Shape Detection in an Image using Parallelized Traditional Image Analysis Techniques

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INTRODRUCTION

In recent history, most image analysis applications have been implemented using machine learning, specifically, convolutional neural networks (CNN). This project aims to implement traditional digital image analysis techniques to detect shapes in an image. This implementation shall be analyzed to provide infomration to the Arizona Autonomous (AZA) club at the University of Arizona. Analytical data on the performance of traditional image analysis techniques for shape detection will allow the AZA computer vision sub-team to select whether to proceed with a pure machine learning approach or implement traditional image analysis techniques in their unmanned aerial vehicle (UAV) computer vision system. The images being analyzed are provided by an unmanned aerial vehicle (UAV) that points a camera to the ground.

There are many factors that can affect the performance of an image detection algorithm. First an foremost, there are algorithmic parameters that can affect the accuracy of shape detection. Performance factors that affect shape detection in particuar include the kind of shape matching algorithms used. When using edge-based shape matching algorithms, small shifts in shape orientation of position can greatly in large amounts of edge alignment of shapes [1]. There are algorithms that can be used to mitigate orientation and position shift errors such as the Hausdorff Distance Algorithms [2]. Regardless, edge-based shape detection alorithms are subject to noise in an image resulting in false edges that make shape detection less accurate because of the sensitivity to noise and illumination changes in a frame [1]. Region based shape matching algorithms can be used instead of pure edge detection so that that small rotations and translations of a shape do not affect detection. While region based shape matching can make shape detection more robust to small disturbances like geometric rotations and translations, it is limited by the complexity of shapes that are able to be captured. Segmentation errors, that is, only capturing part of a region, can affect the reliability of a captured shape. Semgentation errors can be reduced by superimposing multiple images and mapping a larger region from the super imposed images also called over-segmentation.

REFERENCES

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