Sequence Labeling for Gait Analysis using LSTM*

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ABSTRACT

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Categories and Subject Descriptors

H.4 [Information Systems Applications]: Miscellaneous

General Terms

Theory

Keywords

ACM proceedings, LaTeX, text tagging

*TODO give credit to Lab etc.

1. INTRODUCTION

In order to study human gait, it is necessary to divide the gait cycle into swing phase and stance phase. The transition between the phases is marked by two events: the subject's heel hitting the ground (heel strike) and the subject's toe lifting off the ground (toe off). It is paramount to accurately identify these events because otherwise, no meaningful comparison of different stride cycles is possible.

The current gold standard for gait event identification is the use of dedicated hardware such as force plates that measure ground reaction forces and foot switches that are pressed when the foot is in contact with the ground. However, many laboratories lack the necessary equipment and therefore have to resort to alternative ways of event detection. Furthermore, there is a risk that the devices affect gait because they require the modification of normal footware.

Given the drawbacks of the hardware-based solution, the existence of a reliable method based solely on data is highly desirable. In particular, the method should take motion capture data as its input because this kind of data is prevalent in human gait analysis and widely available at most laboratories.

Several data-based methods have been proposed in the literature. However, we believe that the existing methods either rely too heavily on questionable heuristics or require an excessive amount of data preprocessing. For this reason, we propose a new approach to gait event detection based on a Long Short-Term Memory (LSTM) recurrent neural network (RNN).

The rest of this paper is organized as follows: Section 2 discusses some of the existing data-based methods for event detection; Section 3 gives a short overview over LSTM networks in general; Section 4 contains a description the dataset; In Sections 5 and 6 describe the architecture and training of our network; Section 7 presents the experimental results and compares them to existing baselines; Section 8 concludes and shows possible paths for future work.

2. PREVIOUS WORK

3. LSTM

4. DATA

5. NETWORK ARCHITECTURE

6. NETWORK TRAINING