UNIVERSIDAD POLITÉCNICA SALESIANA ECUADOR

PRÁCTICA DE LABORATORIO

CARRERA: Ingenieria en Ciencias de la Computacion		**ASIGNATURA**: Computacion Paralela
NRO. PRÁCTICA:	5	**TÍTULO PRÁCTICA**: Examen Interciclo

OBJETIVO ALCANZADO:

Consumir la aplicación dockerizada mediante una aplicación de android

ACTIVIDADES DESARROLLADAS

1. **Seleccionar tres filtros para aplicar a imágenes**

a) **Anamorphic**
Modifica las proporciones de la imagen, estirándola horizontalmente para replicar el efecto de las lentes anamórficas utilizadas en cine, lo que proporciona una apariencia más amplia y cinematográfica.

b) **Sepia**
Aplica un tono marrón cálido uniforme a toda la imagen, imitando el aspecto de las fotografías antiguas y dándole un aire nostálgico o retro.

c) **Sobremontado de imagen en el centro de otra**
Superpone múltiples imágenes o elementos gráficos sobre una imagen principal, creando un efecto visual compuesto que puede añadir profundidad, contexto o un diseño artístico más complejo.

2. **Codigo utilizado para aplicar los filtros**

a) **APP.PY**

```
from flask import Flask
import os

import logging

import firebase_admin

from firebase_admin import credentials, firestore

from flask_jwt_extended import JWTManager



# Configuración de logging

logging.basicConfig(level=logging.DEBUG)
```

```
# Inicializar Firebase Admin
cred = credentials.Certificate('proyectoflask-47f4f-firebase-adminsdk-l8uq4-3b36e0d55f.json')
firebase_admin.initialize_app(cred)

# Obtén una referencia a la base de datos Firestore
db = firestore.client()

def create_app():
    app = Flask(__name__)

    # Configurar la clave secreta para JWT
    app.config['JWT_SECRET_KEY'] = os.getenv('JWT_SECRET_KEY', 'password')

    # Inicializar JWT Manager
    jwt = JWTManager(app)

    # Importar y registrar los blueprints
    from .views import app_views  # Importación relativa porque `views.py` está en el mismo directorio
    app.register_blueprint(app_views, url_prefix='/api')

    return app

# Crear instancia de la aplicación
app = create_app()

if __name__ == '__main__':
    app.run(debug=True, host='0.0.0.0', port=5000)
```

