A Novel Approach to Fall Prediction and Prevention: Integrating Machine Learning and IoT for Elderly Safety

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Early detection of falls is crucial as they are the leading cause of injury and death among elderly individuals. Prompt intervention is necessary to prevent serious consequences such as broken hips, head trauma, and the emotional toll of losing independence. Most falls occur as elderly individuals attempt to rise from bed, often due to urgent needs or isolation. This research aims to contribute significantly to elderly care and fall prevention, addressing a critical public health challenge while maintaining scalability and accessibility. The research presents a novel machine learning-based (ML) Internet of Things (IoT) system to predict falls. The system, developed based on inputs from multiple stakeholders, utilizes an ML model to classify human movements associated with lying down and transitioning to a standing position, key actions linked to fall-related risks. A custom dataset of images, captured under controlled conditions, depicts diverse postures of lying down and various methods of rising from bed. Using TensorFlow, Python, and Keras within Jupyter Notebooks, a convolutional neural network is trained to accurately distinguish between different movement transition states. The model, trained with 100 epochs, consistently achieved high accuracy in classifying multiple human motions. The ML model is integrated into an Arduino IoT system, including an active buzzer and LED for real-time alerts. This device will be utilized by caretakers as a mobile unit that receives alerts from the ML model. Future work would include improving the model to accurately classify more complex or nuanced movements and incorporating mechanisms to mitigate privacy concerns in public settings, such as in hospitals and senior homes.

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