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UNIVERSITY OF THE WITWATERSRAND

Abstract

Engineering and the Built Environment
School of Electrical and Information Engineering

Master of Science

A Visual Complexity Learning Algorithm for Modelling Human Performance in Visual Cognitive Tests

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Visual complexity has been extensively studied in the mathematical, **computational** sciences. Concurrently, psychological studies have attempted to define visual complexity as perceived by **humans**. The problem lies in that the computational and psychological studies are always explored **separately**, and thus their definitions of visual complexity are disjointed. This is evident when attempting to capture human-perceived complexity through computer vision.

This research attempts to tackle this problem in the context of cognitive assessments. This context introduces a practical application to the general question of computer, and human perception of complexity: Computerized cognitive assessments regularly employ visual stimuli, and present tasks that test a subject's primal cognitive functions. The difficulty of these tasks is not objectively quantified, which reduces the efficiency of the tests' administration, and the accuracy of the results' interpretation. This study developed and examined an algorithm that could computationally predict a visual task's human-perceived complexity.

The algorithm used a database of visual tasks and subjects' performance in terms of response times. Human subjective evaluation of tasks' complexity were captured for a subset of these tasks. Two types of feature sets were extracted from the visual stimuli presented in the tasks: object-specific, and whole image features. Several classifiers were implemented, using the features and the subjects' perceived visual complexity labels. The best algorithm configuration yielded a 58 % prediction, for a three-class complexity scale.

An analysis of the performance of the algorithm, and the relative visual features' importance values, provided insights which could help bridge the gap between mathematical complexity, and human perceived complexity.