STROKEGUARD: VIDEO-BASED GEN AI FOR EARLY STROKE IDENTIFICATION AND TIMELY ASSISTANCE

Project Reference No.: *48S_BE_5124*

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Keywords:

Stroke Detection, FAST, Computer Vision, AI, Mobile App, Facial Drooping, Arm Weakness, Emergency Alerts

Introduction:

Stroke is a major medical emergency that can lead to permanent disability or death if not treated promptly. India witnesses over 1.8 million new stroke cases every year, and early intervention is critical in improving patient outcomes. A stroke occurs when the blood supply to a part of the brain is interrupted or reduced, preventing brain tissue from getting oxygen and nutrients. Within minutes, brain cells begin to die.

Early signs of a stroke include facial drooping, sudden arm weakness, and speech difficulties. Recognizing these symptoms quickly is crucial for effective treatment. However, the current methods of stroke diagnosis require physical presence at a medical facility and are often delayed due to lack of immediate access to healthcare. Public awareness about stroke symptoms remains limited, which further delays response times.Some mobile applications attempt to bridge this gap using symptom checklists, but they are passive and do not utilize real-time detection technologies. They also lack automation and fail to provide emergency notifications.

Our project, StrokeGuard, addresses these limitations by leveraging Computer vision and mobile technology to detect early signs of stroke using the widely recognized FAST framework—Facial Drooping, Arm Weakness, Speech Difficulty, and Time to Act.

Using the smartphone camera, the system analyzes facial features and arm movements in real time to detect symptoms with emergency alerts.

Objectives:

1. Develop a user-friendly mobile application for stroke symptom identification using F.A.S.T acronym and provide timely assistance ensuring prompt medical intervention and prevent permanent brain damage or disability.

2. Use generative AI techniques for data augmentation, creating diverse and realistic facial datasets from limited samples to improve model training and asses performance accuracy.

3. Design a notification mechanism to alert hospital staff and family members instantly when stroke symptoms are identified, ensuring prompt medical intervention.

Methodology:

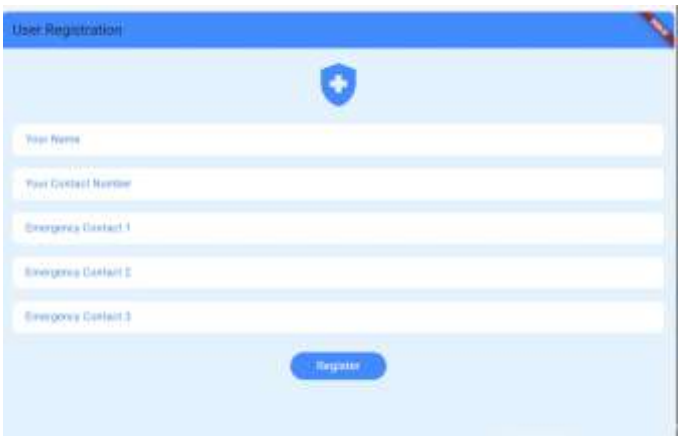
1. **Data Collection and Augmentation:**
    - Real-time facial and arm video data is captured through a mobile camera.
    - Synthetic data is generated via augmentation techniques to improve model robustness for training the model.
2. **Face Drooping Detection:**
    - Facial landmark detection (via Mediapipe or CNN-based models) extracts key facial points.
    - Symmetry is analyzed by comparing left-right features.
    - Significant asymmetry is flagged as potential facial drooping.
3. **Arm Weakness Detection:**
    - Pose estimation detects positions of shoulders, elbows, and wrists.
    - Symmetry and angle deviation are used to identify arm drift.
4. **Integration with Mobile Application:**
    - The app guides the user through the screening process.
    - On detection, the system records the timestamp and displays results.

- Emergency alerts are sent to hospitals, family members, and optionally an ambulance.

5. **Architecture:**
   - The system uses a modular architecture: input layer (camera), processing layer (AI engine), and output (UI + alerts).
6. **Evaluation:**
   - Results are evaluated using metrics like accuracy, precision, and recall.
   - A prototype has been tested on simulated data with encouraging results

Result and Conclusion:

The initial implementation of StrokeGuard has successfully demonstrated the feasibility of detecting stroke symptoms in real time using AI models. The arm weakness detection module has shown accurate tracking and correct face drooping prediction in most test scenarios.



The mobile application's interface supports smooth user interaction, real-time camera integration, and prompt alert generation. Alerts sent to hospitals and emergency contacts carry the necessary user info and detection time, ensuring rapid action.

This approach enhances the speed of medical intervention, especially during the golden hour post-stroke. The integration of timestamp logging and modular detection increases both accuracy and usability. With further testing on real datasets and optimization, StrokeGuard can evolve into a reliable public health tool.

Scope for Future Work:

- **Incorporation of Speech Analysis:**
    - Extend the system to detect slurred or impaired speech patterns using audio processing.
- **Real-World Dataset Expansion:**
    - Enhance model robustness by training on diverse, real-world stroke datasets gathered from various demographics and environments.

- **Assistive Features for Accessibility:**
    - Implement voice-guided instructions to assist elderly users and those with limited literacy. Enable support in multiple regional languages.
- **Wearable Device Integration:**
    - Integrate with smartwatches or fitness bands to enable continuous real-time monitoring of vital signs and movements.
- **Cloud and GPS-Based Enhancements:**
    - Add cloud storage for patient health logs accessible by healthcare professionals. Use GPS data to send precise location info to ambulance and emergency responders.
- **Post-Stroke Monitoring & Resource Optimization:**
    - Expand the app's functionality to assist in post-stroke recovery. Optimize the app for low battery and memory usage on basic smartphones.

Funding Acknowledgement: This project is funded by **AI & Robotics Technology Park (ART-Park), IISc**, and supported technically by **KSCST**. Their contribution is gratefully acknowledged in the development and testing of this system.