b) Filters.py

```
import os
from PIL import Image

import numpy as np

import pycuda.driver as cuda

from pycuda.compiler import SourceModule


def apply_sepia(input_image, intensity=2.0, add_noise=True, vignette=True):

    input_array = np.array(input_image).astype(np.float32) / 255.0

    output_array = np.zeros_like(input_array)


    cuda.init()

    device = cuda.Device(0)

    context = device.make_context()


    try:

        mod = SourceModule("""

        _global_ void sepia_kernel(float *d_image, float *d_result, int width, int height,
float intensity) {

            int x = threadIdx.x + blockIdx.x * blockDim.x;

            int y = threadIdx.y + blockIdx.y * blockDim.y;

            int idx = (y * width + x) * 3;

            if (x < width && y < height) {

                float r = d_image[idx];

                float g = d_image[idx + 1];

                float b = d_image[idx + 2];

                float new_r = min(intensity * (0.393f * r + 0.769f * g + 0.189f * b), 1.0f);
```

```
                float new_g = min(intensity * (0.349f * r + 0.686f * g + 0.168f * b), 1.0f);
                float new_b = min(intensity * (0.272f * r + 0.534f * g + 0.131f * b), 1.0f);
                d_result[idx] = new_r;
                d_result[idx + 1] = new_g;
                d_result[idx + 2] = new_b;
            }
        }
        """)
        sepia_kernel = mod.get_function("sepia_kernel")
        sepia_kernel(
            cuda.In(input_array), cuda.Out(output_array),
            np.int32(input_image.width), np.int32(input_image.height), np.float32(intensity),
            block=(16,    16,    1),    grid=(int((input_image.width    +    15)    //    16),
int((input_image.height + 15) // 16))
        )

        if add_noise:
            noise             =             np.random.normal(loc=0.0,             scale=0.05,
size=output_array.shape).astype(np.float32)
            output_array += noise

        if vignette:
            center_x, center_y = input_image.width / 2, input_image.height / 2
            max_radius = np.sqrt(center_x*2 + center_y*2)
            for y in range(input_image.height):
                for x in range(input_image.width):
                    radius = np.sqrt((x - center_x) * 2 + (y - center_y) * 2)
                    scale = radius / max_radius
                    output_array[y, x] *= (1 - scale * 0.5)
```

```
        output_image = Image.fromarray(np.uint8(output_array * 255))
        return output_image
    finally:
        context.pop()
def apply_anamorphic(input_image):
    input_array = np.array(input_image).astype(np.float32) / 255.0
    output_array = np.zeros_like(input_array)

    cuda.init()
    device = cuda.Device(0)
    context = device.make_context()

    try:
        mod = SourceModule("""
        __global__ void anamorphic_kernel(float *d_image, float *d_result, int width, int
height) {
            int x = threadIdx.x + blockIdx.x * blockDim.x;
            int y = threadIdx.y + blockIdx.y * blockDim.y;
            int idx = (y * width + x) * 3;
            float brightness = 0.299f * d_image[idx] + 0.587f * d_image[idx + 1] + 0.114f *
d_image[idx + 2];
            if (brightness > 0.55) {  // Only apply effect to bright areas
                float effect_strength = 1.5;
                int spread = 25;  // Spread effect to 25 pixels on either side
                for (int i = -spread; i <= spread; i++) {
                    int new_x = x + i;
                    if (new_x >= 0 && new_x < width) {
                        int new_idx = (y * width + new_x) * 3;
```

```
                        atomicAdd(&d_result[new_idx], d_image[idx] * effect_strength / (spread
* 2));
                        atomicAdd(&d_result[new_idx + 1], d_image[idx + 1] * effect_strength /
(spread * 2));
                        atomicAdd(&d_result[new_idx + 2], d_image[idx + 2] * effect_strength /
(spread * 2));
                    }
                }
            } else {
                d_result[idx] = d_image[idx];
                d_result[idx + 1] = d_image[idx + 1];
                d_result[idx + 2] = d_image[idx + 2];
            }
        }
        """)
        anamorphic_kernel = mod.get_function("anamorphic_kernel")
        anamorphic_kernel(
            cuda.In(input_array), cuda.Out(output_array),
            np.int32(input_image.width), np.int32(input_image.height),
            block=(16,    16,    1),    grid=(int((input_image.width    +    15)    //    16),
int((input_image.height + 15) // 16))
        )
        output_image = Image.fromarray(np.uint8(output_array * 255))
        return output_image
    finally:
        context.pop()


import pycuda.autoinit
import pycuda.driver as cuda
import numpy as np
```

```
from pycuda.compiler import SourceModule

from PIL import Image

import os


def apply_logo(input_image):

    input_array = np.array(input_image).astype(np.float32) / 255.0

    logo_path     =     os.path.join(os.path.dirname(os.path.dirname(__file__)),     'static',
'logoups.jpeg')

    logo_image = Image.open(logo_path).convert('RGBA').resize((150, 150))

    logo_array = np.array(logo_image).astype(np.float32) / 255.0


    output_array = np.zeros_like(input_array)


    cuda.init()

    device = cuda.Device(0)

    context = device.make_context()


    try:

        mod = SourceModule("""

        __global__  void  logo_kernel(float  *d_image,  float  *d_logo,  float  *d_result,  int
img_width, int img_height, int logo_width, int logo_height) {

            int x = threadIdx.x + blockIdx.x * blockDim.x;

            int y = threadIdx.y + blockIdx.y * blockDim.y;


            if (x < img_width && y < img_height) {

                int idx = (y * img_width + x) * 3;

                d_result[idx] = d_image[idx];  // Copy RGB directly

                d_result[idx + 1] = d_image[idx + 1];

                d_result[idx + 2] = d_image[idx + 2];
```

```
                // Coordinates to center the logo
                int cx = (img_width - logo_width) / 2;
                int cy = (img_height - logo_height) / 2;

                if (x >= cx && x < (cx + logo_width) && y >= cy && y < (cy + logo_height)) {
                    int logo_idx = ((y - cy) * logo_width + (x - cx)) * 4;  // Logo has alpha channel
                    float alpha = d_logo[logo_idx + 3];
                    // Blend with alpha
                    d_result[idx] = alpha * d_logo[logo_idx] + (1 - alpha) * d_result[idx];
                    d_result[idx + 1] = alpha * d_logo[logo_idx + 1] + (1 - alpha) * d_result[idx + 1];
                    d_result[idx + 2] = alpha * d_logo[logo_idx + 2] + (1 - alpha) * d_result[idx + 2];
                }
            }
        }
        """)
        logo_kernel = mod.get_function("logo_kernel")
        logo_kernel(
            cuda.In(input_array), cuda.In(logo_array), cuda.Out(output_array),
            np.int32(input_image.width), np.int32(input_image.height),
            np.int32(logo_image.width), np.int32(logo_image.height),
            block=(16, 16, 1), grid=(int((input_image.width + 15) // 16), int((input_image.height + 15) // 16))
        )
        output_image = Image.fromarray(np.uint8(output_array * 255))
        return output_image
    finally:
```

```
        context.pop()


def apply_filter(image, filter_type):
    if filter_type == 'sepia':
        return apply_sepia(image)
    elif filter_type == 'anamorphic':
        return apply_anamorphic(image)
    elif filter_type == 'logo':
        return apply_logo(image)
    else:
        raise ValueError("Unknown filter type")
```

