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Mini-Projet TP Technique D'indexation

1/ L'importation des bibliothèques nécessaires tkinter(l'interface graphique), PIL… :

```
import tkinter as tk
from tkinter import filedialog, ttk
from PIL import Image, ImageTk
import cv2
import numpy as np
from sklearn.neighbors import NearestNeighbors
from tensorflow.keras.applications.vgg16 import VGG16,preprocess_input
from tensorflow.keras.preprocessing import image
import os
```

2/ Développement de l'interface graphique avec tkinter

```
class ImageSearchApp:
    def __init__(self, root):
        self.root = root
        self.root.title("Image Search Engine")
        self.root.geometry("1200x800")

        # Image database
        self.images = []
        self.filenames = []
        self.features = {}
        self.nbrs = {}

        # UI Setup
        self.setup_ui()

        # Load VGG16 model
        self.vgg_model = VGG16(weights='imagenet', include_top=False, pooling='avg')

    def setup_ui(self):
        # Left panel - Controls
        control_frame = tk.Frame(self.root, width=300, bg="#f0f0f0")
        control_frame.pack(side=tk.LEFT, fill=tk.Y, padx=10, pady=10)

        # Database controls
        db_frame = tk.LabelFrame(control_frame, text="Image Database", bg="#f0f0f0")
        db_frame.pack(fill=tk.X, pady=5)

        tk.Button(db_frame, text="Load Image Folder", command=self.load_image_folder).pack(fill=tk.X, pady=5)
        tk.Button(db_frame, text="Build Indexes", command=self.build_indexes).pack(fill=tk.X, pady=5)

    # Search controls
    search_frame = tk.LabelFrame(control_frame, text="Search", bg="#f0f0f0")
    search_frame.pack(fill=tk.X, pady=5)

    self.descriptor_var = tk.StringVar(value="color_histogram")
    ttk.Combobox(search_frame, textvariable=self.descriptor_var,
                 values=["color_histogram", "sift", "vgg16"]).pack(fill=tk.X, pady=5)

    tk.Button(search_frame, text="Select Query Image", command=self.select_query_image).pack(fill=tk.X, pady=5)

    # Status bar
    self.status_var = tk.StringVar()
    tk.Label(control_frame, textvariable=self.status_var, bg="#f0f0f0", anchor="w").pack(fill=tk.X, pady=10)

    # Right panel - Results
    result_frame = tk.Frame(self.root)
    result_frame.pack(side=tk.RIGHT, fill=tk.BOTH, expand=True, padx=10, pady=10)

    # Query image display
    self.query_label = tk.Label(result_frame, text="Query Image", relief=tk.SUNKEN)
    self.query_label.pack(fill=tk.X, pady=5)

    # Results display
    results_title = tk.Label(result_frame, text="Top 5 Similar Images")
    results_title.pack(fill=tk.X)
```

3/ Les méthodes pour le chargement des images :

```python
def load_image_folder(self):
    folder_path = filedialog.askdirectory()
    if folder_path:
        self.images, self.filenames = self.load_images(folder_path)
        self.status_var.set(f"Loaded {len(self.images)} images from {folder_path}")

def load_images(self, directory, target_size=(224, 224)):
    images = []
    filenames = []
    for filename in os.listdir(directory):
        if filename.lower().endswith(('.png', '.jpg', '.jpeg')):
            img_path = os.path.join(directory, filename)
            img = cv2.imread(img_path)
            img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
            img = cv2.resize(img, target_size)
            images.append(img)
            filenames.append(filename)
    return np.array(images), filenames
```

4/ La Construction des indexes avec le dossier des images qu'on a sélectionné

```python
    def build_indexes(self):
        if len(self.images) == 0:
            self.status_var.set("Error: No images loaded!")
            return

        self.status_var.set("Building indexes...")
        self.root.update_idletasks()

        # Color Histogram
        self.features["color_histogram"] = self.color_histogram(self.images)
        self.nbrs["color_histogram"] = NearestNeighbors(n_neighbors=5, metric='cosine').fit(
            self.features["color_histogram"])

        # VGG16
        self.features["vgg16"] = self.extract_vgg_features(self.images)
        self.nbrs["vgg16"] = NearestNeighbors(n_neighbors=5, metric='cosine').fit(
            self.features["vgg16"])

        self.status_var.set("Indexes built successfully!")

    def color_histogram(self, images):
        histograms = []
        for img in images:
            hist = cv2.calcHist([img], [0, 1, 2], None, [8, 8, 8], [0, 256, 0, 256, 0, 256])
            hist = cv2.normalize(hist, hist).flatten()
            histograms.append(hist)
        return np.array(histograms)
```

