NORTH SOUTH UNIVERSITY

Department of Electrical and Computer Engineering

Project Topic: Counterfeit Detection of Bangladesh Banknotes

CEP Document

Course Name: Junior Design

Course Code: CSE299

Section: 19

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Team AM

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Knowledge Profile (K)

1. **K5**: **Application of engineering principles**
    - The project applies convolutional neural networks (CNN) to detect counterfeit Bangladeshi banknotes. Techniques such as data preprocessing (e.g., Gaussian Blur and normalization) and advanced image augmentation (rotation, flipping, and cropping) have been employed to enhance model performance. These represent core engineering principles applied in computer vision tasks.
2. **K6**: **Specialized knowledge**
    - Specialized knowledge in machine learning is demonstrated through the use of MobileNet, which enables lightweight yet highly accurate counterfeit detection. The dataset sourced from Kaggle has been meticulously curated and processed to ensure fair representation of genuine and counterfeit notes, establishing the reliability of the trained model.
3. **K7**: **Interdisciplinary integration**
    - The project integrates multiple disciplines, including artificial intelligence for detection, software engineering for web application development, and economic considerations to mitigate the negative impacts of counterfeit currency on financial systems.

Complex Problem Range (P)

1. **P1**: **Wide-ranging requirements**
    - The counterfeit detection system addresses a significant national issue and provides a scalable and cost-effective solution suitable for banking, retail, and individual users, impacting a broad spectrum of stakeholders.
2. **P3**: **Broad problem-solving**
    - By integrating computer science, engineering, and societal needs, the project delivers a technical solution with direct societal impact. The innovative use of machine learning models, combined with a user-friendly web interface, ensures accessibility and reliability.
3. **P4**: **Multifaceted issues**
    - The project tackles technical challenges such as dataset preparation and parameter tuning, alongside societal challenges like fostering public trust, enhancing economic stability, and ensuring financial security.

4. **P5**: **Involvement of multiple stakeholders**
    - The system is designed to serve multiple user groups, including banks, e-commerce platforms, law enforcement agencies, and individuals concerned about counterfeit currency.

Engineering Activities (A)

1. **A1**: **In-depth investigation**
    - The project involves rigorous dataset analysis, including preprocessing (e.g., noise reduction, scaling, and augmentation) and splitting the dataset into training, testing, and validation subsets. Machine learning models were trained and evaluated using performance metrics such as accuracy, precision, recall, and F1 scores.
2. **A3**: **System-based design and development**
    - A fully responsive web application was developed to allow users to upload images of banknotes and verify authenticity. The system incorporates a robust backend powered by Flask and Python, seamlessly integrating the trained MobileNet model for real-time predictions.
3. **A4**: **Development of innovative solutions**
    - The project employs MobileNet, a lightweight model, for efficient counterfeit detection. The trained model was converted into TensorFlow Lite (TFLite) format for faster performance and deployed on the web. Secure Google authentication has been implemented to ensure safe user access.