Leibniz Universität Hannover

Fakultät für Bauingenieurwesen und Geodäsie
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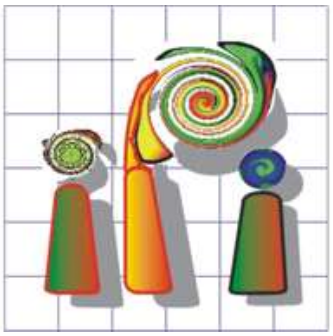
Master Thesis

Navigations and Field Robotics

Dance Synchronicity Analysis using Image-based Human Pose Estimation



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Abstract

For dancers or performances it is especially important that they are perfectly synchronized. The smallest mistakes can already ruin the overall picture. Only perfect synchronicity achieves a beautiful and unison experience. The analysis of synchronicity for dancing was not often computationally analyzed before. Until now, choreographers or professional dancers had to observe the dancers carefully with their perception. Because it is difficult to concentrate on many different dancers and body parts at the same time, it is very dependent on the person's concentration and therefore prone to error. With the help of the 2D multi-person Human Pose Estimation (HPE), the dancers can be reduced to their Key Points (KPs) and digitized, making them comparable. In this thesis, various HPE algorithms were investigated for this purpose and tested for their functionality for the given application.

As the main part of the thesis, an algorithm was then developed using Python, which further processes the given data and analyzes it for synchronicity. This analysis is done for each image in comparing the pose of all dancers either to a chosen reference dancer or to the average pose. Errors due to the pixel height, position and badly detected KPs have been considered and corrected. Subsequently, a method was developed to visualize the detected mistakes in a suitable way. Finally, a method for evaluating the dancers was then developed in order to deliver a comparable analysis of dancers across different videos or HPE algorithms.

The solution introduced in this thesis was then tested with various videos and a survey. For previously defined criteria of good sample videos, the method delivers astonishingly good results. It has proven to be better than professional dancers. The algorithm is able to detect the smallest differences and to visualize this in a suitable manner, which is even understood by beginners. In a Failure Case Analysis videos outside the previously defined criteria have also been tested and even though the algorithm is not error free, it was able to provide good results, with up to 22 dancers in a single video. But nevertheless the synchronicity analysis is still highly depended on the chosen HPE and the quality of the video.