

# **AN INTELLIGENT MULTI AGENT SYSTEM FOR ENHANCED HEALTHCARE PREDICTION USING MACHINE LEARNING**

## **Abstract:**

The prevalence of kidney diseases has become a significant public health concern globally, necessitating advanced diagnostic and predictive methodologies. This project aims to develop an AI-driven system for classifying and segmenting kidney diseases utilizing Convolutional Neural Network (CNN) architectures. By leveraging deep learning techniques, the proposed system will analyze medical imaging data to identify various kidney abnormalities, enhancing diagnostic accuracy and efficiency. Additionally, a chatbot interface will be integrated into the system, providing users with interactive assistance for queries regarding kidney health, symptoms, and preventive measures. This dual approach not only aids healthcare professionals in making informed decisions but also empowers patients with accessible information about their health conditions.

**Keywords:** Kidney Disease Classification, Artificial Intelligence, Early Detection, Data Preprocessing, Data Visualization, Machine Learning Algorithms, Django Framework, Healthcare Analytics.

## **Existing system:**

**Objective:** Histotripsy is a focused ultrasound therapy that ablates tissue via the action of bubble clouds. It is under investigation to treat a number of ailments, including renal tumors. Ultrasound imaging is used to monitor histotripsy, though there remains a lack of definitive imaging metrics to confirm successful treatment outcomes. In this study, a convolutional neural network (CNN) was developed to segment ablation on ultrasound images. **Methods:** A transfer learning approach was used to replace classification layers of the residual network ResNet-18. Inputs to the classification layers were based on ultrasound images of ablated red blood cell phantoms. Digital photographs served as the ground truth. The efficacy of the CNN was compared to subtraction imaging, and manual segmentation of images by two board-certified radiologists. **Results:** The CNN had a similar performance to manual segmentation, though was improved relative to segmentation with subtraction imaging. Predictions of the network improved over the course of treatment, with the Dice similarity coefficient less than 20% for fewer than 500 applied pulses, but 85% for more than 750 applied pulses. The network was also applied to ultrasound images of ex vivo kidney exposed to histotripsy, which indicated a morphological shift in the treatment profile relative to the phantoms. These findings were consistent with histology that confirmed ablation of the targeted tissue. **Conclusion:** Overall, the CNN showed promise as a rapid means to assess outcomes of histotripsy and automate treatment. **Significance:** Data collected in this study indicate integration of CNN image segmentation to gauge outcomes for histotripsy ablation holds promise for automating treatment procedures.

## **Disadvantages:**

- **Limited Generalization:** The CNN was trained on ablated red blood cell phantoms, which may not fully represent the variability in real renal tumors, potentially limiting the model's generalizability.
- **Dependency on Image Quality:** The effectiveness of the CNN might be compromised by variations in ultrasound image quality or artifacts, impacting its accuracy in different clinical settings.
- **Interpretation of Morphological Shifts:** While the CNN showed a morphological shift in the treatment profile, interpreting these changes might require additional validation and could be subject to inconsistencies between phantoms and actual tissue.

## **Proposed System:**

The proposed system consists of two core components: a robust CNN model for kidney disease detection and an interactive chatbot. The CNN model will be trained on a comprehensive dataset of kidney images to segment and classify diseases such as chronic kidney disease, kidney stones, and tumors. The architecture will include multiple convolutional layers for feature extraction, pooling layers for dimensionality reduction, and fully connected layers for classification output. Concurrently, the chatbot will utilize natural language processing (NLP) capabilities to engage users, answering questions related to kidney health and guiding them through symptoms and preventive tips. By integrating AI with a user-friendly interface, this system aims to revolutionize kidney disease management, making advanced diagnostics accessible and informative for both patients and healthcare providers.

## **MERITS:**

- **Enhanced Accuracy:** Advanced preprocessing and ensemble machine learning algorithms improve the precision of disease classification, leading to more reliable early predictions.
- **Intuitive Insights:** Sophisticated data visualization tools make it easier for healthcare professionals to understand patient data and disease patterns, facilitating better decision-making.
- **Seamless Integration:** The Django framework provides a user-friendly web interface, integrating all components efficiently and allowing for interactive data exploration and predictions.

## **ENVIRONMENT REQUIREMENTS:**

### 1. Software Requirements:

Operating System : Windows

Tool : Anaconda with Jupyter Notebook

### 2. Hardware requirements:

Processor : Intel® Core™ i7 processor 14650HX (30M Cache, up to 5.20 GHz)

Hard disk : minimum 80 GB

RAM : minimum 4 GB