Master Research Proposal Nr:

Topic: Tracking and Feedback in Surfing: A 3D Pose Estimation Approach

Surfing, a complex and dynamic water sport, necessitates a comprehensive understanding of the athlete's body posture and movements for optimal performance. Current techniques provide feedback manually, which, while essential, can be time-consuming and subjective. With the advent of cutting-edge developments in computer vision and deep learning, there is potential to harness these advancements for a transformative approach to training in surfing. Markerless pose estimation, especially in sports settings, has recently shown significant promise owing to its unobtrusive nature, ensuring athletes are not hindered in their natural movements. Furthermore, markerless capture proves to be exceptionally useful in uncontrolled environments, which is inherent to the nature of surfing.

However, the dynamic environment of surfing presents several challenges. Surfers usually adorn black full-body wetsuits, complicating the detection of individual body parts [1]. The unpredictable natural lighting, the swift and intricate movements of the surfers, and obstructions like spraying water add layers of complexity to the task. The research aims to bridge the gap between the technological advancements in 3D pose estimation and the specific requirements of surfing.

The primary aim of this research is to develop a robust 3D pose estimation system tailored for surfing, drawing inspiration from existing models like VoxelPose [2] and the Dual-stream Spatio-temporal Transformer proposed in [3]. Furthermore, methods such as the novel learnable triangulation methods for multi-view 3D human pose estimation presented in [4], which combine 3D information from multiple 2D views, will be explored to ascertain if they offer any distinct advantages in the unique environment that surfing presents.

The primary objectives of this research are as follows:

- Develop a 3D pose estimation system for wave surfers.
- Overcome challenges related to body part detection, varying lighting conditions, and fast movements.
- Evaluate the accuracy and reliability of the pose estimation system.
- Investigate the potential applications of the obtained 3D pose data for performance analysis.

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References

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[3] Zhu, Wentao, Ma, Xiaoxuan, Liu, Zhaoyang, Liu, Libin, Wu, Wayne, and Wang, Yizhou. *MotionBERT: A Unified Perspective on Learning Human Motion Representations.* Proceedings of the IEEE/CVF International Conference on Computer Vision, 2023.

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