**KIDNEY STONE DETECTION WITH DIGITAL IMAGE PROCESSING USING YOLO V8**

**1. Motivation**

Kidney stones are a common and painful medical condition that can lead to severe complications if not diagnosed early. Manual analysis of CT scan images is time-consuming and prone to errors. Automation using deep learning, especially object detection models like YOLOv8, provides a faster, more accurate way to detect stones from kidney images. This project aims to assist radiologists and medical professionals by reducing the diagnostic workload and improving detection accuracy.

**2. Objectives**

* To develop a deep learning model for automated detection of kidney stones using YOLOv8.
* To create a web-based interface where users can upload CT scan images and receive prediction results.
* To enable binary classification: “Stone Present” or “No Stone”.
* To evaluate the model using standard performance metrics like precision, recall, and mAP.
* To visualize detection output with bounding boxes and provide diagnostic support.

**3. Abstract**

This project presents a deep learning-based approach for kidney stone detection using YOLOv8, an advanced object detection model. The dataset, consisting of labeled CT scan images, was used to train a custom YOLOv8 model. A Flask-based web application was created to allow users to upload images and view results with bounding boxes highlighting detected stones. The model achieved significantperformance on test data, and the solution aims to support medical professionals in early diagnosis and decision-making.

**4. Introduction**

Kidney stones affect millions worldwide, and early detection is essential to prevent surgical interventions. Traditional methods rely on manual analysis of imaging data, which is both labour-intensive and error-prone. With the rise of artificial intelligence, object detection models like YOLO (You Only Look Once) have shown great promise in medical image analysis. YOLOv8, being the latest in the series, offers better performance, speed, and accuracy, making it a suitable choice for this application.

**5. Block Diagram of Proposed Method**

**Image Upload**

**YOLOv8 Detection**

**(best.pt Model)**

**Prediction Output**

**(Boxes + Label)**

**Flask Web Interface**

**6. Block Wise Explanation of Block Diagram**

1. Image Upload
   * Users upload CT scan images via the web application.
2. YOLOv8 Detection
   * The best.pt model trained on the kidney stone dataset processes the image and returns prediction results.
3. Prediction Output
   * If stones are detected, bounding boxes are drawn around them with confidence scores.
   * If no stones are found, the system outputs “No Stone Detected”.
4. Flask Web Interface
   * The frontend allows users to interact with the model through a simple file upload system.
   * It displays the output image with detection annotations**.**

**7. Software Tool Used**

| **Tool/Library** | **Purpose** |
| --- | --- |
| **YOLOv8 (Ultralytics)** | **Object Detection & Training** |
| **Flask** | **Web Application Framework** |
| **OpenCV** | **Image Processing & Annotation** |
| **Python** | **Core Programming Language** |
| **Google Colab** | **Model Training & Testing** |

**8. References**

* Ultralytics YOLOv8 Documentation: https://docs.ultralytics.com
* Roboflow Dataset Hosting: <https://roboflow.com>
* Flask Documentation: https://flask.palletsprojects.com
* Medical image sources: CT scan datasets curated via Roboflow workspace.
* Research papers on kidney stone detection using CNNs and YOLO variants.