5/ La Sélection de l’image à rechercher

```
def select_query_image(self):
    if len(self.images) == 0:
        self.status_var.set("Error: Please load image database first!")
        return

    file_path = filedialog.askopenfilename(filetypes=[("Image files", "*.jpg *.jpeg *.png")])
    if file_path:
        self.search_similar_images(file_path)
```

6/ Recherche des deux images similaires :

```
def search_similar_images(self, query_path):
    descriptor_type = self.descriptor_var.get()

    # Load and process query image
    query_img = cv2.imread(query_path)
    query_img = cv2.cvtColor(query_img, cv2.COLOR_BGR2RGB)
    query_img = cv2.resize(query_img, (224, 224))

    # Display query image
    self.display_image(query_img, self.query_label)

    # Extract features based on descriptor type
    if descriptor_type == "color_histogram":
        query_feat = self.color_histogram([query_img])[0]
    elif descriptor_type == "vgg16":
        query_feat = self.extract_vgg_features([query_img])[0]

    # Find similar images
    distances, indices = self.nbrs[descriptor_type].kneighbors([query_feat])

    # Display results
    for i, (idx, dist) in enumerate(zip(indices[0], distances[0])):
        if i < 5:  # Show top 5 results
            result_img = self.images[idx]
            self.display_image(result_img, self.result_labels[i],
                               f"Similarity: {1-dist:.2f}")
```

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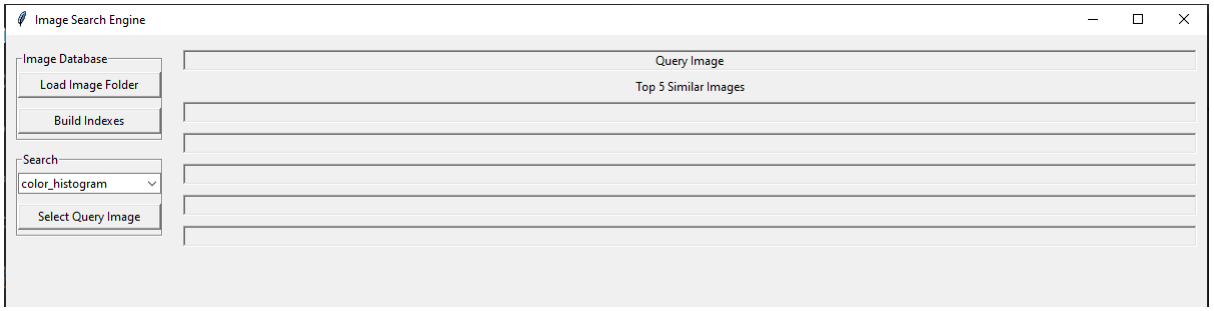
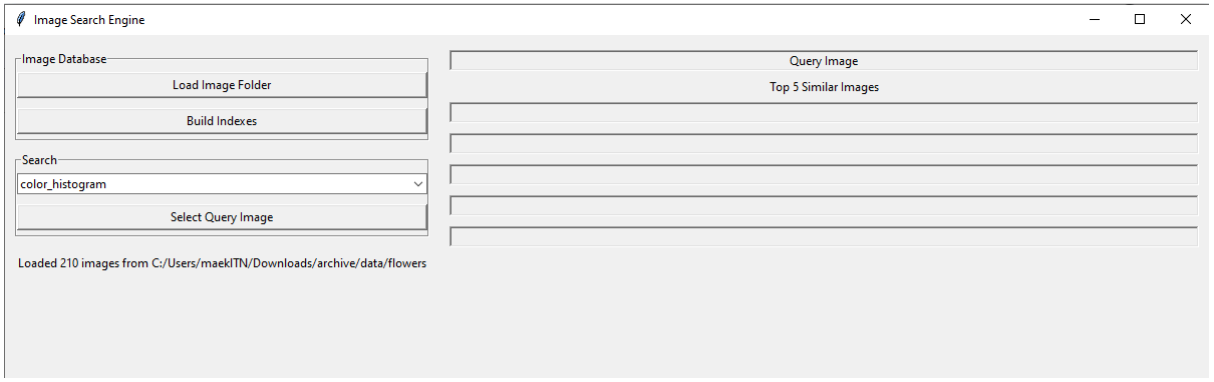
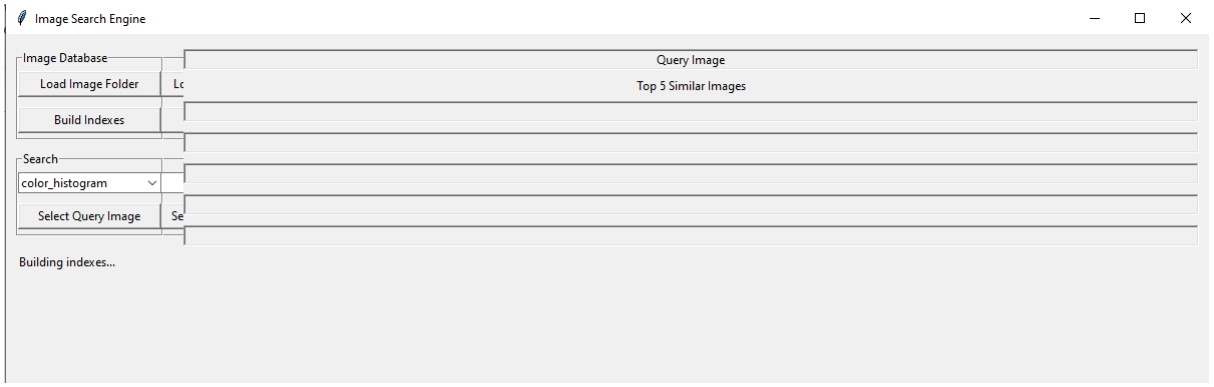
L’interface graphique principale de l’application :

