    background-clip: text;
    text-shadow: 0 2px 4px rgba(0, 0, 0, 0.5);
}

.bg-white.rounded-lg.shadow-lg {
    background: rgba(30, 30, 47, 0.85);
    backdrop-filter: blur(10px);
    border: 1px solid rgba(168, 85, 247, 0.3);
    box-shadow: 0 8px 32px rgba(0, 0, 0, 0.7);
    color: #dcfcff;
}

select, input {
    background-color: #2a2a3d;
    color: #e0e0ff;
    border-radius: 10px;
    border: 1px solid #5a4a9a;
    transition: all 0.3s ease;
}

select:focus, input:focus {
    transform: translateY(-2px);
    box-shadow: 0 4px 12px rgba(168, 85, 247, 0.6);
    outline: none;
}

button[type="submit"] {
    background: linear-gradient(45deg, #a855f7, #7c3aed);
    border: none;
    border-radius: 25px;
    font-weight: 600;
    letter-spacing: 0.5px;
```

```
        transition: all 0.3s ease;
        color: white;
    }

button[type="submit"]:hover {
    background: linear-gradient(45deg, #9333ea, #6d28d9);
    transform: translateY(-2px);
    box-shadow: 0 6px 20px rgba(168, 85, 247, 0.7);
}

.bg-gradient-to-r.from-purple-50.to-pink-50 {
    background: linear-gradient(135deg, #2a2a3d 0%, #3a2a3d 100%);
    border: 1px solid rgba(168, 85, 247, 0.5);
    border-radius: 15px;
    transition: all 0.3s ease;
    color: #dcfcff;
}

.bg-gradient-to-r.from-purple-50.to-pink-50:hover {
    transform: translateY(-5px);
    box-shadow: 0 10px 25px rgba(168, 85, 247, 0.8);
}

h3 {
    color: #cbb4f9;
    font-weight: 700;
}

@media (max-width: 768px) {
    .container {
        padding: 1rem;
    }

    header {
        padding: 1.5rem;
    }

    h1 {
        font-size: 2rem;
    }
}

@keyframes fadeIn {
    from { opacity: 0; transform: translateY(20px); }
    to { opacity: 1; transform: translateY(0); }
}

.container {
```

```

        animation: fadeIn 0.8s ease-out;
    }

::-webkit-scrollbar {
    width: 8px;
}

::-webkit-scrollbar-track {
    background: #1e1e2f;
}

::-webkit-scrollbar-thumb {
    background: linear-gradient(45deg, #a855f7, #7c3aed);
    border-radius: 4px;
}

::-webkit-scrollbar-thumb:hover {
    background: linear-gradient(45deg, #9333ea, #6d28d9);
}

```

app.py

```

from flask import Flask, render_template, request
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler
from sklearn.metrics.pairwise import cosine_similarity
from sentence_transformers import SentenceTransformer

app = Flask(__name__)
df = pd.read_csv("C:/Users/gokul/OneDrive/Desktop/cosmetics.csv")

skin_cols = ["Combination", "Dry", "Normal", "Oily", "Sensitive"]
df = df[df[skin_cols].sum(axis=1) > 0].reset_index(drop=True)

def build_text(row):
    parts = []
    if pd.notna(row["Label"]): parts.append(str(row["Label"]))
    if pd.notna(row["Brand"]): parts.append(str(row["Brand"]))
    if pd.notna(row["Name"]): parts.append(str(row["Name"]))
    if pd.notna(row["Ingredients"]): parts.append(str(row["Ingredients"]))
    return " || ".join(parts)

df["text"] = df.apply(build_text, axis=1)
texts = df["text"].tolist()
model = SentenceTransformer("all-MiniLM-L6-v2")

```

