LINEAR KINEMATICS ANALYSIS USING KINOVEA

INTRODUCTION

The analysis focuses on studying the linear kinematics of human motion during jumping by tracking key joints (hip,knee and ankle). The goal is to extract and analyze kinematic parameters like velocity and acceleration to gain insights into movement biomechanics. These insights can help improve athletic performance and reduce injury risks.

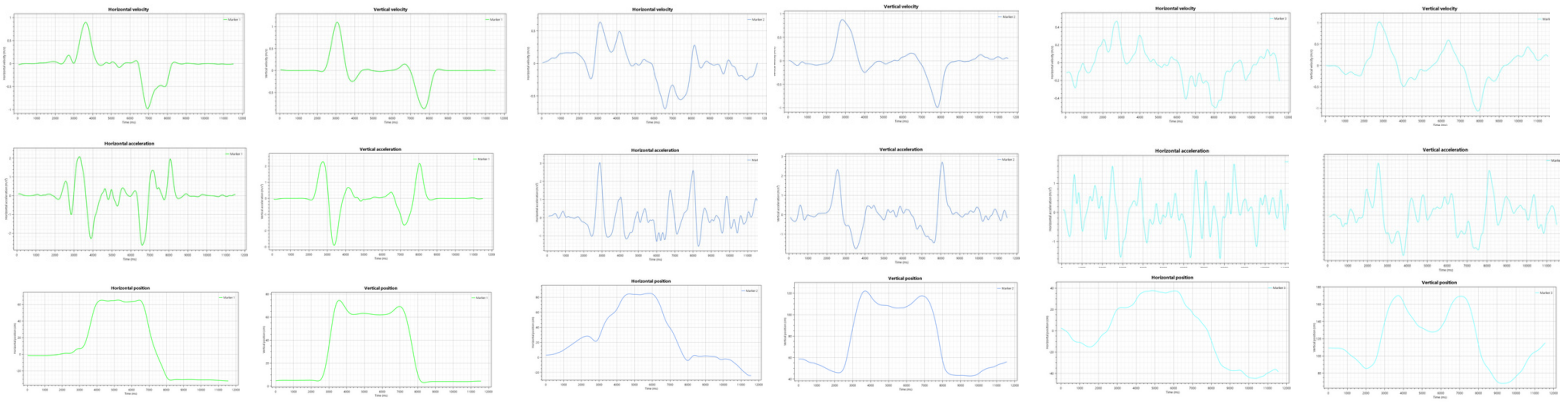
METHODOLOGY

1. Video Setup:
A side-view video of an individual performing a jump was recorded at X frames per second (fps) to ensure smooth tracking of joint movements. The camera was positioned perpendicular to the plane of motion to minimize parallax error.

2. Marker Placement:
Kinovea software was used to place markers on the hip,knee and ankle joints, ensuring consistent and accurate tracking throughout the motion for reliable data extraction.

3. Software Utilization:
Kinovea was employed for:
- Calibrating the video using a known reference length (e.g., a meter stick in the frame).
- Tracking the markers' positions frame by frame with precision.
- Exporting position data for further analysis in statistical or graphing software.

RESULTS



- **Vertical Position: Tracks height changes, showing how the hip, knee, and ankle work together to generate upward force during takeoff and control descent during landing.**
- **Horizontal Position: Reflects forward/backward movement, indicating the joints' combined role in propulsion, stabilization, and directional changes.**
- **Vertical Velocity: Highlights upward speed during takeoff (driven by hip extension, knee extension, and ankle plantarflexion) and controlled descent during landing.**
- **Horizontal Velocity: Shows forward/backward speed, emphasizing the joints' contribution to acceleration, deceleration, and maintaining momentum.**
- **Vertical Acceleration: Indicates explosive upward force (positive) during takeoff and impact absorption (negative) during landing, with the hip, knee, and ankle working synergistically.**
- **Horizontal Acceleration: Demonstrates force generation for forward motion or deceleration, reflecting the joints' coordination during directional changes or stabilization.**

DISCUSSION & CONCLUSION

- **Acceleration Phase: Linear force increases, boosting vertical/horizontal velocity and acceleration, essential for takeoff performance.**
- **Peak Velocity Phase: Maximum linear velocity is achieved mid-air, marking the highest point in vertical motion or fastest speed in horizontal motion.**
- **Deceleration Phase: Velocity and acceleration decrease as landing approaches, requiring control to manage impact forces effectively.**
- **Explosive Power: High acceleration during takeoff reflects explosive strength, critical for optimal performance in jumps, sprints, or similar movements.**
- **Controlled Deceleration: Proper landing mechanics and strength are vital to absorb impact and reduce injury risk.**
- **Performance Optimization: Insights from velocity and acceleration analysis help design training programs to enhance explosive power and landing control for similar movements.**

References

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[3] D. Knudson, Fundamentals of Biomechanics, 2nd ed. New York, NY, USA: Springer, 2007.