Human Body Parts Model Combined Trajectories Feature Based Volleyball Player Receive Reaction Time Detection

**Background**

- **Stimulus**: Opponent spikes the ball
- **Response**: Receiver starts to move

![Diagram showing the reaction process][1]

**Proposals**

**Input**: Receive action video
- Camera selection
- Feature extraction
- Trajectories categorization
- Standby motion detection
- Reaction motion detection

**Output**: Reaction frame

- **P1**: Human body parts model
- **P2**: Feet trajectory length change feature
- **P3**: Arms trajectory direction change feature

**Feet trajectory length change feature**

- **Before**
  - Standby: Feet not move
  - Run: Feet start to move
- **During**
  - Length decrease: React frame detect start!
- **After**
  - Reaction frame

**Arms trajectory direction change feature**

- **Before**
  - Standby
- **During**
  - Move Arms: Angle change randomly
  - Angle: Angle no large change
- **After**
  - Reaction frame

**Experiment results**

<table>
<thead>
<tr>
<th>Sequence</th>
<th>P2+P3</th>
<th>P3</th>
<th>P1+P2+P3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>61.5%</td>
<td>69.2%</td>
<td>100%</td>
</tr>
<tr>
<td>Type B</td>
<td>34.2%</td>
<td>58.6%</td>
<td>65.7%</td>
</tr>
<tr>
<td>Total</td>
<td>38.5%</td>
<td>60.2%</td>
<td>71.1%</td>
</tr>
</tbody>
</table>

**Conclusion**

Combining the three proposals, the proposed Receive reaction time detection system achieves 89.2% within 33ms tolerant error.

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**Type A**: "Standby->Move feet"
**Type B**: "Standby->Move arms"