**Enhacing Seizure Detection using deep learning models**

**Overview**

This repository contains the implementation of a deep learning-based seizure detection model, designed to be integrated into wearable devices. By leveraging multimodal sensor data, our approach enhances seizure recognition accuracy, ultimately improving patient care and intervention strategies.

**Dataset**

The dataset used in this project consists of sensor readings from wearable devices, capturing:

* **Electrodermal Activity (EDA)**
* **Accelerometer (ACC)**
* **Heart Rate (HR)**
* **Blood Volume Pulse (BVP)**
* **EEG readings (if available)**

To improve detection accuracy, we preprocess the dataset by removing unnecessary features and splitting it into training and validation sets.

**Methodology**

**1. Data Preprocessing:** Removal of irrelevant columns, normalization, and train-validation splitting.

**2. Model Selection:** Implementation of multiple machine learning and deep learning models for comparison.

**3. Deep Learning Models:**

* Feedforward Neural Network (FFNN)
* Multi-Layer Perceptron (MLP)
* Recurrent Neural Network (RNN)

**4. Traditional Machine Learning Models:**

* + XGBoost
  + K-Nearest Neighbors (KNN)
  + Logistic Regression
  + Naive Bayes
  + Decision Tre
  + Random Forest

**5. Evaluation:** Models were evaluated based on accuracy, precision, recall, and F1 score.

**6. Wearable Device Integration:** The final deep learning model is designed to be deployable on low-power wearable devices for real-time seizure detection.

**Implementation**

Each model was trained using Python libraries such as TensorFlow, Keras, Scikit-learn, and XGBoost. Hyperparameter tuning and optimization techniques such as early stopping and grid search were employed to enhance performance.

**Results**

Each model's performance was measured using key metrics:

* Accuracy
* Precision
* Recall
* F1 Score

Graphs were plotted to visualize training loss, accuracy trends, and classification reports.

**Potential Impact**

This project aims to revolutionize epilepsy management by enabling real-time seizure detection via wearable devices. Key benefits include:

* + **Timely Intervention:** Reducing the risk of SUDEP by providing early alerts.
  + **Enhanced Caregiver Awareness:** Empowering healthcare professionals with actionable insights.
  + **Improved Quality of Life:** Offering a non-invasive, reliable solution for epilepsy monitoring.

**Installation**

**1. Clone the repository:**

git clone https://github.com/your\_username/seizure-detection.git

cd seizure-detection

**2. Install dependencies:**

pip install -r requirements.txt

**3. Run the script:**

python seizure\_detection.py

**Contributions**

We welcome contributions to enhance this project. Feel free to submit pull requests or report issues.