

Swimming Analyzer



Mark Shperkin
Computer Science
Lead ML Engineer



Travis Shuler II
Computer Engineering
ML Research Scientist

Problem:

- Many swimmers struggle to identify and correct flaws in their swimming technique, leading to suboptimal performance and increased risk of injury.
- Coaches often rely on subjective observation, which can miss subtle but critical technique issues.

Why It's Interesting:

- Swimming technique plays a crucial role in an athlete's speed, efficiency, and endurance.
- A precise, data-driven method to analyze and improve technique can significantly enhance performance.

Project Type:

- Research and Development of a Software Tool.

Current solutions:

- Velocity meter paired with a camera. This captures the speed and the movements of the swimmer.
- This system is expansive and requires professionals to operate.



Solution Overview:

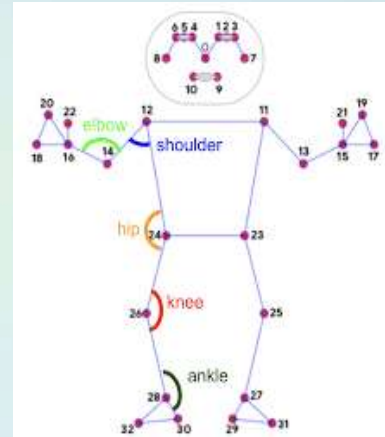
- Development of a 3D modeling system using neural networks to analyze swimming techniques.
- The model will visualize swimmer movements in real-time, highlighting areas for improvement.

Key Outcome/Deliverable:

- A software tool that provides detailed, visual feedback to swimmers and coaches, enabling precise technique refinement.

Neural network models used (subject to change):

- **Pose Estimation Model** : Detects and estimates the positions of key points (e.g., joints) on the swimmer's body within the bounding box, crucial for understanding posture and movement.
- **3D Pose Reconstruction Model or Image Segmentation(GNN and 3D CNN)**: Converts 2D key points into 3D coordinates, creating a full 3D representation of the swimmer's posture and movement.



Struggles in This Project:

Data Collection: Capturing accurate and high-quality swimming data for training the neural networks.

Model Accuracy: Ensuring the neural networks accurately model the swimmer's technique in 3D.

Real-Time Processing: Achieving real-time analysis and feedback during a swimmer's performance without significant delays.

Integration: Integrating the solution seamlessly into existing coaching and training workflows.

Evaluation



Qualitative Evaluation:



Expecting visual comparisons of swimmer techniques before and after using the analyzer, with clear illustrations of improvements in form.



Accurate videos or 3D animations showcasing corrected techniques.



Quantitative Evaluation:



Use performance metrics like stroke efficiency, speed, time, and consistency from before using the model and after.



General improvement of the swimmer. This could come in more efficient swimming or better results at competition.