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Colour Consistency in Computer Vision: A Multiple Image Dynamic Exposure Colour Classification System

A THESIS PRESENTED TO THE
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Abstract

Colour classification vision systems face difficulty when a scene contains both very bright and dark regions. An indistinguishable colour at one exposure may be distinguishable at another. The use of multiple cameras with varying levels of sensitivity is explored in this thesis, aiding the classification of colours in scenes with high illumination ranges. Titled the Multiple Image Dynamic Exposure Colour Classification (MIDECC) System, pie-slice classifiers are optimised for normalised red/green and cyan/magenta colour spaces. The MIDECC system finds a limited section of hyperspace for each classifier, resulting in a process which requires minimal manual input with the ability to filter background samples without specialised training. In experimental implementation, automatic multiple-camera exposure, data sampling, training and colour space evaluation to recognise 8 target colours across 14 different lighting scenarios is processed in approximately 30 seconds. The system provides computationally effective training and classification, outputting an overall true positive score of 92.4% with an illumination range between bright and dim regions of 880 lux. False positive classifications are minimised to 4.24%, assisted by heuristic background filtering. The limited search space classifiers and layout of the colour spaces ensures the MIDECC system is less likely to classify dissimilar colours, requiring a certain ‘confidence’ level before a match is outputted. Unfortunately the system struggles to classify colours under extremely bright illumination due to the simplistic classification building technique. Results are compared to the common machine learning algorithms Naïve Bayes, Neural Networks, Random Tree and C4.5 Tree Classifiers. These algorithms return greater than 98.5% true positives and less than 1.53% false positives, with Random Tree and Naïve Bayes providing the best and worst comparable algorithms, respectively. Although resulting in a lower classification rate, the MIDECC system trains with minimal user input, ignores background and untrained samples when classifying and trains faster than most of the studied machine learning algorithms.

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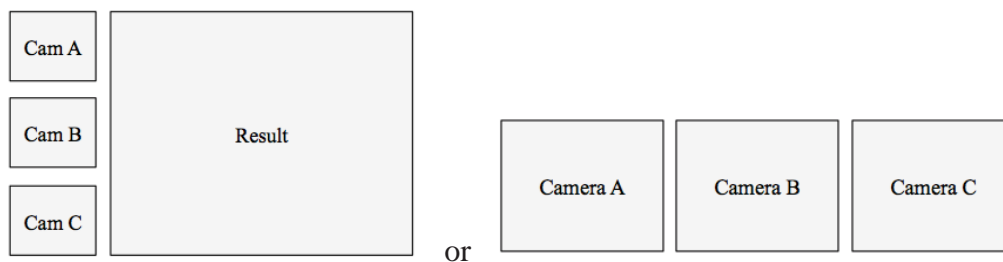


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