c) VIEWS.PY

```
from flask import Blueprint, request, jsonify
from werkzeug.security import generate_password_hash, check_password_hash
from flask_jwt_extended import create_access_token, jwt_required, get_jwt_identity
from PIL import Image
import io
import firebase_admin
from firebase_admin import firestore
from .filters import apply_filter


db = firestore.client()
app_views = Blueprint('app_views', __name__)


@app_views.route('/upload', methods=['POST'])
def upload_image():
    filter_type = request.form.get('filter', 'sepia')
```

```
    image_file = request.files['image']
    if not image_file:
        return jsonify({'error': 'No image file provided'}), 400

    image = Image.open(image_file.stream)
    filtered_image = apply_filter(image, filter_type)
    img_byte_arr = io.BytesIO()
    filtered_image.save(img_byte_arr, format='JPEG')
    img_byte_arr.seek(0)

    file_path = f'static/processed_{filter_type}.jpg'
    filtered_image.save(file_path)

    new_image_ref = db.collection('processed_images').document()
    new_image_ref.set({
        'filter_type': filter_type,
        'image_path': file_path
    })

    return jsonify({'message': 'Image uploaded and processed successfully', 'image_url': file_path}), 201

@app_views.route('/register', methods=['POST'])
def register():
    data = request.get_json()
    email = data.get('email')
    password = data.get('password')
    if not email or not password:
        return jsonify({"message": "Email and password required"}), 400
```

```
    users_ref = db.collection('users')
    user_query = users_ref.where('email', '==', email).get()
    if list(user_query):
        return jsonify({"message": "User already exists"}), 409

    password_hash = generate_password_hash(password)
    new_user_ref = users_ref.document()
    new_user_ref.set({
        'email': email,
        'password_hash': password_hash
    })
    return jsonify({"message": "User created successfully"}), 201

@app_views.route('/login', methods=['POST'])
def login():
    data = request.get_json()
    email = data.get('email')
    password = data.get('password')
    if not email or not password:
        return jsonify({"message": "Email and password required"}), 400

    users_ref = db.collection('users')
    user_query = users_ref.where('email', '==', email).get()
    if not list(user_query) or not check_password_hash(list(user_query)[0].to_dict()['password_hash'], password):
        return jsonify({"message": "Invalid credentials"}), 401

    # Create a new access token for the authenticated user
```

```
    access_token = create_access_token(identity=email)


    return jsonify({"message": "Login successful", "access_token": access_token}), 200


@app_views.route('/users', methods=['GET'])
def get_users():
    users_ref = db.collection('users')
    docs = users_ref.stream()
    users_list = [doc.to_dict() for doc in docs]
    return jsonify(users_list), 200
```