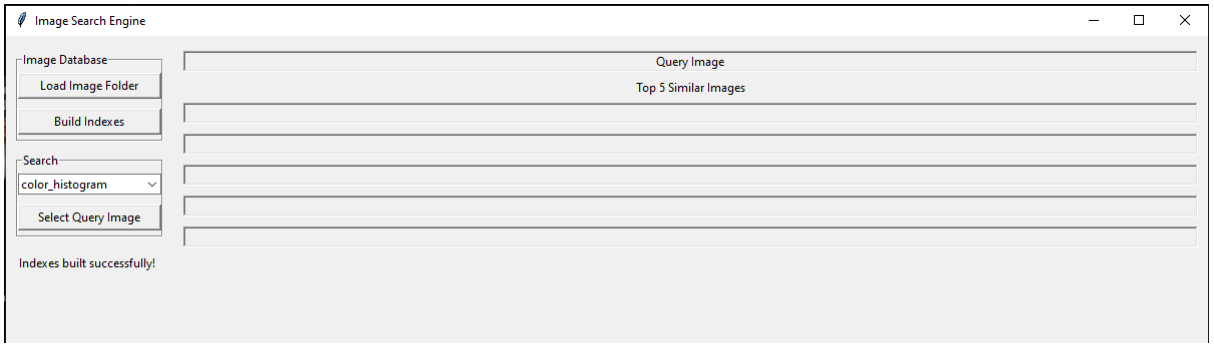


Le processus de chargement des images :



La Construction des indices à partir du dossier des images sélectionné :





