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Enhancing Athlete Training using Real Time Pose Estimation with Neural Networks

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Abstract : Traditional methods for analyzing athlete movement often lack the detail and immediacy required for optimal training. This project aims to address this limitation by developing a Real-time human pose estimation system specifically designed to enhance athlete training across various sports. This system leverages the power of convolutional neural networks (CNNs) to provide a comprehensive and immediate analysis of an athlete's movement patterns during training sessions. The core architecture utilizes dilated convolutions to capture crucial long-range dependencies within video frames. Combining this with the robust encoder-decoder architecture to further refine pose estimation accuracy. This capability is essential for precise joint localization across the diverse range of athletic poses encountered in different sports. Furthermore, by quantifying movement efficiency, power output, and range of motion, the system provides data-driven insights that can be used to optimize training programs. Pose estimation data analysis can also be used to develop personalized training plans that target specific weaknesses identified in an athlete's movement patterns. To overcome the limitations posed by outdoor environments, the project employs strategies such as multi-camera configurations or depth sensing techniques. These approaches can enhance pose estimation accuracy in challenging lighting and occlusion scenarios, where pose estimation accuracy in challenging lighting and occlusion scenarios. A dataset is collected From the labs of Martin Luther King at San Jose State University. The system is evaluated through a series of tests that measure its efficiency and accuracy in real-world scenarios. Results indicate a high level of precision in recognizing different poses, substantiating the potential of this technology in practical applications. Challenges such as enhancing the system's ability to operate in varied environmental conditions and further expanding the dataset for training were identified and discussed. Future work will refine the model's adaptability and incorporate haptic feedback to enhance the interactivity and richness of the user experience. This project demonstrates the feasibility of an advanced pose detection model and lays the groundwork for future innovations in assistive enhancement technologies.

Keywords : computer vision, deep learning, human pose estimation, U-NET, CNN
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