Finding Near Optimum Colour Classifiers : Genetic Algorithm-Assisted Fuzzy Colour Contrast Fusion using Variable Colour Depth

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Abstract

This thesis presents a complete self-calibrating illumination intensity-invariant colour classification system. We extend a novel fuzzy colour processing technique called Fuzzy Colour Contrast Fusion (FCCF) by combining it with a Heuristic-assisted Genetic Algorithm (HAGA) for automatic fine-tuning of colour descriptors. Furthermore, we have improved FCCF's efficiency by processing colour channels at varying colour depths in search for the optimal ones. In line with this, we introduce a reduced colour depth representation of a colour image while maintaining efficient colour sensitivity that suffices for accurate real-time colour-based object recognition. We call the algorithm Variable Colour Depth (VCD) and we propose a technique for building and searching a VCD look-up table (LUT). The first part of this work investigates the effects of applying fuzzy colour contrast rules to varying colour depths as we extract the optimal rule combination for any given target colour exposed under changing illumination intensities. The second part introduces the HAGA-based parameter-optimisation for automatically constructing accurate colour classifiers. Our results show that for all cases, the VCD algorithm, combined with HAGA for parameter optimisation improve colour classification via a pie-slice colour classifier.For 6 different target colours, the hybrid algorithm was able to yield 17.63% higher overall accuracy as compared to the pure fuzzy approach. Furthermore, it was able to reduce LUT storage space by 78.06% as compared to the full-colour depth LUT.

Preface

Some merits of this work has already been recognised, published and submitted.

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