Data-driven Finger Motion Synthesis for Gesturing Characters

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Hand and Finger Movements

- integral and crucial part of language and communication [Kendon04, McNeill92]
- very hard to capture and often animated separately [Majkowska et al. 04] or only a few degrees of freedom are captured [Kitagawa and Windsor 08]
How to Animate Fingers

• Motion capture

• Keyframe animation

• Algorithms
How to Animate Fingers

- **Motion capture** → not always accurate [Kahlesz et al. 2004], needs post-processing [Kitagawa and Windsor 2008]
- **Keyframe animation**
- **Algorithms**

![CyberGlovesII](image1)
![Markerset for hands](image2)
![3Gear Systems](image3)
How to Animate Fingers

- Motion capture

- **Keyframe animation** → time-consuming

- Algorithms
How to Animate Fingers

- **Motion capture**

- **Keyframe animation**

- **Algorithms** → rule-based [ElKoura03], physics-based [Pollard05, Liu09, Ye12], data-driven [Majkowska06]

ElKoura03 Pollard05 Majkowska06 Liu09
Augmenting Body Motions with Finger Motions

Body Motion → Data-driven Finger Motion Synthesis → Body + Hand Motion

Database of Motions (Body and Hands)
No Finger Motions

Our Approach

./vids/Ken1.mov
Input Motion

Database
segment lengths between 0.33s and 2s
Method: Segmentation

- speed in m/s
- frames
- preparation and stroke
- post-stroke hold
- retraction
- split 1
- split 2
finding k most similar segments
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Dec 1, 2012
What is the Best Similarity Metric?

Captured database with multiple similar gestures:

- 8 types of motions
- 8 examples for each type
- 2-4 valid segments per example
Total: 187 segments
What is the Best Similarity Metric?

Leave-one-out cross validation

correct = segment from the same type
What is the Best Similarity Metric?

Class confusion matrix

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<th>att.</th>
<th>big</th>
<th>d-s</th>
<th>ok</th>
<th>PP</th>
<th>small</th>
<th>turn</th>
<th>wipe</th>
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<td>1</td>
<td>1</td>
<td>83</td>
</tr>
</tbody>
</table>
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Segment cost

1  2  3  4

1 0.2  0.4  0.5
2 ....  ....  ....
3 ....  ....  ....
4 ....  ....  ....
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transition cost

1 2 3 4

1 0.2 0.4 0.5

2 0.5 0.1

3...

4...
shortest path: Dijkstra’s algorithm
shortest path: Dijkstra’s algorithm

compute transitions
Small Gesture Database

14 gestures
7 types x 2 gestures of each type

./vids/mainResults.mov
Perceptual Experiment

8 clips x 3 motion types x 3 repetitions
14 participants

![Bar chart showing perceived realism comparison between no finger motions, motion capture, and our method.](chart.png)
Limitations

No guarantee for correctness

No interaction handling

Adequate database necessary
Conclusion and Future Work

Method simple

Plausible results for many situations

Multiple results could be suggested based on user input
Thanks