```

embeddings = model.encode(
    texts, batch_size=64, convert_to_numpy=True, normalize_embeddings=True
)
extra_cols = ["Price", "Rank"]
numX = df[extra_cols].fillna(df[extra_cols].median()).to_numpy(dtype=float)
scaler = StandardScaler().fit(numX)
numX = scaler.transform(numX)
X = np.hstack([embeddings, numX])
@app.route("/", methods=["GET", "POST"])
def index():
    recommendations = []
    if request.method == "POST":
        skin_type = request.form["skin_type"]
        skin_concern = request.form["skin_concern"]
        product_type = request.form["product_type"]
        avoid_ingredients = request.form["avoid_ingredients"]
        budget_range = request.form["budget_range"]
        product_format = request.form["product_format"]
        user_query = (
            f"Skin type: {skin_type}. "
            f"Concern: {skin_concern}. "
            f"Product: {product_type}. "
            f"Avoid ingredients: {avoid_ingredients}. "
            f"Budget: {budget_range}. "
            f"Format: {product_format}."
        )
        query_emb = model.encode(
            [user_query], convert_to_numpy=True, normalize_embeddings=True
        )
        sims = cosine_similarity(query_emb, embeddings)[0]
        top_idx = np.argsort(-sims)[:5]
        for i in top_idx:
            recommendations.append({
                "Product": df.iloc[i]["Name"],
                "Brand": df.iloc[i]["Brand"],
                "Similarity": round(sims[i], 3)
            })
    return render_template("index.html", recommendations=recommendations)

if __name__ == "__main__":
    app.run(debug=True)

```

OUTPUT SCREENSHOT

USER INPUT 1:

The screenshot shows a web browser window at 127.0.0.1:5000. The title bar reads "Skincare Product Recommendation System". Below the title, a subtitle says "Find the perfect skincare products tailored to your needs". The main form contains the following input fields:

- Skin Type: Oily
- Skin Concern: Dryness
- Product Type: Sunscreen
- Avoid Ingredients: alcohol
- Budget Range: ₹1000 - ₹2000
- Product Format: Cream

A purple "Get Recommendations" button is centered below the input fields.

RECOMMENDATION:

The screenshot shows the same web browser window after the "Get Recommendations" button was clicked. The input fields remain the same as in the previous screenshot. Below the input fields, a section titled "Top 5 Recommended Products" displays five items:

Product Name	Brand	Similarity
BB Tinted Treatment 12-Hour Primer Broad Spectrum SPF 30 Sunscreen	TARTE	0.623
Lingerie de Peau BB Cream	GUERLAIN	0.555
Ultra Facial Moisturizer SPF 30	KIEHL'S SINCE 1851	0.558
Your Skin But Better™ CC+™ Cream with SPF 50+	IT COSMETICS	0.542
BB Cream SPF 35	BOBBI BROWN	0.539

USER INPUT 2:

The screenshot shows a web browser window with the URL 127.0.0.1:5000. The title of the page is "Skincare Product Recommendation System". Below the title, a sub-header says "Find the perfect skincare products tailored to your needs". There are four dropdown menus for filtering products: "Skin Type" (set to "Sensitive"), "Skin Concern" (set to "Dryness"), "Product Type" (set to "Serum"), and "Budget Range" (set to "₹500 - ₹1000"). To the right of the "Product Type" dropdown is a text input field labeled "Avoid Ingredients" containing "alcohol". Below these filters is a "Get Recommendations" button.

RECOMMENDATION:

The screenshot shows the same web browser window after the "Get Recommendations" button was clicked. The "Budget Range" and "Product Format" dropdowns remain the same as in the previous screenshot. Below them is another "Get Recommendations" button. To the right, a section titled "Top 5 Recommended Products" displays five items in cards:

- Perfect Canvas Skin Finishing Serum
Brand: REN CLEAN SKINCARE
Similarity: 0.536
- BB Tinted Treatment 12-Hour Primer Broad Spectrum SPF 30 Sunscreen
Brand: TARTE
Similarity: 0.52
- Ready Steady Glow Daily AHA Tonic
Brand: REN CLEAN SKINCARE
Similarity: 0.517
- Benefiance WrinkleResist24 Night Cream
Brand: SHISEIDO
Similarity: 0.507
- Lingerie de Peau BB Cream
Brand: GUERLAIN
Similarity: 0.505

USER INPUT 3:

The screenshot shows a web browser window with the URL 127.0.0.1:5000. The title of the page is "Skincare Product Recommendation System". Below the title, a sub-header says "Find the perfect skincare products tailored to your needs". There are four input fields in a grid:

- Skin Type: Combination
- Skin Concern: Wrinkles / Anti-aging
- Product Type: Toner
- Avoid Ingredients: alcohol
- Budget Range: ₹500 - ₹1000
- Product Format: Foam

Below these fields is a purple "Get Recommendations" button.

RECOMMENDATION:

The screenshot shows the same web browser window after the "Get Recommendations" button was clicked. The title "Skincare Product Recommendation System" is still visible at the top. Below it, the "Top 5 Recommended Products" section is displayed:

Product Name	Brand	Similarity
Essential Power Skin Toner for Combination to Oily Skin	LANEIGE	0.567
BB Tinted Treatment 12-Hour Primer Broad Spectrum SPF 30 Sunscreen	TARTE	0.549
Lingerie de Peau BB Cream	GUERLAIN	0.536
Ultra Facial Moisturizer SPF 30	KIEHL'S SINCE 1851	0.502
Ultra Facial Toner	KIEHL'S SINCE 1851	0.501

The screenshot shows a code editor interface with the following details:

- EXPLORER** panel: Shows a project structure for "SKINCAREWEB" with files: templates, images.jpg, index.html, style.css, and app.py.
- TERMINAL** panel: Displays the command "python app.py" and its output, which shows multiple requests from 127.0.0.1 to the application, indicating it is running locally.
- OUTPUT**, **DEBUG CONSOLE**, and **PROBLEMS** panels are also visible at the bottom.

