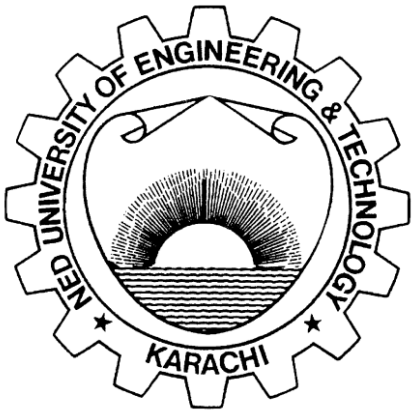
Practical Workbook

CS-436

Computer Vision



Name : _____

Year : _____

Batch : _____

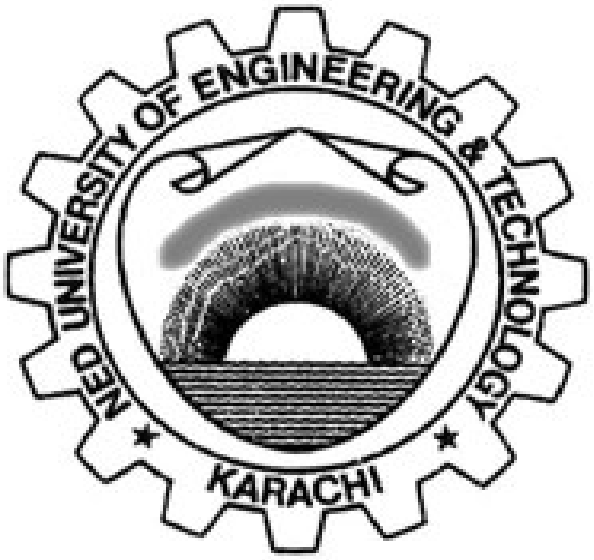
Roll No : _____

Department: _____

Teacher : _____

Department of Computer & Information Systems Engineering
NED University of Engineering & Technology

Practical Workbook
CS-436
Computer Vision



Prepared by:
Dr.-Ing. Shehzad Hasan
Ms. Fauzia Yasir

Revision 1:

April, 2024

Department of Computer & Information Systems Engineering
NED University of Engineering & Technology

INTRODUCTION

Over the past decades, computer vision has evolved into a mature subject that covers many topics and applications: from automatic (robot) assembly to automatic vehicle guidance, from automatic document interpretation to signature verification, and from remote sensing image analysis to fingerprint and human blood cell verification. To improve the quality, safety, and cost efficiency of a product or process, automated visual inspection has become a necessity due to the enormous amount of visual data. The Computer Vision Lab Manual provides a structured journey through the essential concepts and practical applications of image processing and analysis. In fourteen lab sessions, students explore a range of topics, from basic functions for retrieving and storing images in MATLAB to more advanced techniques such as deep learning for object classification. Each session is designed to offer hands-on experience and a solid understanding of key principles, covering areas such as noise reduction, edge detection, morphological operations, and template matching. By integrating modern technologies like cloud-based image annotation tools and pretrained models, students gain insight into contemporary practices in computer vision. The manual culminates in a challenging engineering activity where students build a customized deep learning model, consolidating their skills and knowledge in the field. The course profile of CS-436 Computer Vision mentions the following Course Learning Outcome (CLO) for the lab work which is mapped to the cognitive domain of learning:

CLO-3: **"Explore modern techniques to implement Computer Vision"** (C3, PLO-5)

In Lab 1, students learn basic functions for retrieving and saving images in MATLAB, laying the foundation for effective image data handling. Lab 2 focuses on enhancing grayscale images to improve quality and detail. Lab 3 explores the effects of noises on images, crucial for understanding image processing. Lab 4 delves into convolution and correlation operations in MATLAB for spatial filtering and feature extraction. Lab 5 introduces nonlinear filters, providing a deeper understanding of advanced filtering methods. Lab 6 covers various edge detection techniques in MATLAB for accurate object boundary detection. Lab 7 examines morphological operations for image structure manipulation. Lab 8 explores properties of connected regions within images to understand spatial relationships. Lab 9 introduces basic template matching using Normalized Cross Correlation for pattern recognition. Lab 10 showcases cloud-based image annotation tools for computer vision applications. Lab 11 involves object detection from images and videos using pretrained models for efficient recognition. Lab 12 introduces open-source computer vision tools for image augmentation, expanding image manipulation skills. Lab 13 guides students through object classification using prebuilt dataset on Python. Finally, Lab 14 presents a challenging activity where students build a customized deep learning model for object classification.

CONTENTS