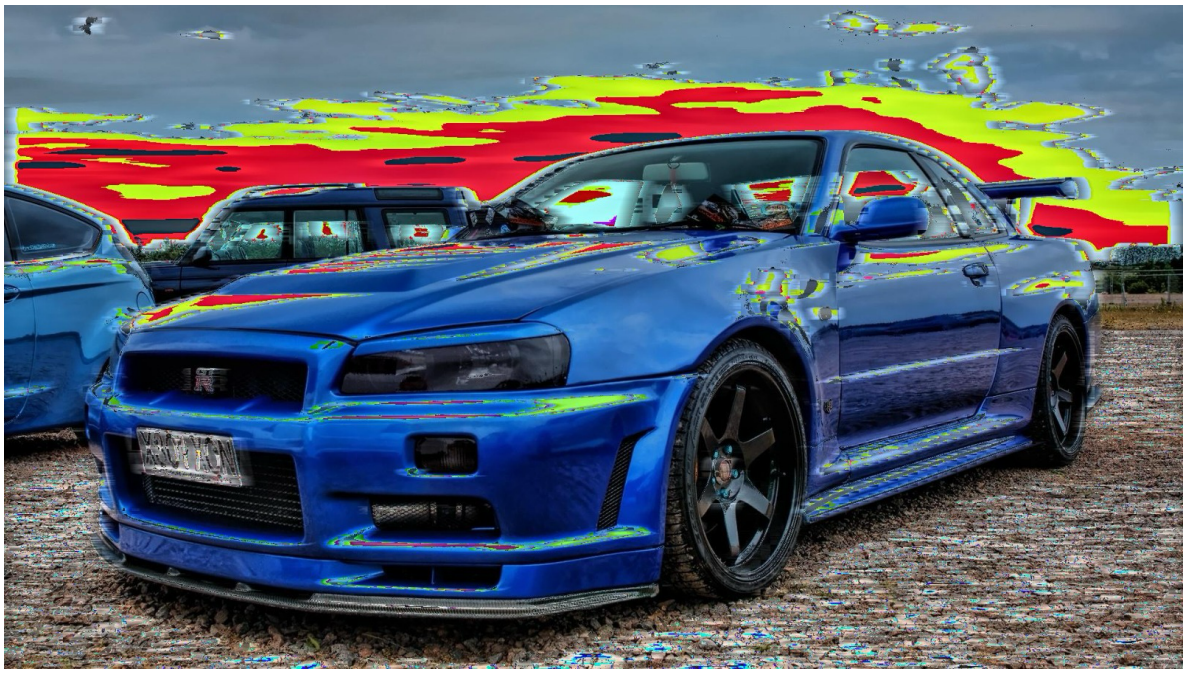
CODIGO EN ANDROID STUDIO

3. LINKS DEL PROYECTO EN GITHUB

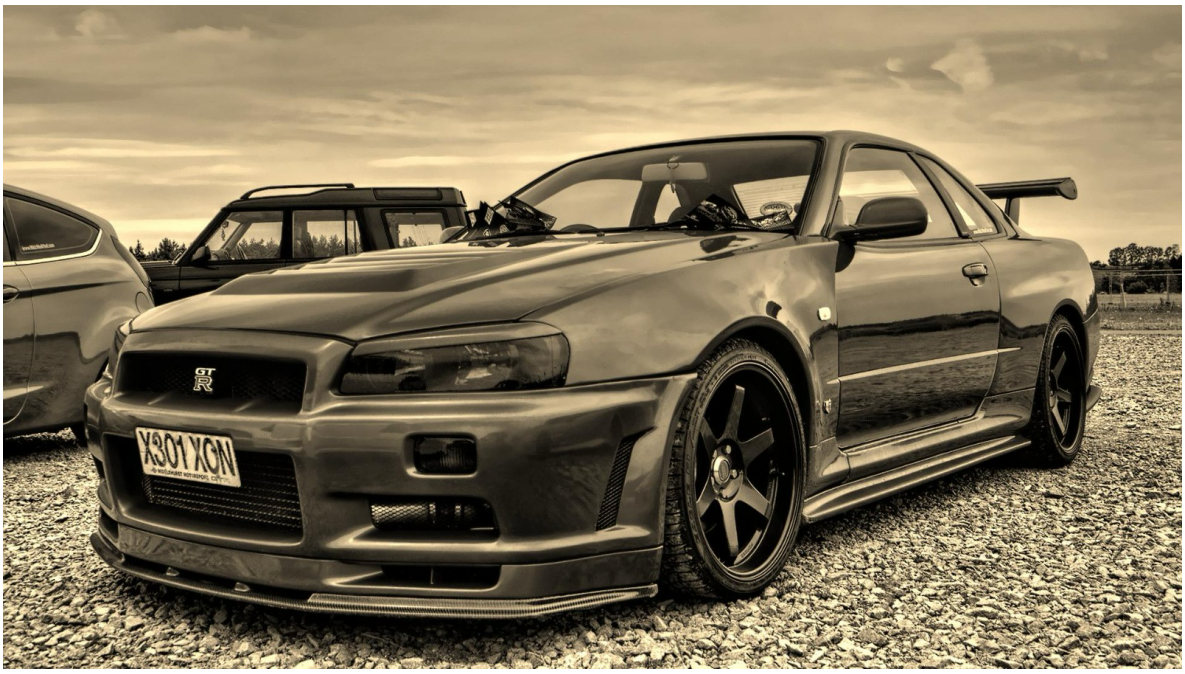
https://github.com/ChristianJapon/API_Mobil.git