```

from flask import Flask, render_template, request
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler
from sklearn.metrics.pairwise import cosine_similarity
from sentence_transformers import SentenceTransformer

app = Flask(__name__)
df = pd.read_csv("C:/Users/gokul/OneDrive/Desktop/cosmetics.csv")
skin_cols = ["Combination", "Dry", "Normal", "Oily", "Sensitive"]
df = df[df[skin_cols].sum(axis=1) > 0].reset_index(drop=True)

def build_text(row):
    parts = []
    if pd.notna(row["Label"]): parts.append(str(row["Label"]))
    if pd.notna(row["Brand"]): parts.append(str(row["Brand"]))
    if pd.notna(row["Name"]): parts.append(str(row["Name"]))
    if pd.notna(row["Ingredients"]): parts.append(str(row["Ingredients"]))
    return " ".join(parts)

```

DEPLOYMENT IN NGROK SERVER

The screenshot shows a code editor interface with the following details:

- EXPLORER** panel: Shows a project structure for "SKINCAREWEB" with files: templates, images.jpg, index.html, style.css, and app.py.
- TERMINAL** panel: Displays the command "ngrok http 5000" and its output, showing session details and forwarding information.
- OUTPUT**, **DEBUG CONSOLE**, and **PROBLEMS** panels are also visible at the bottom.

```

Session Status      online
Account            Gokulesh (Plan: Free)
Update             update available (version 3.32.0, Ctrl-U to update)
Version            3.24.0-msix
Region             India (in)
Latency            25ms
Web Interface     http://127.0.0.1:4040
Forwarding         https://rosetta-unsubmergible-ungloomily.ngrok-free.dev -> http://localhost:5000

```

The screenshot shows a code editor interface with the following details:

- EXPLORER** panel: Shows a project structure for "SKINCAREWEB" with files: templates, images.jpg, index.html, style.css, and app.py.
- TERMINAL** panel: Displays the command "ngrok http 5000" and its output, showing session details and forwarding information.
- OUTPUT**, **DEBUG CONSOLE**, and **PROBLEMS** panels are also visible at the bottom.

```

Session Status      online
Account            Gokulesh (Plan: Free)
Update             update available (version 3.32.0, Ctrl-U to update)
Version            3.24.0-msix
Region             India (in)
Latency            31ms
Web Interface     http://127.0.0.1:4040
Forwarding         https://rosetta-unsubmergible-ungloomily.ngrok-free.dev -> http://localhost:5000

```

AFTER DEPLOYMENT:

The screenshot shows a web browser window with the URL `rosetta-unsubmergible-ungloomily.ngrok-free.dev` in the address bar. The page title is "Skincare Product Recommendation System". Below the title, a sub-header says "Find the perfect skincare products tailored to your needs". The main content area contains several input fields for filtering product recommendations:

- Skin Type:** A dropdown menu showing "Oily".
- Skin Concern:** A dropdown menu showing "Acne".
- Product Type:** A dropdown menu showing "Moisturizer".
- Avoid Ingredients:** A text input field containing "e.g., Alcohol, Paraben".
- Budget Range:** A dropdown menu showing "₹500 - ₹1000".
- Product Format:** A dropdown menu showing "Cream".

At the bottom center of the form is a purple button labeled "Get Recommendations".

WEBSITE LINK:

<https://rosetta-unsubmergible-ungloomily.ngrok-free.dev/>