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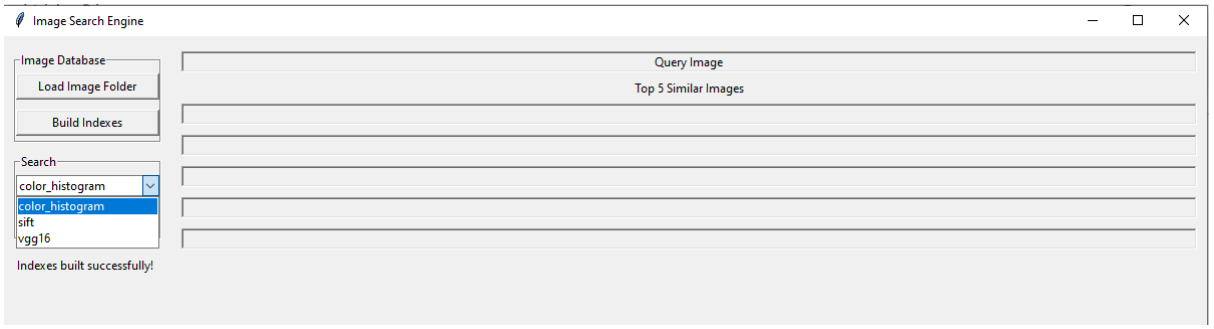
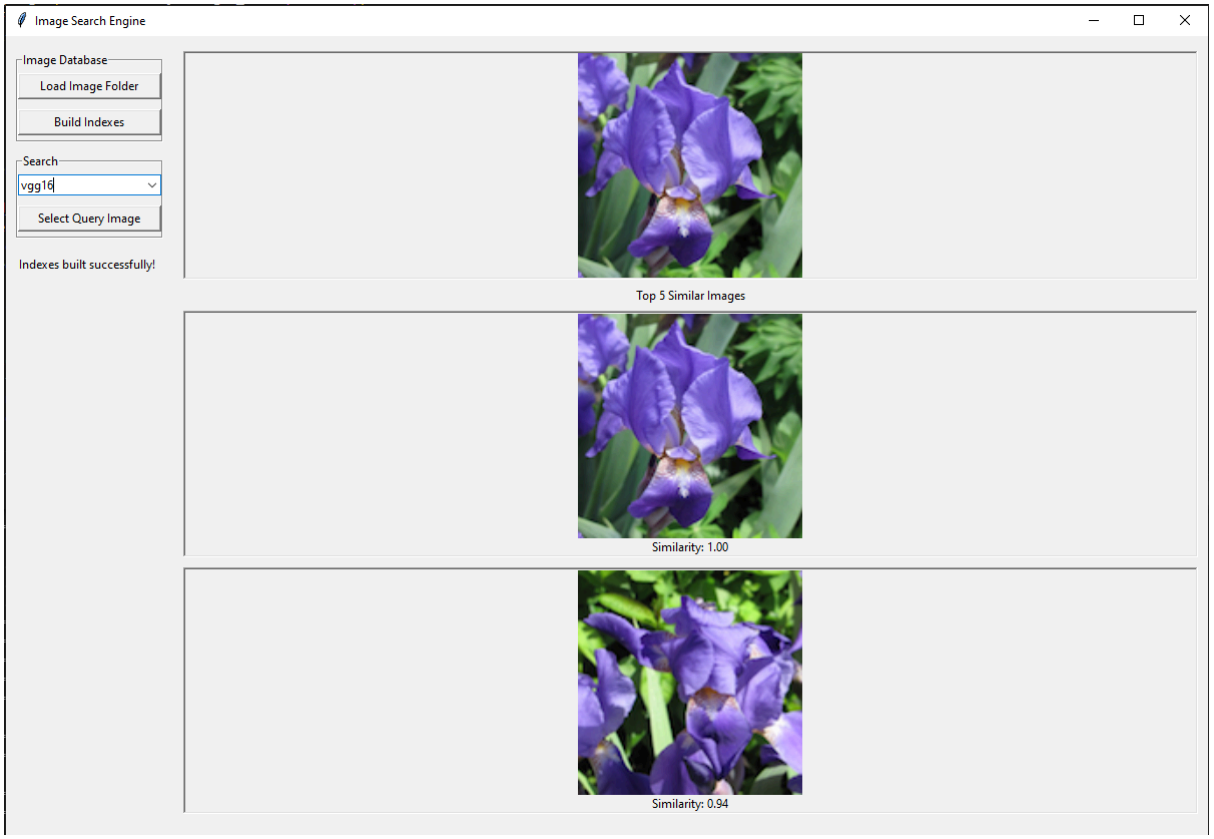
Le choix du modèle de recherche soit par l'historgramme de couleur soit par le modele VGG16



Les résultats de la recherche avec le modèle VGG16



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Les resultats de recherche avec l’histogramme de couleur des images