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import cv2
import numpy as np
from skimage import exposure
from tkinter import *
from tkinter import filedialog
from PIL import Image, ImageTk
import matplotlib.pyplot as plt

# --- setup GUI utama ---
root = Tk()
root.title("GUI Perbaikan Kualitas Citra (Histogram Equalization &
Specification)")
root.geometry("900x700")
root.configure(bg="white")

lbl_title = Label(root, text="Perbaikan Kualitas Citra", font=("Arial",
18, "bold"), bg="white")
lbl_title.pack(pady=10)

panel = Label(root, bg="white")
panel.pack(pady=10)

img_original = None

# --- fungsi upload ---
def upload_image():
    global img_original
    file_path = filedialog.askopenfilename()
    if file_path:
        img = cv2.imread(file_path, cv2.IMREAD_GRAYSCALE)
        img_original = img
        show_image(img)

def show_image(img):
    img_rgb = cv2.cvtColor(img, cv2.COLOR_GRAY2RGB)
    img_pil = Image.fromarray(img_rgb)
    img_tk = ImageTk.PhotoImage(img_pil)
    panel.configure(image=img_tk)
    panel.image = img_tk

# --- fungsi perataan histogram ---
def equalize_hist():
    global img_original
    if img_original is not None:
        eq = cv2.equalizeHist(img_original)
        show_image(eq)
        show_histogram(eq, title="Histogram Setelah Perataan")

# --- fungsi spesifikasi histogram ---
def match_hist():
    global img_original
    ref_path = filedialog.askopenfilename(title="Pilih Gambar
Referensi")
    if img_original is not None and ref_path:
        ref = cv2.imread(ref_path, cv2.IMREAD_GRAYSCALE)
        matched = exposure.match_histograms(img_original, ref)
        matched = np.uint8(np.clip(matched, 0, 255))
```

```
        show_image(matched)
        show_histogram(matched, title="Histogram Setelah Spesifikasi")

# --- fungsi tampilkan histogram ---
def show_histogram(img=None, title="Histogram"):
    if img is None:
        img = img_original
    plt.figure(figsize=(6,4))
    plt.title(title)
    plt.xlabel("Intensitas")
    plt.ylabel("Frekuensi")
    plt.hist(img.ravel(), 256, [0,256])
    plt.show()

# --- tombol kontrol ---
btn_frame = Frame(root, bg="white")
btn_frame.pack(pady=10)

Button(btn_frame, text="Upload Citra", command=upload_image,
bg="#0078D7", fg="white", width=20).grid(row=0, column=0, padx=5)
Button(btn_frame, text="Perataan Histogram", command=equalize_hist,
bg="#0078D7", fg="white", width=20).grid(row=0, column=1, padx=5)
Button(btn_frame, text="Spesifikasi Histogram", command=match_hist,
bg="#0078D7", fg="white", width=20).grid(row=0, column=2, padx=5)
Button(btn_frame, text="Tampilkan Histogram", command=lambda:
show_histogram(), bg="#0078D7", fg="white", width=20).grid(row=0,
column=3, padx=5)

root.mainloop()
```