National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: Multi-modal Feature Analysis for Classification of Gait Abnormality
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Venue	: CS323 (CSE Department)
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Abstract	: Accurate classification of gait abnormalities is essential for the early diagnosis and treatment of movement disorders. With advancements in sensor technology and data processing techniques, multi-modal feature analysis has emerged as a promising direction for improving gait disorder detection by integrating complementary biomechanical signals. This approach leverages diverse sensor modalities, such as ground reaction forces and motion trajectories, to extract rich spatial-temporal features, enabling more reliable and explainable gait classification.In the first part of this study, we propose an energy-based unsupervised feature learning approach using a Self-attention based Convolutional Restricted Boltzmann Network (SCRB-Net). This model is designed to capture the complex temporal dependencies inherent in gait sequences. The SCRB-Net extracts deep temporal features which are applied on standard GaitRec dataset to classify between Healthy Controls and Gait Disorder using a Fully Connected Neural Network Model. However most complex deep learning model often fails to capture proper interpretability which leads to transparency and trust issues. To resolve this , Shapely Additive Explanations analysis is used to identify key gait charecteristics that improve the model&rsquos transparency and interpretability. This model achieves a classification accuracy of 93.17%, outperforming traditional statistical and machine learning methods.To further enhance gait disorder classification, the second part of the study explores a multimodal sensor data fusion framework that combines spatial-temporal features using the Unscented Kalman Filter integrated with a Bidirectional Long Short-Term Memory network. This hybrid model effectively captures both biomechanical patterns and temporal dependencies in experimental gait recordings. Signal fidelity is validated through Signal-to-Noise Ratio and Correlation metrics, confirming the preservation of meaningful gait characteristics. This multimodal fused approach achieves a superior classification accuracy of 97.25%, outperforming traditional filtering techniques such as Kalman Filter, Extended Kalman Filter, and even standalone Unscented Kalman Filter models.