Birzeit University
Department of Electrical & Computer Engineering
First Semester, 2024/2025
ENCS5343 Computer Vision
Assignment#2
Due Date December 15, 2024

Arabic Handwritten Text Identification Using Local Feature Extraction Techniques

1. **Objective**
   The goal of this assignment is to explore and apply local feature extraction techniques for identifying handwritten text. Students will implement and compare SIFT algorithm with other related algorithm like **SURF** (Speeded-Up Robust Features). The evaluation will be based on accuracy, efficiency, and robustness to variations in the handwritten samples.

2. **Introduction**
   Feature extraction is a critical step in computer vision tasks, enabling systems to identify and differentiate objects or patterns effectively. In handwritten text identification, local feature extraction techniques like SIFT play a pivotal role by detecting and describing key points in images that are invariant to scale, rotation, and illumination. This assignment focuses on the practical application of these algorithms for distinguishing between different handwritten text samples. You will preprocess the input data, extract local features, match key points between images, and evaluate the performance of the methods on a given dataset. The assignment emphasizes the importance of choosing the right features and understanding the trade-offs between accuracy and computational efficiency.

3. **Dataset**
   The AHAWP dataset (Arabic Handwritten Automatic Word Processing) is a comprehensive benchmark dataset designed to aid the development and evaluation of handwritten Arabic text recognition and identification systems. For this assignment, the focus will be exclusively on the word-level data, allowing for targeted feature extraction and robust comparisons. The dataset includes 10 unique Arabic words, handwritten by 82 individuals, with each writer contributing 10 samples per word. This results in a total of 8,144 word images. Each writer is uniquely but anonymously identified by a user ID, ensuring that samples can be tracked without revealing personal information. The diversity in handwriting styles across writers and the consistent structure of the dataset make it an excellent resource for exploring local feature extraction techniques and evaluating their performance.

   Dataset Link: https://data.mendeley.com/datasets/2h76672znt/1/files/9031138a-b812-433e-a704-8acb1707936e

4. Metrics for Comparison

To evaluate the performance of the algorithms, consider the following metrics:
1. **Accuracy**: Measure the percentage of correctly matched key points in test cases.
2. **Time Efficiency**: Record the execution time for feature extraction and matching for each method.
3. **Robustness**: Test how well each method handles variations in scale, rotation, illumination, and noise.
4. **Number of Key Points**: Compare the number of key points detected by each algorithm.

5. Submission Requirements

- Code implementation in Python (or any preferred programming language).
- A short report (3–5 pages) summarizing:
  - The methods used.
  - Results and visualizations.
  - Observations on the performance of the algorithms.