4. Resultados obtenidos aplicando los filtros

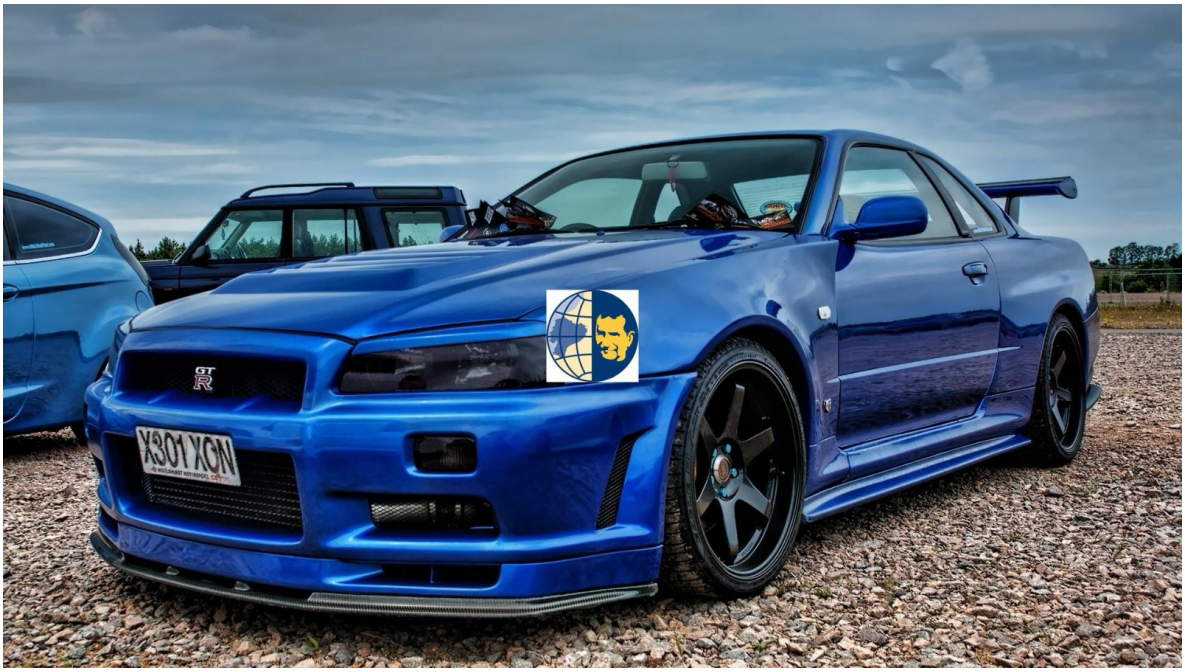
a) Resultado filtro ANAMORPHIC



b) Resultado filtro SEPIA



c) Resultado FILTRO SOBREMONTADO DE IMÁGENES



RESULTADO(S) OBTENIDO(S):

Hemos aplicado el filtro de manera exitosa y se pudo observar que los filtros aplicados con pycuda y este a su vez que fue dockerizado si es usado de manera eficiente y cumple con el proposito para el cual fue programado

CONCLUSIONES:

La aplicación esta basada en pycuda, estos filtros estan considerados para trabajar con bloques e hilos que nos permite ir aplicando en los distintos pixeles el filtro seleccionado, la dockerizacion nos permite habilitar el puerto que vamos a usar en este caso el 5000, en este esta funcionando nuestras APIs que seran utilizadas en nuestra aplicación de android(que funciona como Front End)

***Nombre de estudiante*: Ronald Andrade, Christian Japon**

***Firma de estudiante*:**