## Title: Real-time Hand Gesture Recognition System for Human-Computer Interaction

**Abstract :**
The Real-time Hand Gesture Recognition System is a professional-grade solution designed to enable intuitive human-computer interaction through hand gestures. This system combines computer vision techniques, machine learning algorithms, and real-time video processing to accurately detect and classify hand gestures in a variety of applications.

The system utilizes the following packages and libraries: OpenCV for image and video processing, Mediapipe for hand tracking, and TensorFlow for deep learning-based gesture recognition. The hand tracking functionality provided by Mediapipe allows for precise localization and tracking of hand landmarks in the video frames.

The gesture recognition model, trained using a diverse dataset, is loaded into the system using TensorFlow. The model is capable of classifying a wide range of hand gestures with high accuracy. The class names associated with each gesture are loaded from an external file for easy interpretation and display.

To begin, the system initializes the necessary packages and loads the pre-trained model and class names. It then initializes the webcam to capture video frames. Each frame is processed by flipping it vertically to match the user's perspective and converting it to the RGB color space for compatibility with the model.

The hand landmarks are extracted using the Mediapipe library, providing precise information about the position and movements of the user's hand. The landmarks are then used as input to the gesture recognition model, which predicts the corresponding gesture class. The predicted class is mapped to a human-readable gesture name using the loaded class names.

The recognized gesture is displayed on the video frame, allowing users to see the detected gesture in real-time. This system provides a seamless and natural method for users to interact with devices and applications, eliminating the need for traditional input devices such as keyboards or touchscreens.

The Real-time Hand Gesture Recognition System has broad applications in various domains, including virtual reality, augmented reality, robotics, gaming, and smart home automation. It empowers users to control devices and applications effortlessly and intuitively, enhancing the overall user experience and expanding the possibilities of human-computer interaction.

Keywords: Hand gesture recognition, computer vision, machine learning, real-time, video processing, human-computer interaction, OpenCV, Mediapipe, TensorFlow, deep learning, webcam, gesture classification.