Deep Learning for Sensor-based Activity Recognition: A Survey

Research Highlights:

- Survey of deep learning-based activity recognition in sensor modality, deep model, and application.

- Comprehensive discussion of insights into deep learning models for activity recognition tasks.

- Extensive investigation of why deep learning can improve activity recognition performance.

- Summary of frequently used public datasets for activity recognition research.

- Presentation of grand challenges and feasible solutions for deep learning-based activity recognition.

Abstract:

Sensor-based activity recognition involves extracting high-level knowledge about human activities from low-level sensor readings. Traditional pattern recognition approaches heavily rely on hand-crafted features, limiting their generalization performance. Deep learning, with its automatic feature extraction capabilities, has shown promising results in various domains. This paper surveys the recent advancements in deep learning-based sensor-based activity recognition. It covers sensor modalities, deep models, and applications. The paper provides insights into existing work and proposes future research challenges.

Keywords: Deep learning, activity recognition, pattern recognition, pervasive computing

Introduction:

Human activity recognition (HAR) is crucial for understanding human behavior based on sensor inputs. There are two types of HAR: video-based and sensor-based. This paper focuses on sensor-based HAR, which analyzes motion data from smart sensors. Conventional pattern recognition methods have achieved progress in HAR but rely on hand-crafted features. Deep learning offers an alternative by automatically extracting high-level features, enabling better performance for unsupervised and incremental learning tasks.

Why Deep Learning?

Conventional PR methods have limitations:

1. Reliance on heuristic and hand-crafted features.

1. Limited capability to learn shallow features.

1. Dependence on labeled data, hindering unsupervised learning.

1. Insufficient support for online and incremental learning.

Deep learning overcomes these limitations:

1. Automatic feature extraction without human intervention.

1. Ability to learn high-level representations for complex tasks.

1. Utilization of unlabeled data for training.

1. Feasibility for unsupervised and incremental learning.

Conclusion:

This paper presents a survey of deep learning-based sensor-based activity recognition. It highlights the advantages of deep learning in overcoming the limitations of conventional methods. The paper provides insights into sensor modalities, deep models, and applications. It also identifies grand challenges and potential solutions for future research in this field.