**Human Motion Recognition Using IMUs with LSTM in MATLAB**

* This work uses MATLAB's long short-term memory networks and inertial measurement unit (IMU) sensors to develop a human activity recognition (HAR) system. It uses time-series motion data from accelerometers, gyroscopes, and magnetometers to categorize everyday activities like walking, running, sitting, and standing. The process entails gathering labelled IMU data from either private experiments or publicly available datasets, then preprocessing the data using techniques like normalisation, noise filtering, and sliding window segmentation to get it ready for deep learning.
* To capture temporal patterns in motion sequences, the core architecture uses an LSTM network with 128–256 units in conjunction with dropout layers and softmax classification. We use the LSTM and it will implement hybrid CNN-LSTM models, in which 1D convolutions extract spatial features prior to LSTM processing, are investigated for improved performance. The model, trained using MATLAB's Deep Learning Toolbox with Adam optimization and cross-entropy loss, achieves good accuracy on controlled datasets. Kalman filters are used to reduce sensor noise, weighted loss functions are used to handle class imbalance, and model quantisation is used to optimise for real-time deployment.
* Applications include augmented reality, sports analytics, and healthcare. Future directions include exploring transformer-based models for better sequence modelling, deploying edge AI on microcontrollers, and fusing multimodal sensors. The project offers a comprehensive MATLAB pipeline from raw data to real-time classification, showcasing the efficacy of LSTM in HAR and offering insightful information for wearable motion analysis systems.