This is a summary of the thesis project:
"*Development and Evaluation of a Machine-Learning Based Fall Detection System for Prosthetic Knees*"
Full thesis available at: https://lup.lub.lu.se/student-papers/

Revolutionizing Safety: AI-Powered Fall Detection for Prosthetic Users

Every year, numerous prosthetic users face risks of severe injuries due to falls. This thesis explores integrating advanced fall detection directly into prosthetic knees controlled by microprocessors, using artificial intelligence (AI), potentially transforming safety and autonomy for amputees.

Falls are a common yet hazardous part of everyday life, especially for amputees, where a fall can lead to significant injuries. This project focuses on leveraging advanced AI technologies to equip prosthetics with real-time fall detection capabilities, enhancing safety and independence for amputees.

The research began with a publicly available dataset, UMAFall, which includes motion data from various daily activities and simulated falls. This helped establish a baseline for understanding how falls could be detected through different movements. Real-time data from prosthetics posed a significant challenge due to the rarity and unpredictability of falls. The solution was controlled experiments with a volunteer wearing the sensor-equipped prosthetic, capturing valuable data under supervised conditions.

This innovative approach has shown that AI can differentiate between fall-like movements and regular activitites with remarkable accuracy, providing a proof of concept for real-world application. In the future, a prosthetic leg could not only support a user's weight but also alert them or their caregivers in case of a fall, significantly reducing the risk of injuries.

These findings are not just a step forward in prosthetic technology but also offer hope for improving the quality of life for amputees. By giving prosthetic limbs the ability to detect and react to falls, we can turn these devices from passive supporters into active protectors, potentially saving many from the dire consequences of falling.

Moreover, while the journey from concept to application involves numerous challenges, including refining the technology, ensuring user privacy, and adapting to individual needs, the potential benefits justify the continued development. This research paves the way for a new era in prosthetic technology, where smart limbs could dramatically enhance safety and independence for their users.

As we look to the future, the integration of such technologies could redefine what it means to live with a prosthetic, transitioning from mere mobility aids to comprehensive care systems that offer greater security and confidence to their users.

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