Understanding football boot traction requirements through high-speed video analysis

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Background

- PhD – “Testing methodologies in football boot outsole design”
- Identify realistic testing conditions

Select an analysis method

Develop method into a player movement analysis protocol

Analyse obtained data to extract accurate and useful foot-to-surface loading conditions
Methodology
Marker location

Marker locations on a football boot:

- **Forefoot**: P3 and P5
- **Rear-foot**: P1, P2, and P4
Automated tracking
Data collection

- Doncaster Rovers FC training ground, October 2010
- 8 youth team players
- Copa Mundial football boots
- 3 movements:
  - Acceleration phase of sprinting
  - 45° lateral side-cut
  - Long range kick (filming planted foot)
- 5 repeats of each movement
- Ground condition – midrange (FIFA ball bounce)
Visualisation and Informatics

- Stud transposition
Visualisation and Informatics

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- Euler angle (orientation)
Visualisation and Informatics

- Stud transposition
- Euler angle (orientation)
- Centre of rotation (2D)
Visualisation and Informatics

- Stud transposition
- Euler angle (orientation)
- Centre of rotation (2D)
- Helical screw axis (3D)
Example results

Video

Pitch = 11 ± 1°
Yaw = 26 ± 3°
Roll = 16 ± 2°

Pitch = 20 ± 4°
Yaw = 26 ± 3°
Roll = 12 ± 3°

Pitch = 35 ± 3°
Yaw = 20 ± 4°
Roll = 5 ± 1°
Conclusions and future work

- Player testing protocol for laboratory and outside.
- Can track shoe position through 3 movements.
- Can deduce shoe position, orientation and velocity.
- Identify time requiring highest traction.
- Is there a simple movement that can be easily replicated?
- How do the results relate to current traction testing protocol?
- What suggestions can be made to improve realism of testing?
Long term goals

- Player testing
- Prototype
- Design cycle
- Traction testing
- FE model
Thank you for listening

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