**Department of Electrical and Computer Engineering**

**North South University**

**CSE299: Junior Design**

**Project Title: Image Classification and Identification**

**Course Instructor: Mohammad Shifat-E-Rabbi**

**Section: 5**

**Group Members:**

|  |  |
| --- | --- |
| Name | ID |
| Noshin Nawar | 2221507042 |
| Md. Arebi Sarker | 2221362042 |
| Mubashshira Kaisar | 2221070642 |
| Md Zidan Khan | 2231413642 |

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**Department of Electrical and Computer Engineering**   
**North South University**  
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**Subject: Proposal for Junior Design Project – *Image Classification and Identification***

Sir,

We, the undersigned team, are pleased to submit our proposal for the Junior Design project titled **"Image Classification and Identification"**. This project aims to leverage machine learning techniques to classify and identify images across multiple real-world scenarios, including animal recognition, handwriting analysis, facial detection, traffic sign interpretation, and medical image diagnostics.

We would be honored if you kindly consider this proposal and provide your valuable feedback. It would be our sincere pleasure if you find the contents informative and helpful in gaining a clear perspective on the project's objectives and scope.

**Objective:**

The primary goal of this project is to develop efficient and accurate image classification models using Python and relevant ML frameworks. These models will recognize and distinguish key visual features in different image types, enabling practical applications in areas such as veterinary care, handwriting analysis, security, transportation, and healthcare.

**Scope of Work:**

Our work will focus on implementing and testing several image classification tasks using standard datasets and deep learning models. The key categories are:

**1. Image Classification**

* Includes tasks like cat vs. dog classification, pet age classification, traffic sign recognition, facial expression recognition, etc.
* Use datasets like Kaggle Dogs vs. Cats, FER2013, GTSRB, etc., and apply models like CNNs, MobileNet, or ResNet for accurate predictions.

**2.** **Image Segmentation**

* Assign a label to each pixel in an image to distinguish different objects or regions.
* Helps to understand the structure and layout within images.
* Common models include U-Net, DeepLab, and Mask R-CNN.

**3. Object Detection**

* Detect objects such as faces, vehicles, planes, trains, etc., by drawing bounding boxes.
* Use detection models like YOLO, SSD, or Haar Cascades (for face detection) and DNN models for real-time applications.

**4. Object Size Estimation**

* Measure objects in images using a known reference (e.g., coin, A4 paper).
* Convert pixel distances to real-world dimensions (cm/inch) using scaling techniques.

**5.** **Handwritten Digit and Character Recognition**

* Recognize handwritten digits (0–9) and letters (A–Z).
* Use the MNIST and EMNIST datasets with deep learning models like CNNs.

**6. Document Scanner**

* Detect document corners and apply perspective transformation to correct skew.
* Generate clean, scanned-like versions from raw images using OpenCV.

**7. OMR Test Grader**

* Identify filled bubbles in OMR sheets and match them with answer keys.
* Automate test grading using thresholding, contour detection, and image preprocessing.

**8. Ball Tracker**

* Detect and track the movement of a ball across video frames.
* Use contour tracking and object detection techniques for motion analysis.

**9. Drowsiness Detection**

* Monitor the eye aspect ratio (EAR) to determine signs of drowsiness.
* Trigger alerts if the subject appears to be falling asleep using facial landmarks and temporal monitoring.

**10. Bone Fracture Detection**

* Detect bone fractures in X-ray images using CNN models.
* Use medical imaging datasets like MURA to train and validate diagnostic performance.

**Technologies and Tools:**

* Programming Language: Python
* Frameworks/Libraries:
  + TensorFlow / Keras
  + OpenCV
  + NumPy / Pandas
  + Matplotlib / Seaborn

**Key Machine Learning Concepts:**

* Convolutional Neural Networks (CNNs)
* Data Preprocessing: resizing, normalization, augmentation
* Evaluation Metrics: accuracy, confusion matrix
* Overfitting Control: dropout, regularization
* Transfer Learning: VGG16, MobileNet, etc.

**Expected Outcomes:**

* Successfully working models for each problem domain.
* Visual outputs showing detections, classifications, or predictions.
* A final report summarizing:
  + Methodologies
  + Dataset challenges
  + Results and accuracy metrics
  + Improvement opportunities

**Conclusion:**

This project will help us strengthen our understanding of machine learning, image processing, and their application in solving practical problems. We look forward to receiving your valuable feedback and approval.