Gait Event Detection Using an LSTM Network

10-701 Project Presentation

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Introduction

- Goal: detect gait events (heel strike, toe off) in motion capture data
- Necessary to measure changes in gait that arise from training, disease or aging

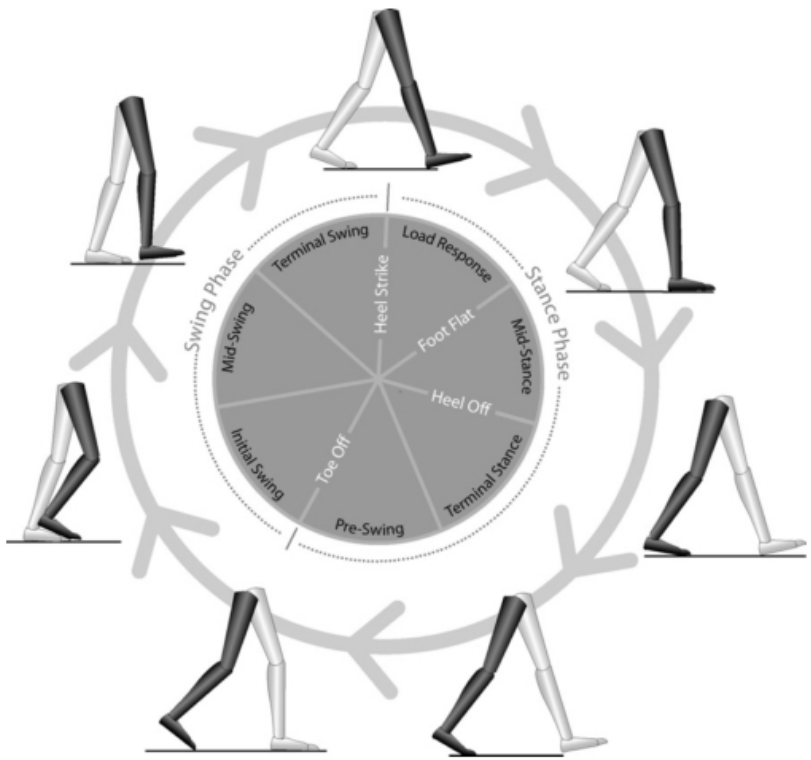

Figure 1: Gait events [Rueterbories et al., 2010]

Data

- Time series data
- 54 features (18 motion capture markers $\times$ 3 dimensions)
- 240 000 samples (8 subjects $\times$ 3 trials $\times$ 10 000 samples)
- Groundtruth from force plates

Baseline Methods

- Signal processing approach [O'Connor et al., 2007]
  - Heuristic based on speed of heel and toe markers
  - No learning
  - Sensitive to threshold value
- Feed-forward Neural Network [Miller, 2009]
  - Sliding window centered around the desired marker
  - Requires heavy preprocessing (dimensionality reduction, variable window size based on foot speed)

Our Approach: LSTM

- LSTM = Recurrent Neural Network with memory cells
- Motivation
  - Detect long-range dependencies
  - No windowing required
- Network architecture
  - TODO
- Implementation
  - Torch/Lua
  - LSTM cell by de Freitas (Oxford University, Google Deepmind)
  - AWS EC2 GPU instance (g2.2xlarge)

Results

Q&A

Thank you for your attention!