# **Enhanced Disease Detection Using Digital Image Processing for COVID-19, Pneumonia, Brain Tumors, and Alzheimer's Diagnosis**

**Course and Section**:

* BSCS-5C

**Group Members**:

* + Ayesha Urooj (SU92-BSCSM-F22-107)
  + Abdul Sami (SU92-BSCSM-F22-141)

**Instructor**:

* Prof. Dr. Sohail

**Abstract**

This project leverages digital image processing techniques to enhance early detection of critical diseases such as COVID-19, pneumonia, brain tumors, and Alzheimer’s. By utilizing advanced methods and tools, the project aims to achieve higher diagnostic accuracy, reduce delays in detection, and improve patient outcomes.

**Introduction**

Digital image processing has revolutionized disease detection. With the advent of advanced imaging techniques, it is now possible to diagnose conditions more accurately and swiftly. This project focuses on four major diseases where early detection plays a crucial role:

1. COVID-19
2. Pneumonia
3. Brain Tumors
4. Alzheimer’s Disease

The integration of digital image analysis in the healthcare system ensures timely intervention and reduces mortality rates, particularly for conditions that are often detected late.

**Background and Statistics**

**Pneumonia**

* Annually, 1.5 million deaths occur, predominantly among children and elderly individuals.
* Early diagnosis could prevent up to 50% of pneumonia-related deaths globally.

**COVID-19**

* During the pandemic, delayed diagnosis contributed to a 20–30% higher mortality rate in severe cases.
* Digital image processing helps identify pneumonic patterns in chest X-rays and CT scans for quicker diagnosis.

**Brain Tumors**

* Around 60% of cases are diagnosed at advanced stages.
* Early detection increases the 5-year survival rate from 22% to 75%.

**Alzheimer's Disease**

* Late-stage detection often limits treatment effectiveness.
* Digital techniques can detect cortical atrophy and brain volume changes in early stages, improving outcomes.

**Detection Techniques**

**Pneumonia Detection**

* Uses chest radiographs.
* Techniques include image filtering and pattern recognition for identifying infiltrates.

**COVID-19 Detection**

* Analyzes chest X-rays and CT scans.
* Employs digital methods to highlight pneumonic patterns.

**Brain Tumor Identification**

* Utilizes MRI scans.
* Techniques like edge detection and template matching help define tumor boundaries, enhancing surgical precision.

**Alzheimer’s Disease Diagnosis**

* Brain scans are processed to evaluate cortical thickness and volume changes.
* Early intervention enabled by precise imaging analysis.

**Implementation**

1. **Tools and Technologies**:
   * Backend: Python(CV2, OS , Tensorflow ->Keras etc) and Flask API
   * Frontend: HTML, CSS, Bootstrap
   * Dataset: Specific datasets for X-ray, CT, MRI, and brain scans
2. **Workflow**:
   * **Data Preprocessing**: Cleaning and formatting the dataset.
   * **Feature Extraction**: Using image processing algorithms to detect disease-specific features.
   * **Analysis and Modeling**: Implementing machine learning models for diagnostic predictions.
   * **Results Visualization**: Displaying diagnosis results on a user-friendly web interface.

**Accuracy and Results**

Based on initial tests, the system demonstrated:

* **Pneumonia Detection**: High precision in identifying infiltrates.
* **COVID-19 Detection**: Rapid detection of pneumonic patterns in X-rays.
* **Brain Tumor Identification**: Clear boundary delineation for surgical planning.
* **Alzheimer's Diagnosis**: Early detection of cortical changes for timely care.

**Conclusion**

This project underscores the potential of digital image processing in transforming disease diagnostics. The enhanced accuracy and efficiency offered by this system promise to save lives by ensuring timely detection of critical conditions.